

PATENT SPECIFICATION

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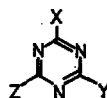
- (72) Inventors ALEXANDER MICHAEL CHALMERS, JAMES JACK and BARRY COOK

(54) NEW PIPERIDINE DERIVATIVES

(71) We, CIBA-GEIGY A.G., a Swiss Body Corporate, whose Registered office address is: 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 new compounds useful as stabilisers for organic material and in particular to new piperidine derivatives useful for the stabilisation of polymers.

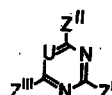
In British Patent Specification No. 977,587 there are described compounds having the formula:—



wherein X, Y and Z may be, inter alia, substituted aryl groups, each bound to the ring carbon by an —S—, —O—, >N-benzyl, >N-lower alkyl or —NH— group. The compounds are said to stabilise organic material against oxidative deterioration.

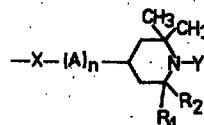
We have now found that a further class of compounds, related to those of Specification No. 977,587, confer on polymeric material an exceptionally high degree of stability towards thermal- and especially photo-degradation.

Accordingly, the present invention provides a compound having the formula:—



I

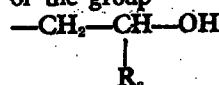
and salts thereof wherein U is —CH= or —N=, Z' is a residue having the formula:



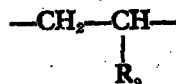
II

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 form, together with the ring carbon atom to which they are each bound, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring; X is an —O—, —S— or —N— residue, wherein R₃ is hydrogen, a

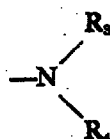
R₃ straight or branched alkyl residue having from 1 to 20 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms; Y is —O—, hydrogen, a straight or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 12 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group



wherein R_s is hydrogen, or a methyl or phenyl residue; n is 0 to 1; and A is $-\text{CH}_2-$, or the group



- 5 wherein R_s is hydrogen or an alkyl residue having from 1 to 20 carbon atoms; Z'' and Z''' are the same or different and each is a piperidine residue of formula II as hereinbefore defined, a halogen atom, an optionally substituted amino group having the formula:—



III

- 15 wherein R_s and R_s are the same or different and each is hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, an aryl residue which is unsubstituted or substituted by one or more alkyl groups and having a total of from 6 to 18 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms; or R_s and R_s , together with the nitrogen atom to which they are bound form a heterocyclic residue having 5 to 7 ring atoms; or Z'' and Z''' are each independently an hydroxy or ether group having the formula:—



IV

- 30 wherein R_s is hydrogen, a straight- or branched- chain alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms, an aryl residue which may be unsubstituted or substituted by one or more alkyl groups, having a total of 6 to 18 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms; or Z'' and Z''' are each independently a thiol or thio ether group having the formula:—



V

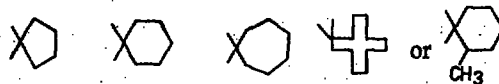
- 40 wherein R_s is hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring or a phenyl or benzyl residue.

Preferably, the ring atom U is $-\text{N}=-$.

- 45 Examples of alkyl substituents R_s and R_s include, methyl, ethyl, n -propyl, isopropyl, n -butyl, sec-butyl, n -hexyl, n -octyl and n -dodecyl residues; however, preferred alkyl residues R_s and R_s are those having from 1 to 4 carbon atoms and most preferably R_s and R_s are each a methyl residue.

When the residues R_s and R_s , together with

the carbon atom to which they are bound, form a cycloalkyl group, examples of such cycloalkyl groups are those of formula:



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Examples of the residue X are $-\text{O}-$, $-\text{S}-$, $-\text{NH}-$ and $-\text{NR}_s-$ wherein R_s is a methyl, ethyl, isobutyl, n -hexyl, n -decyl, n -eicosyl or benzyl residue. Preferably, however, X is $-\text{O}-$ or $-\text{NH}-$.

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Examples of Y , apart from hydrogen and $-\text{O}-$, are methyl, ethyl, n -propyl, isopropyl, n -butyl, sec-butyl, n -hexyl, n -octyl, n -dodecyl, allyl, α -methallyl, 10-undecenyl, prop-2-ynyl, benzyl, α -methylbenzyl, p -methylbenzyl, p -methyl- α -methylbenzyl, α -naphthylmethyl and β -hydroxyethyl, β -hydroxypropyl or β -hydroxy- β -phenyl ethyl residues. Particularly preferred substituents Y however are hydrogen and straight or branched alkyl residues having from 1 to 4 carbon atoms, the most preferred substituents being hydrogen and methyl residues.

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Examples of residue A when n is 1 are $-\text{CH}_2-$, and

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wherein R_s is hydrogen, a methyl, ethyl, isopropyl, sec-butyl, n -hexyl, n -decyl or n -eicosyl residue. Preferably R_s is hydrogen and preferably, either n is 0 or n is 1 and A is $-\text{CH}_2\text{CH}_2-$.

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A particular sub-group of Z'' and/or Z''' are substituted amine groups $-\text{NR}_s\text{R}_s$ wherein examples of substituents R_s and R_s , apart from hydrogen, are methyl, ethyl, n -propyl, isopropyl, n -butyl, sec-butyl, n -hexyl, n -octyl, n -dodecyl, n -eicosyl, cyclopentyl, cyclohexyl, cyclododecyl, p -methylphenyl, p - t -butylphenyl, p - n -dodecylphenyl, benzyl, α -methylbenzyl and α -naphthyl-methyl residues; substituents R_s and R_s are, however, each preferably hydrogen or an alkyl residue having from 6 to 20 carbon atoms.

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When the residues R_s and R_s , together with the nitrogen atom to which they are bound form a heterocyclic residue, the heterocycle may contain further heteroatoms such as a further nitrogen atom or an oxygen atom. Examples of such heterocyclic residues are pyrrolidin-1-yl, piperidino, 2-methylpiperidino, 4- n -hexylpiperidino, morpholino, piperazin-1-yl, 2-methylhexahydroazepin-1-yl; preferred heterocyclic residues, however, are morpholino and piperidino residues.

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Examples of substituent R_s , apart from hydrogen, are methyl, ethyl, n -propyl, isopropyl, n -butyl, sec-butyl, n -hexyl, n -octyl,

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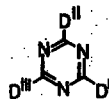
n-dodecyl, n-eicosyl, cyclopentyl, cyclohexyl, cyclododecyl, phenyl, p-methylphenyl, p-t-butylphenyl, p-n-dodecylphenyl, benzyl, α -methylbenzyl, p-methyl- α -methylbenzyl and α -naphthylmethyl residues; substituent R_6 is, however, preferably hydrogen or an alkyl group having from 6 to 20 carbon atoms.

Examples of substituent R_6 , apart from hydrogen, are methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, n-hexyl, n-octyl, n-dodecyl, n-eicosyl, cyclopentyl, cyclohexyl, cyclododecyl, phenyl and benzyl. The preferred substituent R_6 is an alkyl residue having from 6 to 20 carbon atoms.

Preferably, Z'' and Z''' are each the same or different piperidine residue II. In less preferred embodiments, Z'' and/or Z''' are halogen, preferably chlorine, N-alkyl substituents or S-alkyl substituents.

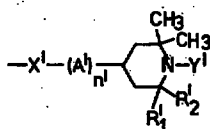
The invention also includes salts of the compounds of formula I for instance salts of inorganic acids such as phosphates, carbonates, sulphates and chlorides and salts of organic acids such as acetates, stearates, maleates, citrates, tartrates, oxalates, benzoates and salts of substituted carbamic acids.

A preferred sub-group of compounds are those having the formula:—



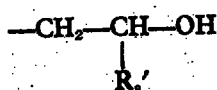
IA

- wherein D' , D'' and D''' are the same or different and each is halogen or a residue of formula:—

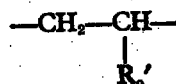


IIA

- 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 bound, form a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, X' is an —O—, —S— or —NR_{1'}— residue wherein R_1' is hydrogen, an alkyl residue having from 1 to 12 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms, Y' is —O—, hydrogen, an alkyl residue having from 1 to 12 carbon atoms, an alkenyl or alkynyl residue having from 3 to 12 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group:



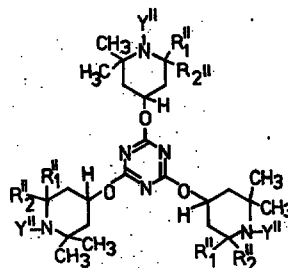
- wherein R_6' is hydrogen, or a methyl or phenyl residue, n' is 0 or 1 and A' is —CH₂—, or



wherein R_6' is hydrogen or an alkyl residue having from 1 to 12 carbon atoms; with the proviso that at least one of D' , D'' and D''' is not a halogen atom; and salts of these compounds.

Within the group of compounds of formula IA, those compounds are preferred wherein D' , D'' and D''' are the same or different piperidine residue of formula IIA. More preferably, residues D' , D'' and D''' are the same piperidine residue IIA. It is also preferred that X' is —O— or —NH—, n' is 0, R_1' and R_2' are each a methyl residue and Y' is hydrogen or an alkyl residue having from 1 to 4 carbon atoms, especially a methyl residue.

A further sub-group of preferred compounds of formula I are those of formula:—



IB

wherein R_1'' and R_2'' are the same or different and each is a straight- or branched-chain alkyl group having from 1 to 12 carbon atoms or R_1'' and R_2'' , together with the carbon atom to which they are each bound, form a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, and Y'' is hydrogen, a straight- or branched-chain alkyl group having from 1 to 12 carbon atoms, an alkenyl group having from 3 to 12 carbon atoms or an aralkyl group having from 7 to 12 carbon atoms; and salts of these compounds.

It is preferred that substituents R_1'' and R_2'' are each a methyl residue and that Y'' is hydrogen or an alkyl residue of 1 to 6 carbon atoms, especially a methyl residue.

Specific examples of compounds of formula I include:—

- 2,4,6 - tris[2',2',6',6' - tetramethylpiperidinyl-4' - amino] - 1,3 - pyrimidine
- 2,4,6 - tris[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine
- 6 - chloro - 2,4 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine
- 6 - chloro - 2,4 - bis[1' - ethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine
- 4,6 - dichloro - 2 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine
- 2 - methylamino - 4,6 - bis[2',2',6',6' - tetra-

	methylpiperidinyl - 4' - amino] - 1,3,5-triazine	methylpiperidinyl - 4'' - amino] - 1,3,5-triazine	
2	- ethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - cyclododecyloxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	70
5	2 - iso - propylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - phenoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
10	2 - n - hexylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - (p - t - butylphenoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
15	2 - n - octadecylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - (p - n - dodecylphenoxy) - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	80
20	2 - cyclopentylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - (2' - methylphenoxy) - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	85
	2 - cyclohexylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - benzyloxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
25	2 - cyclododecylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - α - naphthylmethoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	90
	2 - dimethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - mercapto - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
30	2 - ethyl - n - propylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - methylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	95
35	2 - methyl - n - decylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - ethylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - anilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - n - propylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	100
40	2 - (p - t - butylanilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - dodecylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - (p - methylanilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - cyclopentylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	105
45	2 - (p - n - dodecylanilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - cyclohexylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
50	2 - benzylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - cyclododecylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	110
	2 - α - naphthylmethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - morpholino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	115
55	2 - amino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - piperidino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - hydroxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - (pyrrolidin - 1'' - yl) - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	120
60	2 - methoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - (hexahydroazepin - 1'' - yl) - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - ethoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2,4 - diamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	125
65	2 - n - decyloxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2,4 - di(methylamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - n - eicosyloxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2,4 - di(n - octylamino)6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	130

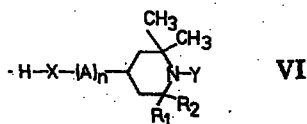
	methylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - octadecylamino - 4 - 6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	
5	2,4 - di(benzylamino) - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - benzylamino - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	70
	2,4 - dianilino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - anilino - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
10	2,4 - dimethoxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - methoxy - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5-triazine	75
	2,4 - di - n - heptyloxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - tetradecyloxy - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5-triazine	80
15	2,4 - dihydroxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - methylthio - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2,4 - dimercapto - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - ethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	85
20	2,4 - dimethylthio - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - octadecylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	
	2,4 - di - n - hexylthio - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - benzylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	90
25	2,4 - dicycloheptylthio - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - anilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5-triazine	95
30	2 - chloro - 4 - amino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - ethoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	
	2 - chloro - 4 - methylamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - eicosyloxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	100
35	2 - chloro - 4 - ethylamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - methylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	
	2 - chloro - 4 - isopropylamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - ethylamino - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	105
40	2 - chloro - 4 - n - octadecylamino - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - n - octadecylamino - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	110
45	2 - chloro - 4 - methoxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - benzylamino - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - chloro - 4 - n - hexyloxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - ethylamino - 4[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 6[2'',2'',6'',6'' - tetramethylpiperidinyl - 4'' - oxy] - 1,3,5-triazine	115
50	2 - chloro - 4 - n - eicosyloxy - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - anilino - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	120
55	2 - chloro - 4 - mercapto - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - methoxy - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	
	2 - chloro - 4 - methylthio - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - methylthio - 4,6 - bis[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine	125
60	2 - chloro - 4 - n - dodecylthio - 6 - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine	2 - ethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	
	2 - ethylamino - 4,6 - bis[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5-triazine	2 - n - octadecylamino - 4,6 - bis[2',2',6',6' -	130
65			

	tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	methyl piperidinyl - 4' - amino] - 1,3,5 - triazine	65
2	- benzylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	2,4,6 - Tris[1' - benzyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - thio] - 1,3,5 - triazine	
5	2 - anilino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	2,4,6 - Tris[1' - oxy] - 2',2',6',6' - tetramethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	70
10	2 - methoxy - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	2,4,6 - Tris[1' - oxy] - 2',2',6',6' - tetramethyl piperidinyl - 4' - amino] - 1,3,5 - triazine	
15	2 - methylthio - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - methylenamino] - 1,3,5 - triazine	2,4 - Bis[2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - oxy] - 6 - [1',2',2',6',6' - pentamethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	80
20	The counterparts to the compounds listed above but having oxygen and sulphur bridges in the 4'-position are also to be understood as being examples of specific compounds of formula I.	2,4 - Bis[2',2',6',6' - tetramethyl piperidinyl - 4' - oxy] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - amino] - 1,3,5 - triazine	
25	Specific examples of compounds of formula IA include:—	2,4 - Bis[2',2',6',6' - tetramethyl piperidinyl - 4' - amino] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - oxy] - 1,3,5 - triazine	85
30	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - methylenoxy] - 1,3,5 - triazine	
35	2,4,6 - Tris[2',2' - dimethyl - 6',6' - diethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[1',2',2',6',6' - pentamethyl piperidinyl - 4' - methylenoxy] - 1,3,5 - triazine	
40	2,4,6 - Tris[2',2',6',6' - trimethyl - 6' - ethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - methylenamino] - 1,3,5 - triazine	90
45	2,4,6 - Tris[2',2' - dimethyl - 6',6' - diisopropyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[1',2',2',6',6' - pentamethyl piperidinyl - 4' - methylenamino] - 1,3,5 - triazine	
50	2,4,6 - Tris[2',2' - dimethyl - 6',6' - di-n-butyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - methylenethio] - 1,3,5 - triazine	95
55	2,4,6 - Tris[2',2' - dimethyl - 6',6' - di-n-dodecyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4 - Bis[2',2',6',6' - tetramethyl piperidinyl - 4' - oxy] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - methylenoxy] - 1,3,5 - triazine	100
60	2,4,6 - Tris[1' - aza - 2',2' - dimethyl spiro[5,5] - undecane - 4 - oxy] - 1,3,5 - triazine	2,4 - Bis[1',2',2',6',6' - pentamethyl piperidinyl - 4' - oxy] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - methylenamino] - 1,3,5 - triazine	105
	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - amino] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenoxy] - 1,3,5 - triazine	
	2,4,6 - Tris[2',2' - dimethyl - 6',6' - diethyl piperidinyl - 4' - amino] - 1,3,5 - triazine	2,4,6 - Tris[1',2',2',6',6' - pentamethyl piperidinyl - 4' - ethylenoxy] - 1,3,5 - triazine	110
	2,4,6 - Tris[1' - aza - 2',2' - dimethyl spiro[5,5] - undecane - 4' - amino] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4 - ethylenamino] - 1,3,5 - triazine	
	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - thio] - 1,3,5 - triazine	2,4,6 Tris[1',2',2',6',6' - pentamethyl piperidinyl - 4' - ethylenamino] - 1,3,5 - triazine	
	2,4,6 - Tris[1',2',2',6',6' - pentamethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4,6 - Tris[2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenethio] - 1,3,5 - triazine	115
	2,4,6 - Tris[1' - ethyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - thio] - 1,3,5 - triazine	2,4 - Bis[2',2',6',6' - tetramethyl piperidinyl - 4' - amino] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - ethylenamino] - 1,3,5 - triazine	
	2,4,6 - Tris[1' - n-propyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - amino] - 1,3,5 - triazine	2,4 - Bis[1',2',2',6',6' - pentamethyl piperidinyl - 4' - oxy] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - ethylenoxy] - 1,3,5 - triazine	120
	2,4,6 - Tris[1' - benzyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - oxy] - 1,3,5 - triazine	2,4 - Bis[2',2',6',6' - tetramethyl piperidinyl - 4' - methylenoxy] - 6 - [2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - ethylenamino] - 1,3,5 - triazine	125
	2,4,6 - Tris[1' - allyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine	2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine	
	2,4,6 - Tris[1',2',2',6',6' - pentamethylpiperidinyl - 4' - amino] - 1,3,5 - triazine		
	2,4,6 - Tris[1' - allyl - 2',2',6',6' - tetra-		

- 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - amino) - 1,3,5 - triazine
- 2 - Chloro - 4,6 - di(1 - oxyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine
- 5 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - thio) - 1,3,5 - triazine
- 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - methylenoxy) - 1,3,5 - triazine
- 10 2 - Chloro - 4,6 - di(1' - allyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine
- 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - methylenamino) - 1,3,5 - triazine
- 15 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenoxy) - 1,3,5 - triazine
- 20 2 - Chloro - 4,6 - di(2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenamino) - 1,3,5 - triazine
- 2 - Chloro - 4 - (2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 6 - (2'',2'',6'',6'' - tetramethyl piperidinyl - 4'' - amino) - 1,3,5 - triazine
- 25 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine
- 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - amino) - 1,3,5 - triazine
- 30 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - thio) - 1,3,5 - triazine
- 2,4 - Dichloro - 6 - (1',2',2',6',6' - pentamethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine
- 35 2,4 - Dichloro - 6 - (1'oxyl - 2',2',6',6' - tetramethyl piperidinyl - 4' - oxy) - 1,3,5 - triazine
- 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenoxy) - 1,3,5 - triazine
- 40 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - ethylenamino) - 1,3,5 - triazine
- 45 2,4 - Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - methylenoxy) - 1,3,5 - triazine
- Dichloro - 6 - (2',2',6',6' - tetramethyl piperidinyl - 4' - methylen amino) - 1,3,5 - triazine
- 50 2,4,6 - Tris[1' - β - hydroxyethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - Tris[1' - β - hydroxyethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine
- 55 2,4,6 - Tris[1' - β - hydroxyethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - ethylenamino] - 1,3,5 - triazine
- 2,4,6 - Tris[1' - β - hydroxypropyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 60 2,4,6 - Tris[1' - β - hydroxypropyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine
- 65 2,4,6 - Tris[1' - β - hydroxy - β - phenylethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - Tris[1' - β - hydroxy - β - phenylethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine
- as well as the sulphate, chloride, oxalate and acetate salts of the preceding compounds 1A.
- Specific examples of compounds of formula IB include:—
- 2,4,6 - tris[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[2',2' - dimethyl - 6',6' - diethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[2',2',6' - trimethyl - 6' - ethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[2',2' - dimethyl - 6',6' - diisopropylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[2',2' - dimethyl - 6',6' - di-n-dodecylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - aza - 2',2' - dimethyl spiro[5,5] - undecane - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 6 - [1'' - aza - 2'',2'' - dimethyl spiro[5,5] - undecane - 4'' - oxy] - 1,3,5 - triazine
- 2 - [2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 4 - [2'',2'' - dimethyl - 6'',6'' - diisopropylpiperidinyl - 4'' - oxy] - 6 - [1''' - aza - 2''',2''' - dimethyl spiro[5,5] - undecane - 4''' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1',2',2',6',6' - pentamethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - ethyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - n - butyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - n - dodecyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - alkyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - benzyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1',2',2' - trimethyl - 6',6' - di-n-butylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - allyl - 2',2' - dimethyl - 6',6' - di-n-dodecylpiperidinyl - 4' - oxy] - 1,3,5 - triazine
- 2,4,6 - tris[1' - aza - 1' - benzyl - 2',2' - dimethyl spiro - [5,5] - undecane - 4' - oxy] - 1,3,5 - triazine
- 2,4 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 6 - [1'',2'',2'',6'',6'' - pentamethylpiperidinyl - 4'' - oxy] - 1,3,5 - triazine
- 2 - [2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 4,6 - bis[1'',2'',2'',6'',6'' - penta-

methylpiperidinyl - 4'' - oxy] - 1,3,5-triazine.

The present invention also provides a first process for the production of a compound of formula I comprising reacting a cyanuric halide, preferably cyanuric chloride, with the compound having the formula:



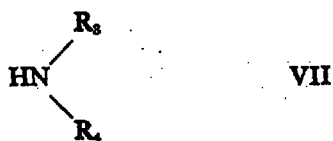
When Z'' and Z''' are piperidine residues, the compounds of formula I may be symmetrical or unsymmetrical, depending upon the nature of the substituents in the formula VI. For the preparation of symmetrical compounds of formula I, it is convenient to use at least three molecular proportions of the compound of formula VI per molecular proportion of cyanuric halide, preferably cyanuric chloride.

In order to produce an unsymmetrical compound of formula I, dissimilar compounds of formula VI may be added stepwise by introducing one or two residues into the triazine molecule at one time. In this way, two or three different piperidinyl residues may be introduced into the triazine nucleus.

For the preparation of compounds having two identical piperidine residues, the reaction is carried out using at least two molecular proportions of a single compound VI per molecular proportion of cyanuric halide. It is convenient to carry out the reaction in the presence of a halogen acid binding agent and in the presence of a solvent inert under the reaction conditions. Suitable examples of halogen acid binding agents include organic bases such as triethylamine, inorganic bases such as sodium hydroxide or sodium carbonate; alternatively an excess amount of the amine reactant of formula VI may be employed as the halogen acid binding agent. If a solvent is used suitable examples of such solvents are toluene and xylene.

In the particular case of compounds of formula VI wherein X is —O—, the alkali metal salt of this compound may be first prepared, for instance, by reacting the compound with an alkali metal, prior to reaction with the cyanuric halide.

When Z'' and Z''' are not both piperidine residues, reaction of the remaining halogen can be accomplished by treating the derived compound with an amine of formula:



or the derived strong acid salt, water, or an alcohol of formula:



or a thio compound of formula:



The reaction is conveniently carried out in the presence of a suitable halogen acid binding agent as described above. In the particular case of the amine VII a stoichiometric excess amount of this reactant may be employed. In the particular case of the alcohol VIII the alkali metal salt may first be prepared prior to reaction.

Alternatively these compounds containing two piperidine residues can be prepared by reacting one molecular portion of a cyanuric halide firstly with one molecular proportion of the compounds VII, VIII or IX and then by treating the derived dihalogenated material with the piperidine compound VI using the conditions described above.

For compounds containing only one piperidine residue, one molecular proportion of compound VI may be added, usually at low temperature, to one molecular proportion of the cyanuric halide using the conditions described above. The derived dihalogenated material can then be treated with one or two molecular proportions of VII, VIII or IX as desired.

Alternatively one or two molecular proportions of the compounds VII, VIII or IX may be added to one molecular proportion of a cyanuric halide to yield the di- or monohalogenated product which can then be reacted with one molecular proportion of piperidine compound VI.

The present invention also provides a second process for producing a compound of formula I wherein Y is other than hydrogen, comprising reacting the corresponding compound of formula I wherein Y is hydrogen with a compound capable of replacing the hydrogen at the nitrogen atom by the group Y.

For example, the nitrogen substitution reactions may be effected using an alkylating, alkenylating, alkynylating or aralkylating agent e.g. an alkyl, alkenyl, alkynyl or aralkyl halide.

Alternatively, the nitrogen substitution reactions may be carried out by a Leuckart or Wallach reaction using formic acid and the appropriate aldehyde or ketone. For example, the corresponding NH compound may be reacted with formic acid and formaldehyde to produce the N-methyl compound.

To produce a compound of formula I wherein one or more of the substituents Y is a hydroxyalkyl group, the corresponding compound of formula I wherein Y is hydrogen, may be reacted with the appropriate alkylene

oxide e.g. ethylene oxide, propylene oxide or styrene oxide.

To produce a compound of formula I wherein one or more of Y is $-\dot{O}$, the corresponding compound of formula I wherein the corresponding Y substituent is hydrogen may be oxidised with an oxidizing agent. Suitable oxidizing agents are peroxides e.g. hydrogen peroxide, optionally in the presence of per-tungstic acid, or with a per-acid e.g. performic or peracetic acid. In a modification of this oxidation reaction, the starting-material may be the corresponding N-alkyl compound (the alkyl group having 1 to 6 carbon atoms) rather than the NH compound of formula I.

Although in theory this method may be used to produce compounds of formula I in which only one of Y is $-\dot{O}$, in practice it is very much preferred to conduct the oxidation so that all of Y are $-\dot{O}$; otherwise complex mixtures are obtained from which it is difficult to isolate partial N-oxyls of formula I.

The compounds of formula I have been found to be excellent light stabilisers for organic material, especially polymers.

Accordingly, the present invention also provides a composition comprising an organic material and, as stabiliser, a minor proportion of a compound of formula I as hereinbefore defined.

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-dimethylpentene-1, and also co- and ter-polymers 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 ter-polymers 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. These polymers can, for instance, form the basis of surface coating media such as

paints and lacquers having an oil or resin, for instance an alkyd or polyamide resin base.

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 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 compounding 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 one or more 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 or stabilizers, 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.

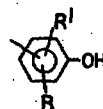
The present invention therefore includes binary, ternary and multi-component compositions containing the stabiliser of formula I together with one or more other functional additives for polymers.

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

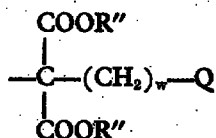
(1) Phenolic compounds having the general formula



wherein Q is



A_1 is $-\text{CR}(\text{COOR}'')_2$ or



- R is hydrogen or alkyl of 1 to 6 carbon atoms,
R' is alkyl of 1 to 6 carbon atoms,
5 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:

- 10 di - n - octadecyl α - (3,5 - di - t - butyl - 4 - hydroxybenzyl) malonate,
di - n - octadecyl α - (3 - t - butyl - 4 - hydroxy - 5 - methylbenzyl) malonate
15 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.
20 (2) Phenolic compounds having the general formula



- wherein Q is as hereinbefore defined and
25 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

- 30 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:



- 35 wherein Q and w are as hereinbefore defined.

Illustrative examples of the compounds shown are:

- 40 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),
45 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),
50 4,4' - methylene - bis - (3 - t - butyl - 5 - methylphenol), and
2,2' - methylene - bis - (3 - t - butyl - 5 - methylphenol).

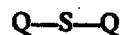
- (4) Phenolic compounds having the formula:



wherein Q and R''' are as hereinbefore defined.

Illustrative examples of such compounds are:

- 2,5 - di - t - butylhydroquinone,
2,6 - di - t - butylhydroquinone, and
5 5 - di - t - butyl - 4 - hydroxyanisole.
(5) Phenolic compounds having the formula:

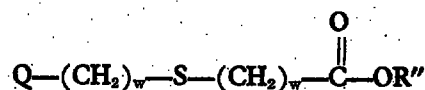


wherein Q is as hereinbefore defined.

Illustrative examples of such compounds are:

- 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).
75

- (6) Phenolic compounds having the formula

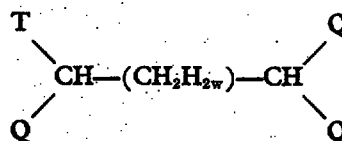


wherein Q, R'' and w are as hereinbefore defined.

Illustrative examples of such compounds are:

- octadecyl - (3,5 - dimethyl - 4 - hydroxybenzylthio) - acetate, and
dodecyl - (3,5 - di - t - butyl - 4 - hydroxybenzylthio) - propionate.
85

- (7) Phenolic compounds having the formula

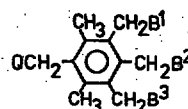


wherein T is hydrogen or Q, and Q and w are as hereinbefore defined.

Illustrative examples of such compounds are:

- 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.
95

- (8) Phenolic compounds having the formula: 100

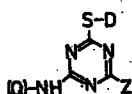


wherein B¹, B² and B³ are each independently hydrogen, methyl or Q, provided that when B¹ and B³ are Q then B² is hydrogen or methyl and when B² is Q then B¹ and B³ are each independently hydrogen or methyl; and Q is as hereinbefore defined. Illustrative examples of such compounds are:

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

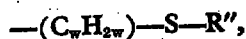
1,3,5 - tri(3,5 - di - t - butyl - 4 - hydroxybenzyl) - 2,4,6 - trimethylbenzene.

(9) Phenolic compounds having the formula



wherein Z is NHQ, —S—D— or O—Q

D is an alkyl group having from 4 to 18 carbon atoms or



Q, R'' and w 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,

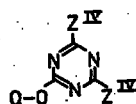
6 - (4 - hydroxy - 3,5 - dimethylanilino) - 2,4 - bis - (n - octylthio) - 1,3,5 - triazine,

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



and Q, D and w 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 - butylphenol) - 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

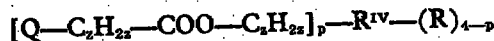
2,4 - bis - (4 - hydroxy - 3,5 - di - t - butylphenoxy) - 6 - (n - octylthiopropylthio) - 1,3,5 - triazine

2,4 - bis - (4 - hydroxy - 3,5 - di - t - butylphenoxy) - 6 - (n - octylthioethylthio) - 1,3,5 - triazine

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 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 1 to 30 carbon atoms, aliphatic mono or diether having from 1 to 30 carbon atoms, aliphatic mono or dithioether having from 1 to 30 carbon atoms, and

z is 0 or an integer from 1 to 6.

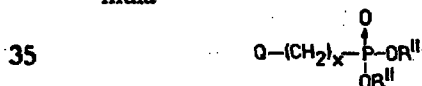
Illustrative examples of such compounds are

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,
 10 n - Hexyl - 3,5 - di - t - butyl - 4 - hydroxybenzoate,
 n - Dodecyl - 3,5 - di - t - butyl - 4 - hydroxybenzoate,
 Neo - dodecyl - 3 - (3,5 - di - t - butyl - 4 - hydroxyphenyl) - propionate,
 15 Dodecyl - β - (3,5 - di - 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
 20 Octadecyl - α - (4 - hydroxy - 3,5 - di - t - butylphenyl) - propionate.

Subclass II

- 2 - (n - octylthio)ethyl 3,5 - di - t - butyl - 4 - hydroxybenzoate,
 25 2 - (n - octylthio)ethyl 3,5 - di - t - butyl - 4 - hydroxyphenylacetate,
 2 - (n - octadecylthio)ethyl 3,5 - di - t - butyl - 4 - hydroxyphenylacetate,
 2 - (n - octadecylthio)ethyl 3,5 - di - t - butyl - 4 - hydroxybenzoate, and
 30 2 - (n - octadecylthio)ethyl 3 - (3,5 - di - t - butyl - 4 - hydroxyphenyl)propionate.
 (12) Phenolic compounds having the formula



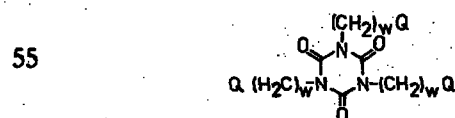
where X is 1 or 2; Q and R'' are as hereinbefore defined.

Illustrative examples of such compounds are

- 40 Di - n - octadecyl 3,5 - di - t - butyl - 4 - hydroxybenzyl - phosphonate,
 Di - n - octadecyl 3 - t - butyl - 4 - hydroxy 5 methylbenzyl - phosphonate,
 Di - n - octadecyl 2 - (3,5 - di - t - butyl - 4 - hydroxyphenyl) - ethanephosphonate,
 45 Di - n - tetradecyl 3,5 - di - t - butyl - 4 - hydroxybenzyl - phosphonate,
 Di - n - hexydecyl 3,5 - di - t - butyl - 4 - hydroxybenzyl - phosphonate, and
 50 Di - n - docosyl - 3,5 - di - t - butyl - 4 - hydroxybenzyl - phosphonate.

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

- (13) Phenolic compounds having the formula

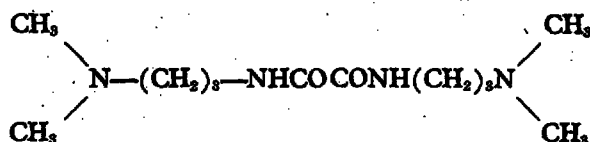


wherein w and Q are hereinbefore defined.

Sub-class III

- 1,2 - propylene glycol bis - [3,5 - di - t - butyl - 4 - hydroxyphenyl]propionate],
 Ethylene glycol bis - [3 - (3,5 - di - t - butyl - 4 - hydroxyphenyl)propionate],
 60 Neopentylglycol bis - [3 - (3,5 - di - t - butyl - 4 - hydroxyphenyl)propionate],
 Ethylene glycol bis - (3,5 - di - t - butyl - 4 - hydroxyphenylacetate),
 65 Glycerine - 1 - n - octadecanoate - 2,3 - bis - (3,5 - di - t - butyl - 4 - hydroxyphenylacetate),
 Pentaerythritol - tetrakis - [3 - (3,5 - di - t - butyl - 4 - hydroxyphenyl)propionate],
 70 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],
 75 2 - stearoyloxyethyl 7 (3 - methyl - 5 - t - butyl - 4 - hydroxyphenyl)heptanoate, and
 1,6 - n - hexanediol - bis[(3',5' - di - t - butyl - 4 - hydroxyphenyl)propionate].
 80 The above phenolic ester stabilizers of subclasses I, II and III are more fully described in British Patent Specifications Nos. 1103144, 1105699 and 1001098.
 An illustrative example of such compounds is
 85 tris - (3,5 - di - t - butyl - 4 - hydroxybenzyl)isocyanurate.
 The above hydroxyphenylalkyl isocyanurates are more fully described in U.S. Patent Specification No. 3,531,483.
 90 The above phenolic stabilizers are known and many are commercially available.
 While any of the above mentioned antioxidants can be useful in combination with 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 as mentioned above. The most preferred hindered phenols are those of groups 1, 9, 11, 12 and 13.
 95 Further examples of antioxidants are those of the aminoaryl series for instance aniline and heterocyclic derivatives such as:—
 phenyl - 1 - naphthylamine,
 100 phenyl - 2 - naphthylamine,
 N,N' - diphenyl - p - phenylenediamine,
 N,N' - di - sec.butyl - p - phenylenediamine,
 6 - ethoxy - 2,2,4 - trimethyl - 1,2 - dihydroquinoline,
 110 6 - dodecyl - 2,2,4 - trimethyl - 1,2 - dihydroquinoline,
 mono- and di-octyliminodibenzyl, and polymerised 2,2,4 - trimethyl - 1,2 - dihydroquinoline.
 115 Ultraviolet absorbers and light protectants include
 (a) 2 - (2' - hydroxyphenyl)benzotriazoles, for instance 5' - methyl; 3',5' - di - t - butyl; 5' - 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' - carbamethoxyethyl; 5-
chloro - 3',5' - di - t - amyl derivatives;
(b) 2,4 - bis - (2' - hydroxyphenyl) - 6-
alkyl - S - triazines, for instance the
6-ethyl or 6-undecyl derivatives;
(c) 2-hydroxybenzophenones, for instance the
4 - hydroxy, 4 - methoxy, 3 - octoxy, 4-
decyloxy, 4 - dodecyloxy, 4,2',4' - tri-
hydroxy or 2' - hydroxy - 4,4' - di-
methoxy derivatives.
(d) 1,3 - bis(2' - hydroxybenzoyl) - benzenes
for instance,
1,3 - bis - (2' - hydroxy - 4' - hexyloxy-
benzoyl)benzene,
1,3 - bis - (2' - hydroxy - 4' - octyloxy-
benzoyl)benzene, and
1,3 - bis(2' - hydroxy - 4' - dodecyloxy-
benzoyl)benzene;
(e) Aryl esters of optionally substituted ben-
zoic acids such as phenylsalicylate, octyl-
phenyl salicylate, dibenzoyl resorcinol,
bis - O - (4 - tert.butylbenzoyl) resorci-
nol, O - benzoyl - resorcinol 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;
(f) Acrylates, for instance
 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 com-
plexes 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 - diethanolamine; nickel
complexes of bis - (4 - tert.octylphenyl)
sulphone such as the 2:1 complex, option-
ally having other ligands such as 2-ethyl-
caproic acid; nickel dibutyl dithiocarba-
mates; nickel salts of 4 - hydroxy - 3,5-
di - tert.butylbenzyl - phosphonic acid
mono-alkyl esters such as the methyl-,
ethyl- or butyl esters; the nickel complex
of 2 - hydroxy - 4 - methyl - phenyl - un-
decylketonoxime; and nickel - 3,5 - di-
tert.butyl - 4 - hydroxy benzoate; and
(h) oxalic acid diamides, for instance
4,4' - dioctyloxyoxanilide,
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 com-
pound of formula:—



- Phosphite stabilisers include triphenyl phos-
phite, diphenylalkyl phosphites, phenyl dialkyl
phosphites, trinonylphenyl phosphite, trilauryl
phosphite, trioctadecyl phosphite, 3,9 - di-
isodecyloxy - 2,4,8,10 - tetraoxa - 3,9 - di-
phosphaspiro - (5,5) - undecane and tri - (4-
hydroxy - 3,5 - di - tert.butylphenyl)phosphite.
Peroxide-decomposing compounds for poly-
olefins include esters of β -thiodipropionic
acids, for instance the lauryl-, stearyl, myristyl-
or tridecyl esters, and salts of mercaptobenz-
imidazoles such as the zinc salt and diphenyl-
thiourea.
Suitable polyamide stabilisers include cop-
per salts in combination with iodides and/or
further phosphorus compounds and salts of bi-
valent manganese.
Basic co-stabilisers are, for example, poly-
vinylpyrrolidone, melamine, benzoguanamine,
triallyl cyanurate, dicyandiamide, urea deriva-
tives, hydrazine derivatives, amines, poly-
amides, polyurethanes, and alkali and alkaline
earth salts of higher saturated or unsaturated
fatty acids such as calcium stearate.
- Polyvinyl chloride stabilisers include organo-
tin compounds, organo lead compounds and
Ba/Cd salts of fatty acids.
Examples of nucleation agents are 4-tert.
butyl benzoic acid, adipic acid and diphenyl-
acetic 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 ternary com-
binations with such antioxidants and U.V.
absorbers listed above, the compounds of for-
mula I provide very effective stabiliser pack-
ages in polyolefine formulations.
The halo-compounds of formula I, in addi-
tion to their property of functioning as a
stabiliser for organic material, may also find
use as intermediates for materials such as other
stabilisers.
Some Examples will now be given. Parts,
ratios and percentages are by weight unless

otherwise stated. Parts by weight bear the same relation to parts by volume as do kilograms to litres.

Example 1.

- 5 To 28.2 parts of 2,2,6,6 - tetramethyl-
piperidin - 4 - ol in 200 parts of dry xylene
were added in portions 4.2 parts of sodium.
This mixture was heated at reflux for 18 hours
10 and then cooled. 10.1 parts of cyanuric chloride
were added in portions and the mixture
brought to a reflux temperature for 1 hour.
Evaporation to dryness under reduced pressure
was followed by extraction with petroleum
15 ether (b.p. 60—80°C.) using a Soxhlet
extractor apparatus. Evaporation in vacuo gave
the desired product contaminated with 2,2,6,6-
tetramethylpiperidin - 4 - ol. Sublimation in
vacuo removed this contaminant and the
20 residual colourless solid was crystallised from
petroleum ether (b.p. 60—80°C.) to yield
23.7 parts of 2,4,6 - tris[2',2',6',6' - tetra-
methylpiperidinyl - 4' oxy-] - 1,3,5 - triazine
of melting point 198°—200°C. This material
25 gave the following elemental analysis by
weight:

	Required for $C_{30}H_{54}N_6O_3$	Found
Carbon	65.90%	65.72%
Hydrogen	9.95%	9.85%
Nitrogen	15.37%	15.19%

Example 2.

- 30 38 parts of polypropylene were homogenised
with 0.76 parts of n - octadecyl - β - (4'-
hydroxy - 3',5' - di - t - butylphenyl) pro-
pionate in a kneading machine over a period
of 3 minutes. 0.19 part of the product of
35 Example 1 was then added and homogenisa-
tion continued for another 7 minutes.

The homogenised mixture was removed

from the kneader and pressed to a thickness
of from 2 to 3 mm. in a press.

9 parts of the polypropylene mixture were
then charged into a second press in which the
press-plates were protected by aluminium foil
having a thickness of 0.1 mm. The press was
closed and, for 2 minutes, no pressure was
45 applied. The pressure was then increased up
to a maximum of 12 tons and this pressure
held for 6 minutes, the temperature of the
press being 260°C. The pressure was released
and the material (0.3 mm thick) was cooled
50 under running water.

This material was cut into from 3 to 5
pieces of 35 × 35 mm section and re-charged
to the press. The press was closed and no
pressure was applied for 2 minutes. Over
55 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 polypropyl-
ene foil 0.1 mm thickness was removed and
60 tempered immediately in a circulating air oven
maintained at 150°C. over a period of 60
minutes.

A section measuring 44 × 100 mm was
separated from the 0.1 mm tempered poly-
propylene 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
65 peak emission of 3,000 Angstrom units;
the blacklight lamps were 2 feet long, 40-watt
ultraviolet lamps characterised by a peak
emission of 3,500 Angstrom units. The sample
was rotated concentrically about the bank of
lamps so that the radiation therefrom was uni-
formly distributed over the section under test.

The exposed sample was examined periodic-
ally and the time at which the sample reached
50% of the initial elongation was noted.

TABLE I

Example	Additive	Time to reach 50% initial elongation (hours)
—	None (control)	125
2	2,4,6-tris [2',2',6',6'-tetramethyl- piperidinyl-4'-oxy]-1,3,5-triazine	625

Example 3.

- 85 1000 Parts by weight of unstabilised poly-
propylene powder were thoroughly dry-blended
with 1 part by weight of n - octadecyl - β -
(4' - hydroxy - 3',5' - di - t - butylphenyl)
propionate and 2 parts of the product of

Example 1. The dry-blend was extruded at
cylinder temperatures of from 180° to 220°C.
and the resulting strand was granulated. The
stabilised formulation so obtained was melt-
spun and stretched under the following condi-
tions:—

Extruder temperatures	: 230/265/275°C.
Melt temperature at the dye	: 270°C.
Spinning Speed	: 400 m./minute
Stretching Ratio	: 1 : 5
Titer of Multifilament	: 130/137 denier
Tensile Strength	: 6 g./denier

The multifilament obtained was mounted on a sample holder of a Xenotest 150 apparatus (Quarzlampen GmbH) using white cardboard as backing. ("Xenotest" is a Trade Mark.) In intervals of 200 hours of exposure time, 5 fibre samples are measured for their retained tensile strength. The data obtained are plotted against exposure time and the exposure time to give

50% loss of original tensile strength is derived from the graph. This value is taken as the failure time.

The data are shown in the following Table II which also includes data relating to a control experiment omitting the product of Example 1.

TABLE II

Example	Additive	Time to failure (hours)
—	No light stabiliser	430
3.	2,4,6-tris[2',2',6',6'-tetramethyl piperidiny-4'-oxy]-1,3,5-triazine	1750

Example 4.

18.5 Parts of cyanuric chloride were slurried in 600 parts of water and treated with 31.4 parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine. 8 Parts of sodium hydroxide 20 parts of water were then carefully added and the suspension stirred at room temperature for thirty minutes. The suspension was then heated at 90°C for 16 hours and allowed to cool. 39.5 Parts of a colourless solid, 2-chloro - 4,6 - bis - (2',2',6',6' - tetramethylpiperidiny - 4' - amino) - 1,3,5 - triazine were separated by filtration, washed with water and dried in vacuo. This material of melting point 277—278°C, showed the following elemental analysis by weight:

	Required for $C_{21}H_{38}N_4Cl$	Found
Carbon	59.48%	59.54%
Hydrogen	9.03%	9.09%
Nitrogen	23.12%	22.89%
Chlorine	8.36%	8.32%

Example 5.

12 Parts of the material obtained in Example 4 were warmed in a solution comprising 920 parts of ethanol and 190 parts of water. 9 Parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were added and the solution heated at reflux for 16 hours. The solution was then evaporated to dryness and treated with 200 parts of water. Filtration afforded 14.0 parts of a colourless solid 2,4,6 - tris[2',2',6',6'-tetramethyl piperidiny - 4' - amino] - 1,3,5-triazine monohydrate which was purified by Soxhlet extraction of the impurities with petroleum ether (of boiling range 60—80°C.) The residual material of melting point 213—

215°C, gave the following elemental analysis by weight:

	Required for $C_{30}H_{52}N_6 \cdot H_2O$	Found
Carbon	64.12%	64.01%
Hydrogen	10.58%	10.42%
Nitrogen	22.44%	22.21%

Prolonged heating *in vacuo* of this compound afforded the anhydrous material of melting point 217—219°C.

Example 6.

8.19 Parts of the material prepared in Example 1 were dissolved in 60 parts of isopropanol and 9 parts of methyl iodide added with water cooling. After 120 hours a solid was separated by filtration and washed with diethyl ether. The solid was dissolved in the minimum amount of water and sodium carbonate added until the solution was basic. Chloroform extraction afforded 2,4,6 - tris[1',2',2',6',6' - pentamethylpiperidiny] - 4'-oxy] - 1,3,5 - triazine. This material was crystallised from a 1:1 mixture of chloroform and ethanol to give a colourless solid of melting point 245—247°C which gave the following elemental analysis by weight.

	Required for $C_{33}H_{50}H_6O_3$	Found
Carbon	67.31%	67.36%
Hydrogen	10.27%	10.22%
Nitrogen	14.27%	13.99%

Example 7.

25.8 parts of 4 - hydroxy - 2,2,6,6 - tetramethylpiperidin - 1 - oxyl and 8.4 parts of potassium hydroxide were dissolved in 500

parts of water. 9.2 parts of cyanuric chloride were carefully added and the solution heated at reflux for 2 hours. 5 Parts of a solid were filtered off and washed with 20 parts of water followed by 20 parts of boiling petroleum ether (boiling range 80—100°C). After drying this material 2,4,6 - tris[1' - oxyl - 2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine, gave a melting point of 192—194°C and the following elemental analysis by weight:

	Required for $C_{30}H_{51}N_6O_6$	Found
Carbon	60.89%	60.48%
Hydrogen	8.69%	8.56%
15 Nitrogen	14.20%	13.76%

Example 8.

14.75 Parts of cyanuric chloride were carefully added to a mixture of 25 parts of 2,2,6,6-tetra methyl piperidin - 4 - ol and 13.5 parts of sodium bicarbonate in 250 parts of water. The mixture was stirred and heated to give a clear solution. After 6 hours a colourless precipitate had been produced which was filtered after cooling. The solid was washed three times with 100 parts of water and dried in a vacuum oven to give 13.5 parts of 2-chloro - 4,6 - bis(2',2',6',6' - tetra methyl piperidinyl - 4' - oxy) - 1,3,5 - triazine monohydrate. This material, of melting point 225—226°C, showed the following elemental analysis by weight:

	Required for $C_{21}H_{36}N_6O_2Cl.H_2O$	Found
Carbon	56.79%	56.50%
Hydrogen	8.63%	8.72%
35 Nitrogen	15.78%	15.71%
Chlorine	7.99%	7.86%

Example 9.

To 10.4 parts of 4 - hydroxy - 2,2,6,6-tetra methyl piperidin - 1 - oxyl in 160 parts of dry benzene were added, in portions, 1.38 parts of sodium. This mixture was heated at reflux for 18 hours and then cooled. 3.7 Parts of cyanuric chloride were added with care and the mixture heated at reflux for 18 hours. On cooling the inorganic salt was removed by filtration and the filtrate evaporated *in vacuo*. Sublimation *in vacuo* of the residual solid removed unreacted 4 - hydroxy - 2,2,6,6 - tetra methyl piperidin - 1 - oxyl and the residue was recrystallised three times from absolute ethanol to yield 2 - chloro - 4,6 - bis(1' - oxyl - 2',2',6',6' - tetra methyl piperidinyl - 4' - oxy) - 1,3,5 - triazine. This material had a melting point of 197—199°C and showed the following elemental analysis by weight:

	Required for $C_{21}H_{34}N_6O_4Cl$	Found
Carbon	55.30%	55.24%
Hydrogen	7.52%	7.36%
Nitrogen	15.36%	15.07%
60 Chlorine	7.78%	8.01%

Example 10.

To 4.94 parts of 1 - benzyl - 2,2,6,6 - tetra methyl piperidin - 4 - ol in 100 parts of xylene were added, in portions, 0.8 parts of sodium. This mixture was heated at reflux for 18 hours and then cooled. The excess sodium was removed and 1.2 parts of cyanuric chloride added with care. The mixture was stirred at reflux temperature for 3 hours. Evaporation of the solvent *in vacuo* afforded a solid which was Soxhlet extracted with petroleum ether (of boiling range 80—100°C) to give 1.7 parts of a pale yellow solid. Column chromatography on silica afforded 2,4,6-tris(1' - benzyl - 2',2',6',6' - tetra methyl piperidinyl - 4'oxy) - 1,3,5 - triazine. This material had a melting point of 125—129°C and showed the required spectroscopic features (Infrared, Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry).

Example 11.

4.8 Parts of 2 - chloro - 4,6 - bis(2',2',6',6' - tetra methyl piperidinyl - 4' - amino) - 1,3,5 - triazine were dissolved in a mixture of 300 parts of toluene and 200 parts tertiary butyl alcohol with warming. A solution of 4 parts of the sodium salt of 2,2,6,6-tetra methyl piperidin - 4 - ol in 40 parts toluene (as prepared in the above Examples) was added dropwise and the mixture heated at reflux for 18 hours. Evaporation of the solution and treatment of the residue with 15 parts of water afforded 4 parts of a colourless solid which was filtered and dried *in vacuo*. This material, 2,4 - bis[2',2',6',6' - tetra methyl piperidinyl - 4' - amino] - 6 - [2',2',6',6' - tetra methyl piperidinyl - 4' - oxy] - 1,3,5 - triazine, was crystallised from methanol and water to give a melting point of 186.5—187.5°C and had the following elemental analysis by weight:

	Required for $C_{30}H_{56}N_{10}O_2CH_3OH$	Found
Carbon	64.52%	64.67%
Hydrogen	10.48%	10.14%
Nitrogen	19.43%	19.34%

Example 12.

4 Parts of 2,4,6 - tris[2',2',6',6' - tetra methyl piperidinyl - 4' - amino] - 1,3,5 - triazine in 100 parts of isopropanol at 5°C were treated with 6.4 parts of iodomethane. The mixture was allowed to stand at room temperature for 3 days. Evaporation *in vacuo* afforded a residue which was treated with saturated sodium carbonate. Filtration and drying *in vacuo* afforded a colourless solid which was shown by spectroscopic means to be a partially methylated material. This material was dissolved in 180 parts of isopropanol and treated with 4 parts of iodomethane. The mixture was allowed to stand at room temperature for 3 days. Evaporation *in vacuo*, followed by treatment with saturated sodium carbonate, afforded a colourless solid, 2,4,6 - tris-

(1',2',2',6',6' - pentamethylpiperidinyl - 4'-amino) - 1,3,5 - triazine, which was filtered and dried *in vacuo*. This material was column chromatographed on alumina and then recrystallised from methanol and water to give a melting point of 235—240°C. The compound gave the following elemental analysis by weight:

	Required for $C_{33}H_{63}N_9 \cdot H_2O$	Found
Carbon	65.63%	65.36%
Hydrogen	10.85%	10.53%

Example 13.

To 4.8 parts of 2 - chloro - 4,6 - bis-(2',2',6',6' - tetramethyl piperidinyl - 4'-amino) - 1,3,5 - triazine in a mixture of 100 parts of ethanol and 20 parts of water were added 4 parts of 4 - (β - aminoethyl)-2,2,6,6 - tetra methyl piperidine. The solution was stirred at reflux for 8 hours and then evaporated *in vacuo*. The residue was dissolved in 25 parts of chloroform and washed with 50 parts of water. The chloroform phase was dried and evaporated to yield 6.0 parts of a colourless solid of melting point 75°C. This material was column chromatographed on alumina to give 2,4 - bis(2',2',6',6' - tetra methyl piperidinyl - 4' - amino) - 6-(2',2',6',6'' - tetra methyl piperidinyl - 4''-ethylenamino) - 1,3,5 - triazine of melting point 96—99°C. This substance showed the following elemental analysis by weight:

	Required for $C_{32}H_{61}N_9$	Found
Carbon	67.20%	66.57%
Hydrogen	10.75%	10.65%
Nitrogen	22.05%	21.56%

Example 14.

To 3.94 parts of 1 - allyl - 2,2,6,6 - tetramethyl piperidin-4-ol in 100 parts of toluene were added 0.8 parts of sodium. This mixture was heated at reflux for 18 hours and the excess sodium removed. 1.24 Parts of cyanuric chloride were added with care and the solution was stirred at reflux for 4½ hours. The solvent was evaporated *in vacuo* yielding a residue which was column chromatographed on alumina to give 2 - chloro - 4,6 - bis(1'-allyl - 2',2',6',6' - tetra methyl piperidinyl-4' - oxy) - 1,3,5 - triazine of melting point 167—170°C. This substance gave the following elemental analysis by weight:

	Required for $C_{27}H_{44}N_5O_2Cl$	Found
Carbon	64.06%	64.10%
Hydrogen	8.76%	8.94%
Nitrogen	13.83%	13.35%

Example 15.

5.6 Parts by weight of 2 - (2',2',6',6' - tetra methyl piperidinyl - 4')ethyl alcohol and 1.4 parts by weight of sodium were heated to

reflux for 24 hours in 100 parts by volume of toluene. To the resulting solution were added over 20 minutes 1.8 parts by weight of cyanuric chloride in 30 parts by volume of toluene, and the reflux continued for 18 hours. The toluene was then removed by distillation under reduced pressure and the solid suspended in water, this was extracted with ether (3 × 50 parts by volume), and the combined extracts dried over magnesium sulphate. The ether was removed by distillation and the residue was triturated with petroleum ether to give a solid which was collected by filtration, dissolved in 20 parts by volume of ethyl alcohol and reprecipitated by the addition of 100 parts by volume of water.

Thus was obtained pure 2,4,6 - tris-[2',2',6',6' - tetramethyl piperidinyl - 4'-ethylenoxy] 1,3,5 - triazine, melting at 104—6°C and having the following elemental analysis by weight:

	Required for $C_{36}H_{66}N_6O_3$	Found
Carbon	68.51%	68.54%
Hydrogen	10.57%	10.48%
Nitrogen	13.31%	13.40%

Example 16.

1.8 Parts by weight of cyanuric chloride and 11.0 parts by weight of 2 - (2',2',6',6'-tetramethylpiperidinyl - 4') ethylamine were heated at 160°C with stirring for 4 hrs. The resulting mass was cooled and the oil decanted off, this was diluted with 100 parts by volume of water and allowed to stand at room temperature for 24 hours. A solid precipitate was filtered, dried, and recrystallised from ethyl acetate (50 parts by volume) to give pure 2,4,6 - tris[2',2',6',6' - tetramethylpiperidinyl-4' - ethylenamino]1,3,5 - triazine, melting at 169°C and having the following elemental analysis by weight:—

	Required for $C_{36}H_{69}N_9$	Found
Carbon	68.85%	69.09%
Hydrogen	11.07%	11.16%
Nitrogen	20.07%	20.02%

Example 17.

3.7 Parts of cyanuric chloride were stirred in a mixture of 120 parts of ethanol and 120 parts of water, the temperature being maintained at -15°C. 3.12 Parts of 4 - amino-2,2,6,6 - tetramethyl piperidine were added whilst maintaining this temperature. After 2 hours, a colourless solid had been precipitated; this material was separated by filtration and dried *in vacuo* to yield 2,4 - dichloro - 6-(2',2',6',6' - tetramethyl piperidinyl - 4'-amino) - 1,3,5 - triazine (4.2 parts) as the hydrochloric acid salt. This salt had a melting point of over 275°C. and gave the following elemental analysis by weight:

	Required for $C_{12}H_{19}N_5Cl_2.HCl$	Found
Carbon	42.30%	42.56%
Hydrogen	5.92%	6.00%
Nitrogen	20.55%	20.61%

(4' - hydroxy - 3',5' - di - t - butyl - phenyl) propionate in a kneading machine over a period of 3 minutes at 200°C. 0.19 Part of the product of Example 5 was then added and homogenisation was continued for another 7 minutes.

This composition was compression moulded into films of 0.1 mm. thickness at 260°C. for 6 minutes and the films so obtained were then quenched in cold water.

A section measuring 44 × 100 mm. was separated from the 0.1 mm. annealed polypropylene foil and exposed to light irradiation in a fadometer 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 3,100 Angstrom units; the blacklight lamps were 2 feet long, 20-watt ultra-violet lamps characterised by a peak emission of 3,500 Angstrom units.

The sample was rotated concentrically about the bank of lamps so that the radiation thereupon was uniformly distributed over the section under test.

The exposed sample was examined periodically and portions of it tested to determine the percentage elongation at break, the time (T) at which the sample reached 50% of the initial elongation at break being noted.

A similar test was carried out on a polypropylene sample containing no stabiliser of the invention.

The results obtained are set out in the following Table III.

TABLE III

Example	Additive	FACTOR T/To
		Time to 50% of initial elongation at break (T) (additive)
		Time to 50% of initial elongation at break for control (To)
—	None	1
19	2,4,6-Tris(2',2',6',6'-tetramethyl piperidiny-4'-amino)-1,3,5-triazine	3.5

Example 18.

A solution of 7.4 parts by weight of 2-(2',2',6',6' - tetramethyl piperidiny-4') ethyl amine in 20 parts by volume of toluene was added dropwise to a stirred solution of 1.85 parts by weight of cyanuric chloride in 80 parts by volume of toluene. The resulting suspension was stirred at room temperature for 24 hours, and the solid then collected by filtration and treated with a 10% solution of sodium hydroxide in water for a further 12 hours.

The resulting solid was collected by filtration, washed repeatedly with water until the aqueous washings were pH 6—7, dried at 60°C., and purified by reprecipitation from a chloroform solution by the addition of petroleum ether (boiling range 60—80°C.) to give 2 - chloro - 4,6 - di [2',2',6',6' - tetramethyl-piperidiny-4' - ethylenamino] - 1,3,5-triazine, melting at 168°C. and having the following elemental analysis by weight:

	Required for $C_{25}H_{46}ClN_7$	Found
Carbon	62.5%	62.32%
Hydrogen	9.7%	9.3%
Chlorine	7.4%	7.65%
Nitrogen	20.4%	20.45%

Example 19.

38 Parts of polypropylene were homogenised with 0.076 parts of n - octadecyl - β

6 - (2',2',6',6' - tetramethylpiperidiny-4'-amino) - 1,3,5 - triazine were obtained. This material had a melting point of 189 to 191°C and gave the following elemental analysis by weight:

	Required for $C_{14}H_{25}N_5Cl$	Found
Carbon	53.74%	53.55%
Hydrogen	8.05%	7.96%
Chlorine	11.33%	11.38%
Nitrogen	26.86%	27.10%

Example 21.

Using identical conditions to Example 20, 6.2 parts of 2 - isopropylamino - 4,6 - dichloro - 1,3,5 - triazine were reacted with 4.8 parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine to yield 7 parts of 2 - isopropylamino - 4 - chloro - 6 - (2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 1,3,5 - triazine. This substance had a melting point of 174 to 176°C and gave the following elemental analysis by weight:

	Required for $C_{15}H_{27}N_6Cl$	Found
Carbon	55.11%	54.85%
Hydrogen	8.33%	8.04%
15 Nitrogen	25.71%	25.59%
Chlorine	10.85%	10.98%

Example 22.

Using identical conditions to Example 20, 6.7 parts of 2 - n - octylthio - 4,6 - dichloro - 1,3,5 - triazine were reacted with 3.55 parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine to yield 9.1 parts of 2 - n - octylthio - 4 - chloro - 6 - (2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 1,3,5 - triazine. This material had a melting point of 79 to 81°C and gave the following elemental analysis by weight:

	Required for $C_{20}H_{38}N_6ClS$	Found
Carbon	58.01%	57.86%
30 Hydrogen	8.76%	(8.73%)
Nitrogen	16.91%	16.89%
Chlorine	8.56%	8.74%
Sulphur	7.74%	7.44%

Example 23.

3.6 parts of 1,2,2,6,6 - pentamethylpiperidin - 4 - ol were heated with 0.6 parts of sodium to reflux temperature in toluene. After 16 hours the solution was cooled, the excess sodium removed and the solution treated with 4.1 parts of 2 - chloro - 4,6 - dimethylthio - 1,3,5 - triazine. The solution was heated at reflux temperature for 18 hours after which it was cooled and filtered free of sodium chloride. The solvent was evaporated under reduced pressure to yield a residue which was crystallised from petroleum ether (of boiling point 60—80°C). Two parts of 2,4 - dimethylthio - 6 - [1',2',2',6',6' - pentamethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine were obtained which showed a melting point of 143 to 145°C and gave the following elemental analysis by weight:

	Required for $C_{15}H_{26}N_4OS_2$	Found
Carbon	52.62%	52.66%
55 Hydrogen	7.65%	7.64%
Nitrogen	16.36%	16.13%

Example 24.

2.4 parts of 2 - chloro - 4,6 - bis - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine were treated with 1.2

parts of isopropylamine in 40 parts of water. The solution was stirred at room temperature for 18 hours, at reflux temperature for four hours and then cooled and evaporated to yield 1.6 parts of material. This residue was treated with 10 parts of dilute sodium hydroxide solution and extracted twice with 50 parts of chloroform. After drying and removal of the solvent a semi-solid material was obtained which on addition of two parts of methanol yielded a colourless solid 2 - isopropylamino - 4,6 - bis - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine of melting point 120° to 122°C. It showed the following elemental analysis by weight:

	Required for $C_{24}H_{46}N_8CH_3OH$	Found
Carbon	62.72%	62.60%
Hydrogen	10.53%	9.98%
Nitrogen	23.42%	23.92%

Example 25.

0.36 parts of sodium were added to 150 parts of ethanol and the solution treated with 6.6 parts of 2 - chloro - 4,6 - bis - [2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5 - triazine. The mixture was stirred and heated at reflux for 16 hours after which the solution was cooled and filtered. Evaporation of the filtrate *in vacuo* afforded 6.6 parts of a colourless solid which was chromatographed on an alumina column to yield 2 - ethoxy - 4,6 - bis - (2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 1,3,5 - triazine. This material has a melting point of 189 to 191°C and gave the following elemental analysis by weight:

	Required for $C_{23}H_{43}N_8O.H_2O$	Found
Carbon	61.40%	61.41%
Hydrogen	10.05%	9.87%
Nitrogen	21.70%	21.46%

Example 26.

6.28 Parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were dissolved in 100 parts of toluene and 4.1 parts of 2 - chloro - 4,6 - di(methylthio) - 1,3,5 - triazine were carefully added. The solution was stirred at reflux temperature for 6 hours. 6 Parts of a solid were filtered off and dried. This material was treated with 30 parts of saturated sodium carbonate solution and extracted with 300 parts of chloroform. The organic extract was dried and evaporated to yield a colourless tacky solid. Column chromatography on alumina afforded pure 2 - (2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 4,6 - di(methylthio) - 1,3,5 - triazine. This material was recrystallised from ethanol and had a melting point of 173° to 175°C. It showed the following elemental analysis by weight:

	Required for $C_{14}H_{22}N_6S_2$	Found
Carbon	51.36%	51.63%
Hydrogen	7.70%	7.93%
Nitrogen	21.39%	21.45%

Example 27.

1.4 Parts of sodium and 6.28 parts of 2,2,6,6 - tetramethylpiperidin - 4 - ol was heated at reflux temperature for 24 hours in 100 parts of toluene. To this cooled solution was added 3.86 parts of 2 - ethylamino - 4,6-dichloro - 1,3,5 - triazine and the mixture heated at reflux for 2 hours. Evaporation of the solvent *in vacuo* afforded a material which was extracted with chloroform using a Soxhlet extractor. The extract was evaporated to yield a colourless solid which was chromatographed on an alumina column and then crystallised from ethyl acetate, to give pure 2 - ethylamino-4,6 - bis[2',2',6',6' - tetramethylpiperidinyl-4' - oxy] - 1,3,5 - triazine which showed a melting point of 189.5 to 190.5°C and the following elemental analysis by weight:

	Required for $C_{23}H_{42}N_6O_2$	Found
20 Carbon	63.54%	63.63%
Hydrogen	9.74%	9.77%
Nitrogen	19.34%	19.24%

Example 28.

3 Parts of 2,4 - dichloro - 6 - (2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 1,3,5-triazine hydrochloric acid salt were dissolved in 400 parts of a 1:1 mixture of ethanol and water. 1.18 Parts of n-propylamine were added and the solution heated at reflux for 18 hours. Evaporation of the solvent afforded a colourless solid which was crystallised from the solvent mixture methanol/petroleum ether (of boiling range 60—80°C)/ethyl acetate to give pure 2 - chloro - 4 - n - propylamino - 6-(2',2',6',6' - tetramethylpiperidinyl - 4' - amino) - 1,3,5 - triazine hydrochloric acid salt of melting point greater than 270°C and which gave the following analysis by weight:

	Required for $C_{15}H_{28}N_6Cl_2$	Found
40 Carbon	49.61%	49.26%
Hydrogen	7.77%	7.80%
Nitrogen	23.15%	22.54%

Example 29.

A solution of 2.1 parts by weight of 2-chloro - 4,6 - di(methylthio) - 1,3,5 - triazine and 4.0 parts by weight of 2(1',2',2',6',6' - pentamethylpiperidinyl - 4') - ethylamine in 50 parts by volume of toluene was heated at reflux for 4 hours. The toluene was then filtered and removed by distillation under reduced pressure to give a residual oil, which by trituration with petroleum ether (boiling range 40—60°C) gave a white solid. Recrystallisation from 25 parts by volume of petroleum ether (60—80°C) gave pure 2-(1',2',2',6',6' - pentamethylpiperidinyl - 4' - ethylenamino) - 4,6 - di(methylthio) - 1,3,5-triazine, melting at 119°C and having the following elemental analysis by weight:

	Required for $_{17}H_{31}N_5S_2$	Found
Carbon	55.27%	55.22%
Hydrogen	8.46%	8.62%
Nitrogen	18.96%	19.10%
Sulphur	17.32%	17.15%

Example 30.

1.5 Parts of 2 - chloro - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine were dissolved in 130 parts of an ethanol/water (5:1) mixture and 4 parts of dimethylamine in ethanol solution (33%) added. The mixture was heated in a rocking autoclave at a temperature of 100°C and a pressure of 20 atmospheres gauge nitrogen for 24 hours. The solution was filtered and the filtrate evaporated *in vacuo* to yield a pale brown solid. Charcoal treatment of this material removed the colour and the product was Soxhlet extracted with petroleum ether (of boiling range 60—80°C) for 24 hours to yield 2 - dimethylamino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine monohydrate as a colourless solid. It showed a melting point of 230° to 233°C, a molecular weight of 432 by mass spectrometry and the following elemental analysis by weight:

	Required for $C_{28}H_{44}N_8H_2O$	Found
Carbon	61.30%	61.31%
Hydrogen	10.29%	10.28%
Nitrogen	24.86%	24.87%

Example 31.

3 Parts of 2 - chloro - 4,6 - bis[2',2',6',6' - tetramethylpiperidin - yl - 4' - amino] - 1,3,5-triazine were dissolved in a mixture of 225 parts of ethanol and 46 parts of water with stirring and heating. 1.26 Parts of morpholine were added and the solution heated at reflux for 24 hours. The solution was then evaporated *in vacuo* and 50 parts of water added. After stirring for 30 minutes the solution was filtered and the filtered material treated with 50 parts of saturated sodium carbonate solution and extracted with 200 parts of chloroform. The extract was dried and evaporated *in vacuo* to yield 2 - morpholino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-triazine dihydrate as a colourless solid of melting point 179—181°C. This solid had a molecular weight of 474 by mass spectrometry and showed the following elemental analysis by weight:

	Required for $C_{28}H_{44}N_8O.2H_2O$	Found
Carbon	58.78%	58.60%
Hydrogen	9.87%	9.32%
Nitrogen	21.95%	22.06%

Example 32.

2.2 Parts of 2 - chloro - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3,5-

triazine and 1.07 parts of benzylamine were heated at reflux in a mixture of 150 parts of ethanol and 30 parts of water for 18 hours. On evaporation of the solvent, a material was obtained which was chromatographed on an alumina column. Crystallisation from water gave 2 - benzylamino-4,6 - bis[2',2',6',6' - tetramethylpiperidinyl-4' - amino] - 1,3,5 - triazine monohydrate as

10 colourless solid of melting point 98° to 100°C. It gave the following elemental analysis by weight:

	Required for $C_{28}H_{46}N_8 \cdot H_2O$	Found
15 Carbon	65.60%	65.77%
Hydrogen	9.42%	9.40%
Nitrogen	21.82%	21.81%

Example 33.

2 Parts of 2 - chloro - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine and 2.48 parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were heated at reflux with a mixture of 42 parts ethanol and 20 parts water for 18 hours. A pure colourless solid was filtered from the solution which had a melting point of over 280°C and a molecular weight of 406 by mass spectrometry. This material was the hydrochloric acid salt of 2-amino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine and showed the following elemental analysis by weight:

	Required for $C_{21}H_{38}N_6O_2 \cdot HCl$	Found
Carbon	56.92%	56.96%
Hydrogen	8.87%	8.71%
35 Nitrogen	18.97%	19.28%

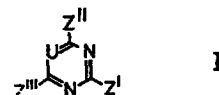
Example 34.

3.6 Parts of 2,4,6 - trichloropyrimidine were dissolved in a mixture of 12 parts of water and 20 parts of dioxane and the solution stirred and cooled to 5°C. 3 Parts of 4 - amino-2,2,6,6 - tetramethylpiperidine were then added slowly maintaining a temperature of below 10°C. 0.8 Parts of sodium hydroxide in 2 parts of water were added and the solution stirred at room temperature for 1 hour. 4.4 Parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were then added followed by 0.8 parts sodium hydroxide in 2 parts of water. The resultant solution was then stirred at reflux temperature for 18 hours. A solid material was filtered off, treated with 100 parts of saturated sodium carbonate solution and extracted with 200 parts of chloroform. The extract was dried and evaporated to yield a solid, 6 - chloro - 2,4 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine monohydrate which was recrystallised from chloroform/petroleum ether (of boiling range 40—60°C) to give a melting point of 198 to 199.5°C and the following elemental analysis by weight:

	Required for $C_{22}H_{30}N_8Cl \cdot H_2O$	Found
Carbon	59.91%	59.63%
Hydrogen	9.37%	9.11%
Nitrogen	19.05%	18.75%

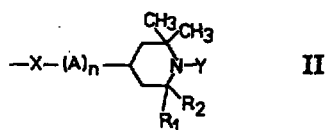
WHAT WE CLAIM IS:—

1. A compound having the formula:



and salts thereof, wherein U is $-\text{CH}=\text{}$, or $-\text{N}=\text{}$, Z' is a residue having the formula:

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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 form, together with the ring carbon atom to which they are bound, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring;

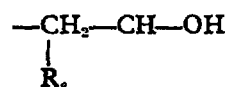
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X is an $-\text{O}-$, $-\text{S}-$ or $-\text{N}-$ residue,

wherein R₁ is hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms; Y is $-\text{O}-$, hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 12 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group

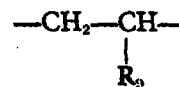
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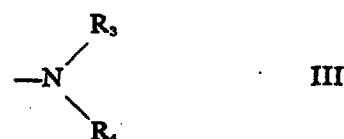
wherein R₄ is hydrogen, or a methyl or phenyl residue; n is 0 or 1; and A is $-\text{CH}_2-$, or the group

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wherein R₅ is hydrogen or an alkyl residue having from 1 to 20 carbon atoms; Z'' and Z''' are the same or different and each is a piperidine residue of formula II as hereinbefore defined, a halogen atom, an optionally substituted amino group having the formula:

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triazine and 1.07 parts of benzylamine were heated at reflux in a mixture of 150 parts of ethanol and 30 parts of water for 18 hours. On evaporation of the solvent, a material was obtained which was chromatographed on an alumina column. Crystallisation from water gave 2 - benzylamino-4,6 - bis[2',2',6',6' - tetramethylpiperidinyl-4' - amino] - 1,3,5 - triazine monohydrate as colourless solid of melting point 98° to 100°C. It gave the following elemental analysis by weight:

	Required for $C_{28}H_{46}N_8 \cdot H_2O$	Found
Carbon	65.60%	65.77%
Hydrogen	9.42%	9.40%
Nitrogen	21.82%	21.81%

Example 33.

2 Parts of 2 - chloro - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine and 2.48 parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were heated at reflux with a mixture of 42 parts ethanol and 20 parts water for 18 hours. A pure colourless solid was filtered from the solution which had a melting point of over 280°C and a molecular weight of 406 by mass spectrometry. This material was the hydrochloric acid salt of 2-amino - 4,6 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - oxy] - 1,3,5 - triazine and showed the following elemental analysis by weight:

	Required for $C_{21}H_{38}N_6O_2 \cdot HCl$	Found
Carbon	56.92%	56.96%
Hydrogen	8.87%	8.71%
Nitrogen	18.97%	19.28%

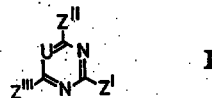
Example 34.

3.6 Parts of 2,4,6 - trichloropyrimidine were dissolved in a mixture of 12 parts of water and 20 parts of dioxane and the solution stirred and cooled to 5°C. 3 Parts of 4 - amino-2,2,6,6 - tetramethylpiperidine were then added slowly maintaining a temperature of below 10°C. 0.8 Parts of sodium hydroxide in 2 parts of water were added and the solution stirred at room temperature for 1 hour. 4.4 Parts of 4 - amino - 2,2,6,6 - tetramethylpiperidine were then added followed by 0.8 parts sodium hydroxide in 2 parts of water. The resultant solution was then stirred at reflux temperature for 18 hours. A solid material was filtered off, treated with 100 parts of saturated sodium carbonate solution and extracted with 200 parts of chloroform. The extract was dried and evaporated to yield a solid, 6 - chloro - 2,4 - bis[2',2',6',6' - tetramethylpiperidinyl - 4' - amino] - 1,3 - pyrimidine monohydrate which was recrystallised from chloroform/petroleum ether (of boiling range 40-60°C) to give a melting point of 198 to 199.5°C and the following elemental analysis by weight:

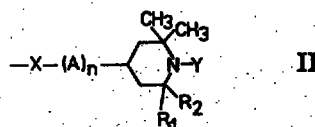
	Required for $C_{22}H_{30}N_6Cl \cdot H_2O$	Found
Carbon	59.91%	59.63%
Hydrogen	9.37%	9.11%
Nitrogen	19.05%	18.75%

WHAT WE CLAIM IS:—

1. A compound having the formula:



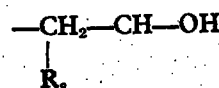
and salts thereof, wherein U is $-\text{CH}=\text{}$, or $-\text{N}=\text{}$, Z' is a residue having the formula:



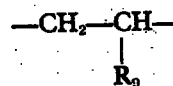
wherein R₁ and R₂ are the same or different and each is a straight or branched alkyl residue having from 1 to 12 carbon atoms or R₁ and R₂ form, together with the ring carbon atom to which they are bound, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring;

X is an $-\text{O}-$, $-\text{S}-$ or $-\text{N}-$ residue,

wherein R₁ is hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms; Y is $-\text{O}-$, hydrogen, a straight- or branched alkyl residue having from 1 to 20 carbon atoms, an alkenyl or alkynyl residue having from 3 to 12 carbon atoms, an aralkyl residue having from 7 to 12 carbon atoms or the group



wherein R₃ is hydrogen, or a methyl or phenyl residue; n is 0 or 1; and A is $-\text{CH}_2-$, or the group



wherein R₆ is hydrogen or an alkyl residue having from 1 to 20 carbon atoms; Z'' and Z''' are the same or different and each is a piperidine residue of formula II as hereinbefore defined, a halogen atom, an optionally substituted amino group having the formula:



wherein R_3 and R_4 are the same or different and each is hydrogen, a straight or branched alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, an aryl residue which is unsubstituted or substituted by one or more alkyl groups and having a total of from 6 to 18 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms, or R_3 and R_4 , together with the nitrogen atom to which they are bound, form a heterocyclic residue having 5 to 7 ring atoms; or Z'' and Z''' are each independently a hydroxy or an ether group having the formula:

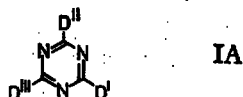


wherein R_5 is hydrogen, a straight or branched chain alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms, an aryl residue which is unsubstituted or substituted by one or more alkyl groups and having a total of 6 to 18 carbon atoms, or an aralkyl residue having from 7 to 12 carbon atoms; or Z'' and Z''' are each independently a thiol or thio ether group having the formula:

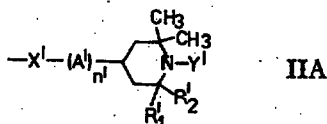


wherein R_6 is hydrogen, a straight or branched alkyl residue having from 1 to 20 carbon atoms, a cycloalkyl residue having from 5 to 12 carbon atoms in the ring or a phenyl or benzyl residue.

2. A compound having the formula:

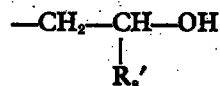


and salts thereof, wherein D' , D'' and D''' are the same or different and each is halogen or a residue of the formula:

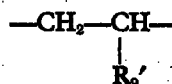


wherein R_1' and R_2' are the same or different and each is a straight or branched alkyl residue having from 1 to 12 carbon atoms, or R_1 and R_2 , together with the carbon atom to which they are bound, form a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, X' is an $-\text{O}-$, $-\text{S}-$ or $-\text{NR}_1'$ residue wherein R_1' is hydrogen, an alkyl residue having from 1 to 12 carbon atoms or an aralkyl residue having from 7 to 12 carbon atoms, Y' is $-\text{O}$, hydrogen, an alkyl residue having from 1 to 12 carbon atoms, an alkenyl or alkynyl residue having from 3 to 12 carbon

atoms, an aralkyl residue having from 1 to 12 carbon atoms or the group:



wherein R_6' is hydrogen, or a methyl or phenyl residue, n' is 0 or 1 and A' is $-\text{CH}_2-$, $-\text{CH}_2-\text{CH}_2-$ or

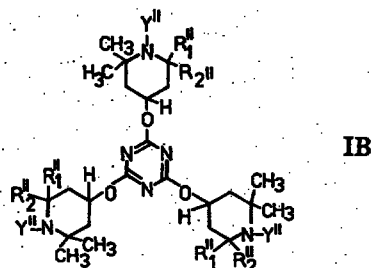


wherein R_6' is an alkyl residue having from 1 to 12 carbon atoms, with the proviso that at least one of D' , D'' and D''' is not a halogen atom.

3. A compound as claimed in Claim 2, wherein D' , D'' and D''' are the same or different piperidine residue IIA.

4. A compound as claimed in Claim 2 or 3, wherein X' is $-\text{O}-$ or $-\text{NH}-$, n' is 0, R_1' and R_2' are each methyl and Y' is hydrogen or a methyl residue.

5. A symmetrical or unsymmetrical compound having the formula:



and salts thereof, wherein R_1'' and R_2'' are the same or different and each is a straight or branched chain alkyl group having from 1 to 12 carbon atoms or R_1'' and R_2'' , together with the carbon atom to which they are each bound, form a cycloalkyl residue having from 5 to 12 carbon atoms in the ring, and Y'' is hydrogen, a straight or branched chain alkyl group having from 1 to 12 carbon atoms, an alkenyl group having from 3 to 12 carbon atoms or an aralkyl group having from 7 to 12 carbon atoms.

6. A compound as claimed in Claim 5, wherein R_1'' and R_2'' are each methyl and Y'' is hydrogen or a methyl residue.

7. A compound as claimed in Claim 1, wherein Z'' and Z''' are each the same or different piperidine residue II as defined in Claim 1.

8. A compound as claimed in Claim 1 or 7, wherein R_1 and R_2 are each a methyl group.

9. A compound as claimed in any of Claims 1, 7 and 8 wherein Y is hydrogen or a methyl residue.



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10. A compound as claimed in any of Claims 1 and 7 to 9 wherein X is —O— or —NH—.

11. A compound as claimed in any of Claims 1 and 7 to 10 wherein R₃ and R₄ are each hydrogen or an alkyl residue having from 6 to 20 carbon atoms.

12. A compound as claimed in any of Claims 1 and 7 to 11 wherein R₃ is hydrogen or an alkyl group having from 6 to 20 carbon atoms.

13. A compound as claimed in any of Claims 1 and 7 to 12 wherein R₆ is an alkyl residue having from 6 to 20 carbon atoms.

14. A compound as claimed in any of Claims 1 and 7 to 13 wherein n is 0.

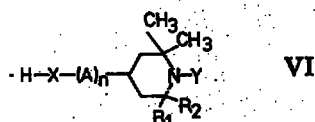
15. A compound as claimed in any of Claims 1 and 7 to 13 wherein n is 1 and A is —CH₂CH₂—.

16. A compound as claimed in Claim 5 substantially as described with reference to Example 1.

17. A compound as claimed in Claim 2 substantially as described with reference to any of Examples 4 to 18.

18. A compound as claimed in Claim 1 substantially as described with reference to any of Examples 20 to 34.

19. A process of producing a compound of formula I as defined in Claim 1 comprising reacting a cyanuric halide with a compound having the formula:



wherein X, A, Y, R₁, R₂ and n are as defined in Claim 1.

20. A process as claimed in Claim 19 wherein the cyanuric halide is cyanuric chloride.

21. A process as claimed in Claim 19 or 20, wherein the compound of formula I contains three identical piperidine residues and is produced by reacting at least three molecular proportions of a single compound of formula VI with one molecular proportion of cyanuric halide.

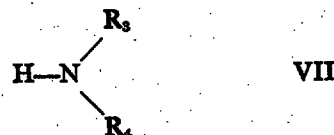
22. A process as claimed in Claim 19 or 20, wherein the compound of formula I contains two identical piperidine residues, and is produced by reacting at least two molecular proportions of a single compound VI per molecular proportion of cyanuric halide.

23. A process of producing a compound of formula I as claimed in claim 1 and wherein Y is a hydroxyalkyl residue comprising reacting a compound of formula I in which Y is hydrogen with an appropriate alkylene oxide.

24. A process as claimed in any of Claims 19 to 22, wherein X is —O— and reaction is effected by first preparing an alkali metal salt

of the compound of formula VI, prior to reaction with the cyanuric halide.

25. A process as claimed in any of Claims 22 to 24, wherein the compound of formula I containing two piperidine residues is reacted with an amine of formula:



or a strong acid salt thereof; wherein R₃ and R₄ are as defined in Claim 1, water, or an alcohol of formula:



wherein R₅ is as defined in Claim 1, or a thio compound of formula:



wherein R₆ is as defined in Claim 1.

26. A process as claimed in Claims 19 or 20, wherein the compound of formula I contains two piperidine residues, and is produced by reacting one molecular proportion of a cyanuric halide, firstly with one molecular proportion of a compound of formula VII, VIII or IX, as defined in Claim 25, and then treating the dihalogenated product with a piperidine compound of formula VI, as defined in claim 19.

27. A process as claimed in Claims 19 or 20, wherein the compound of formula I contains only one piperidine residue and is produced by reacting one molecular proportion of a compound VI, as defined in claim 19, with one molecular proportion of the cyanuric halide and then reacting the dihalogenated product so obtained with one or two molecular proportions of a compound of formula VII, VIII or IX, as defined in claim 25, as desired.

28. A process as claimed in Claims 19 or 20 wherein the compound of formula I contains only one piperidine residue and is produced by reacting one or two molecular proportions of a compound of formula VII, VIII or IX, as defined in claim 25, with one molecular proportion of a cyanuric halide, and then reacting the di- or mono-halogenated product so obtained with one molecular proportion of a compound of formula VI, as defined in claim 19.

29. A process as claimed in any of Claims 19 to 28, wherein the reaction is effected in the presence of a halogen acid binding agent and in a solvent inert under the reaction conditions.

30. A process for producing a compound of formula I as defined in Claim 1 and wherein Y is other than hydrogen comprising reacting a compound of formula I wherein Y is hydrogen,



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with a compound capable of replacing the hydrogen atom at the nitrogen by the group Y.

31. A process as claimed in Claim 30, wherein the compound capable of replacing the hydrogen atom is an alkylating, alkenylating, alkynylating or aralkylating agent.

32. A process as claimed in Claim 31 wherein the agent is an alkyl, alkenyl, alkynyl or aralkyl halide.

33. A process as claimed in Claim 30, wherein the compound capable of replacing the hydrogen atom is an oxidising agent thereby producing a compound of formula I wherein one or more of the Y substituents are —O.

34. A process as claimed in Claim 33, wherein the oxidising agent is a peroxide or a per-acid.

35. A process as claimed in Claim 33 or 34, wherein all of the Y substituents in the compound of formula I produced are —O.

36. A process as claimed in Claim 19 substantially as described with reference to Example 1.

37. A process as claimed in Claim 19 substantially as described with reference to any of Examples 4 to 18.

38. A process as claimed in Claim 19 substantially as described with reference to any of Examples 20 to 34.

39. A compound of formula I when produced by a process claimed in any of Claims 19 to 35 and 38.

40. A compound of formula I when produced by a process claimed in Claim 36.

41. A compound of formula I when produced by a process claimed in Claim 37.

42. A composition comprising an organic material and, as stabiliser, a minor proportion of a compound of formula I as defined in Claim 1.

43. A composition comprising an organic material and, as stabiliser, a minor proportion of a compound as defined in Claim 2.

44. A composition comprising an organic material and, as stabiliser, a minor proportion of a compound as defined in Claim 5.

45. A composition as claimed in any of Claims 42 to 44 wherein the organic material is low- or high-density polyethylene or polypropylene or polystyrene.

46. A composition as claimed in any of Claims 42 to 44 wherein the organic material is a polymer of butene-1, pentene-1, 3-methyl-butene-1, hexene-1, 4-methylpentene-1, 4-methylhexene-1, 4,4-dimethylpentene-1, or a co- or ter-polymer of ethylene or propylene.

47. A composition as claimed in any of Claims 42 to 46 wherein the amount of the compound of formula IA or IB is within the range of from 0.1% to 2% by weight based on the weight of untreated organic material.

48. A composition as claimed in any of Claims 42 to 44 and 47 wherein the organic material is a natural or synthetic polymeric material.

49. A composition as claimed in Claim 48 wherein the polymeric material is a natural or synthetic rubber.

50. A composition as claimed in Claim 49 wherein the synthetic rubber is a homo-, co- or terpolymer of acrylonitrile, butadiene and styrene.

51. A composition as claimed in Claim 48 wherein the polymeric material is polyvinyl chloride, polyvinylidene chloride, a vinyl chloride copolymer, polyvinyl acetate or a condensation polymer comprising ether, ester (derived from carboxylic, sulphonic or carbonic acids), amide or urethane groupings.

52. A composition as claimed in any of Claims 42 to 51 wherein the composition also contains one or more of an antioxidant of the phenol or amine type, a U.V. absorber, a light protectant, a phosphite stabiliser, a peroxide decomposer, a polyamide stabiliser, a basic co-stabiliser, a polyvinyl chloride stabiliser, a nucleation agent, a plasticiser, a lubricant, an emulsifier, an antistatic agent, a flame protectant, a pigment, carbon black, asbestos glass fibres, kaolin or talc.

53. A composition as claimed in Claim 44 substantially as described with reference to Example 2 or 3.

54. A composition as claimed in Claim 43 substantially as described with reference to Example 19.

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