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(54) Diketones, processes for their preparation and their use as components
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European Patent Convention).

Diketones, processes for their preparation
and their use as components
of liquid crystal dielectrics

- For liquid crystal display elements, the properties of nematic or nematic-cholesteric liquid crystal materials are utilised to effect a significant change in their optical properties, such as light transmission, light scattering, double refraction, reflectance or colour, under the influence of electrical fields.
- 10 The function of such display elements is based, for example, on the phenomenon of dynamic scattering, the deformation of oriented phases, the Schadt-Helfrich effect in the twisted cell or the nematic-cholesteric phase transition.
- 15 For industrial application of these effects in liquid crystal display elements, liquid crystal materials are needed which have to meet a large number of requirements. Particularly important requirements are the chemical stability towards moisture, air and physical
- 20 influences, such as heat, radiation in the infra-red, visible and ultra-violet range and steady and alternating electrical fields. Furthermore, a liquid crystal mesophase in the temperature range from at least 0°C to +50°C, and preferably from -10°C to +70°C, and a viscosity
- 25 at room temperature of not more than 60 cP are demanded

- 2 -

for liquid crystal materials which can be used industrially. Finally, these materials must not have any characteristic absorption in the range of visible light, that is to say they must be colourless.

5 A number of liquid crystal compounds are already known which meet the stability requirements demanded of dielectrics for electronic components and which are also colourless. These include, in particular, the p,p'-disubstituted phenyl benzoate described in German Offen-
10 legungsschrift 2,139,628, the p,p'-disubstituted biphenyl derivatives described in German Offenlegungsschrift 2,356,085 or the phenylcyclohexane derivatives described in German Offenlegungsschrift 2,636,684.

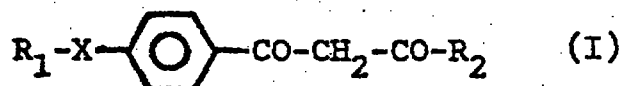
These categories of liquid crystal substances,
15 and also other categories of liquid crystal substances used hitherto in practice, are built up from aromatic or hydro-aromatic rings which have terminal alkyl and/or alkoxy groups and are linked to one another directly or via a bridge group. This structure ensures the
20 rigidity of the molecule necessary for a liquid crystal mesophase, and in particular a nematic mesophase, to occur. However, many of these compounds have relatively little polar character and are therefore frequently not suitable for dissolving polar doping agents
25 and/or dichroitic dyes in the concentrations which are desired for some types of application.

The object on which the invention is based is, therefore, to provide liquid crystal compounds of polar character in which even strongly polar doping agents and/

- 3 -

or dichroitic dyes are soluble to a sufficient extent to enable colour samplers based on the guest-host effect to be produced.

It has now been found, surprisingly, that the
5 diketones of the formula (I)



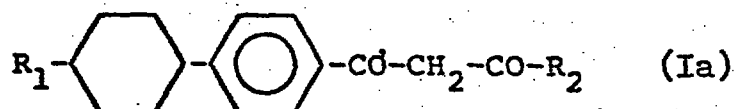
in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 - 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 - 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene
10 or 4,4'-cyclohexylphenyl, are outstandingly suitable as components of polar liquid crystal dielectrics. The compounds of the formula (I) possess liquid crystal mesophases and, because of their polar character, are able to dissolve strongly polar
15 doping agents and/or dichroitic dyes in concentrations hardly achieved hitherto. Furthermore, the compounds of the formula (I) are able to form salts and complex compounds with metal ions and these salts and complexes can be used as doping agents effecting the necessary
20 electrical conductivity in liquid crystal dielectrics for dynamic scattering. Finally, they possess an outstanding stabilising effect on those liquid crystal compounds which are sensitive to light and UV radiation.

The invention thus relates to the diketones of
25 the formula (I), a process for their preparation, and their use as components of liquid crystal dielectrics.

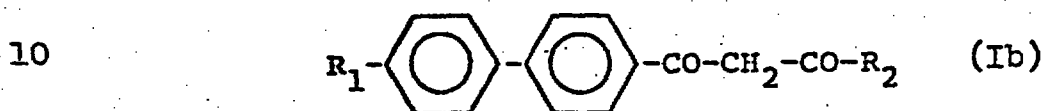
The invention also relates to liquid crystal di-

electrics which contain at least one compound of the formula (I) and to electro-optical display elements which are based on a liquid crystal cell and contain a dielectric of this type.

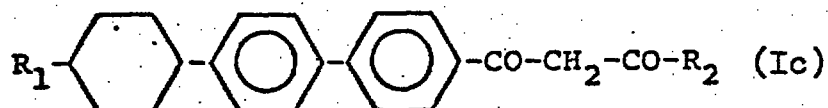
- 5 The diketones according to the invention are either 4-cyclohexylacetophenone derivatives of the formula (Ia)



or 4-phenylacetophenone derivatives of the formula (Ib)



or 4-(4-cyclohexylphenyl)-acetophenone derivatives of the formula (Ic)



- in which partial formulae (Ia) to (Ic) the radicals R_1
15 and R_2 are as defined under formula (I).

In the compounds according to the invention, the radical R_1 is an alkyl, alkoxy or perfluoroalkyl group with 1 to 18 carbon atoms, which can be straight-chain or branched. Amongst the straight-chain radicals R_1 ,
20 that is to say methyl, ethyl, n-propyl, n-butyl, n-pentyl, n-hexyl, n-heptyl, n-octyl, n-nonyl, n-decyl, n-undecyl, n-dodecyl, n-tridecyl, n-tetradecyl, n-pentadecyl, n-hexadecyl, n-heptadecyl or n-octadecyl and the

(52)

- 5 -

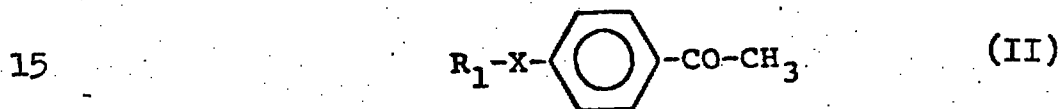
analogous alkoxy or perfluoroalkyl groups, those with not more than 12 carbon atoms are preferred. Occasionally, however, compounds of the formula (I) which contain branched substituents R_1 are also of importance, since these compounds sometimes display better solubility characteristics in the customary liquid crystal base mixtures. Substituents R_1 of this type which are not straight-chain preferably contain not more than one branched in the chain. Preferred branched substituents are those in which the carbon chain is branched at the carbon atom adjacent to the group X or, in particular, at one of the two nearest carbon atoms. Important groups amongst these substituents are those branched groups in which a methyl or ethyl group is located in the 1-, 2- or 3-position on a relatively long carbon chain, for example isopropyl, 1-methylpropyl, 2-methylpropyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, 1-methylpentyl, 1-ethylpentyl, 2-methylpentyl, 1-methylhexyl, 2-ethylhexyl or 1-methylheptyl. These selection criteria also apply analogously for the corresponding alkoxy groups R_1 . If R_1 is a perfluoroalkyl group, preferred groups are those which contain not more than 8 carbon atoms and in particular those with 1 - 5 carbon atoms; amongst such compounds, those in which R_1 is a trifluoromethyl group are particularly easily accessible. In the case of the compounds of the partial formulae (Ia) and (Ic), preferred compounds are those in which R_1 is an alkyl group; because the synthesis of the corresponding alkoxy and perfluoroalkyl derivatives is more difficult,

- 6 -

the use of these derivatives in liquid crystal dielectrics is less economical.

In the compounds according to the invention, the radical R_2 is alkyl or perfluoroalkyl with 1 - 12 carbon atoms. Amongst such compounds, preferred compounds are those in which R_2 is alkyl with 1 - 8 carbon atoms and in particular with 1 - 4 carbon atoms. Amongst the analogous perfluoroalkyl derivatives, those in which R_2 contains not more than 6 and preferably 1 - 4 carbon atoms, and in particular is the trifluoromethyl group, are preferred.

The compounds according to the invention are prepared in the manner customary for such substances. Preferably, an acetophenone of the formula (II)



in which R_1 is as defined in formula (I), is reacted in the presence of a basic condensing agent with a carboxylic acid ester of the formula (III)

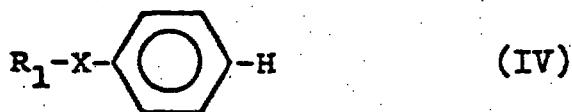


20 in which Z is a lower alkyl group and R_2 is as defined in formula (I), and the initially resulting salt of the enol form of the diketone (I) is hydrolysed to this ketone.

The acetophenones of the formula (II) are known from the literature in some cases, or they can be prepared analogously to the compounds of this type which are

- 7 -

known from the literature, in particular by acetylation of a compound of the formula (IV)



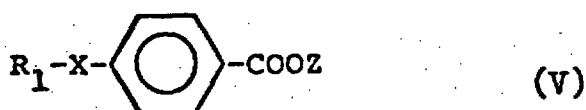
under the conditions of a Friedel-Crafts reaction.

- 5 In the carboxylic acid esters of the formula (III), Z is usually an alkyl group with not more than 4 carbon atoms, preferably methyl or ethyl. These esters are known from the literature.

- The reaction of the acetophenones of the formula
- 10 (II) with the esters of the formula (III) is carried out under the conditions generally customary for Claisen condensations of this type, the basic condensing agents used being, in particular, sodium, potassium, sodium amide, potassium amide, sodium hydride or sodium alco-
- 15 holates or potassium alcoholates. Preferably, the reactions are carried out in an anhydrous, inert organic solvent, for example diethyl ether, tetrahydrofuran, benzene, toluene, xylene or petroleum ether. In most cases, the alkali metal salt of the enol form of the
- 20 diketone of the formula (I) is formed, as a solid precipitate, in this reaction, which preferably is carried out at a temperature of between -20°C and $+50^{\circ}\text{C}$, and this precipitate is filtered off, washed with pure solvent and hydrolysed with water, optionally in the presence of a
- 25 small amount of a mineral acid. If the hydrolysis is carried out in the presence of an organic solvent which

- 8 -

is immiscible with water, the organic phase containing the diketone (I) is subsequently separated off and evaporated. The residual diketone is then purified by recrystallisation from a suitable solvent, for example methanol, ethanol or ethyl acetate. Furthermore, the diketones, according to the invention, of the formula (I) can be prepared by reacting a benzoic acid ester of the formula (V)

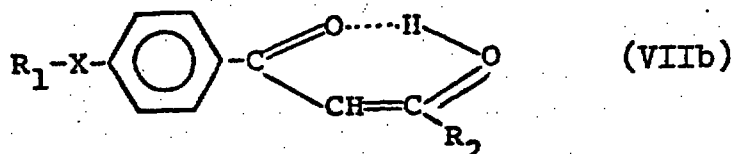
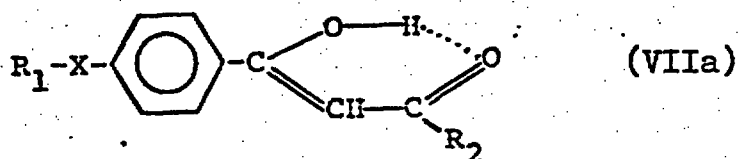


in which R_1 and Z are as defined above, with a ketone of the formula (VI)



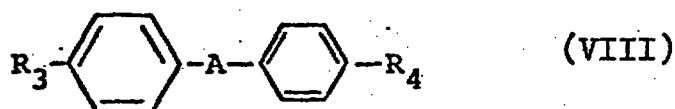
under conditions which are substantially analogous to those for the reaction of the acetophenones (II) with the carboxylic acid esters (III).

The compounds of the formula (I) are valuable components of liquid crystal dielectrics, which are used to produce electro-optical display elements. The fact that the compounds can be used for this purpose is probably due to the existence of the tautomeric enol structures (VIIa) and (VIIb)

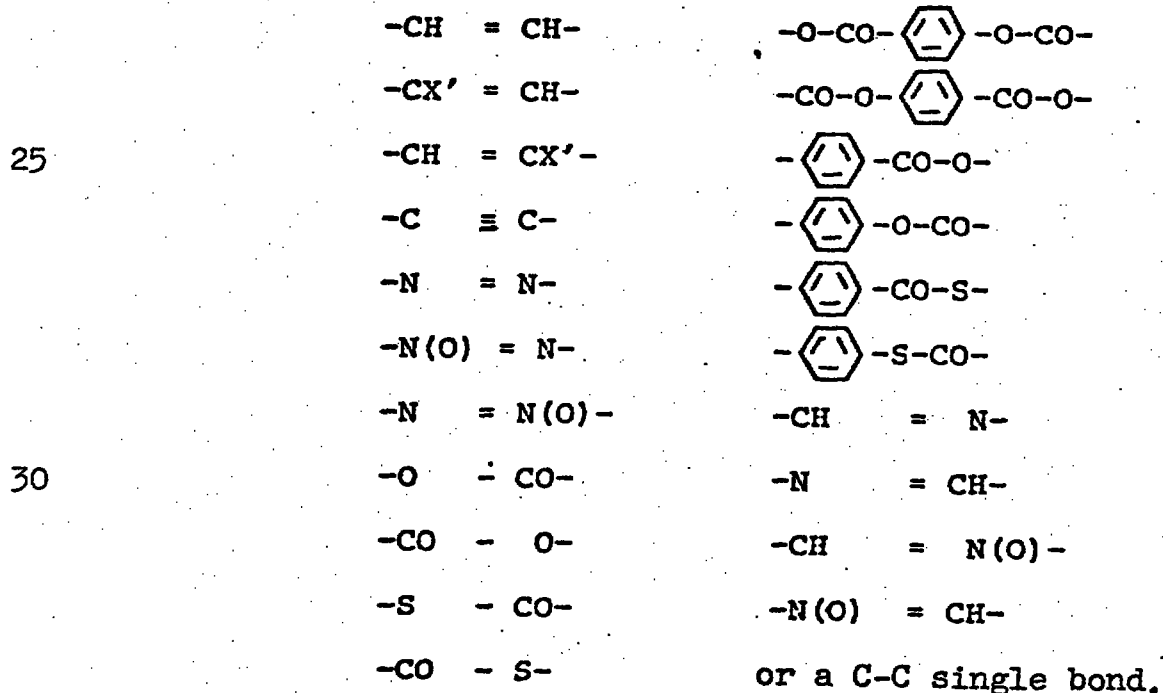


This assumption is also supported by the ability of the diketones according to the invention to form complex salts.

The liquid crystal dielectrics according to the invention consist of two or more components, including at least one of the formula (I). The other components are preferably nematic or nematogenic substances from the categories of the azobenzenes, azoxybenzenes, biphenyls, Schiff's bases, in particular benzylidene derivatives, phenyl benzoates, phenylcyclohexanes, optionally halogenated stilbenes, diphenylacetylene derivatives, diphenylnitrones and substituted cinnamic acids. The most important compounds which can be used as other components of this type can be characterised by the formula (VIII):



in which A is



- 10 -

Further possible components of the dielectrics according to the invention are those compounds of the formula (VIII) in which one or more phenyl rings have been replaced by a corresponding number of trans-cyclohexyl rings; X' is halogen, preferably Cl. R₃ and R₄ are identical or different and can be alkyl, alkoxy, alkanoyl, alkanoyloxy or alkoxycarbonyloxy radicals with not more than 18 and preferably not more than 8 C atoms; furthermore, one of these radicals can also be a cyano, nitro or isonitrile group. In most of these compounds, R₃ and R₄ are preferably different and one of the radicals is usually an alkyl or alkoxy group. However, a large number of other variants of the envisaged substituents are also customary. Many such substances are available commercially.

The dielectrics according to the invention contain as a rule at least 30, preferably 50 - 99 and in particular 60 - 98 parts by weight of the compounds of the formulae (I) and, optionally, (VIII). Of this amount preferably at least 15 parts by weight and usually even 20 or more parts by weight are made up by one or more compounds of the formula (I). However, it is also possible to prepare dielectrics according to the invention which consist exclusively of two or more compounds of the formula (I). On the other hand, the invention also comprises those liquid crystal dielectrics to which, for example for doping purposes, only less than 15 parts by weight, for example 0.1 to 3 parts by weight, of one or more compounds of the formula (I) have been added.

(88)

- 11 -

The dielectrics according to the invention are prepared in a manner which is in itself customary.

As a rule, the desired amount of one or more compounds of the formula (I) is dissolved in any further components
5 which may be present, preferably at elevated temperature. If the temperature chosen is above the clear point of the base material, it is particularly easy to observe when the dissolving process has gone to completion.

It is, however, also possible to mix solutions
10 of the components of the formulae (I) and, optionally, (VIII) in a suitable organic solvent, for example acetone, chloroform or methanol, and, after thorough mixing, to remove the solvent again, for example by distillation under reduced pressure. Of course, with this proce-
15 dure care must be taken that no impurities or undesired doping agents are carried in by the solvent.

By means of suitable additives, the liquid
crystal dielectrics according to the invention can be so modified that they can be used in all types of liquid
20 crystal display elements disclosed hitherto. Such additives are known to those skilled in the art and are described in detail in the relevant literature. For example, substances for changing the dielectric anisotropy, the viscosity, the conductivity and/or the
25 orientation of the nematic phases can be added. Such substances are described, for example, in German Offenlegungsschriften 2,209,127, 2,240,864, 2,321,632, 2,338,281 and 2,450,088.

- 12 -

The examples which follow are intended to illustrate the invention without restricting it. In the examples, m.p. denotes the melting point and Cl. the clear point of a liquid crystal substance in degrees centigrade; boiling points are designated b.p. Unless stated otherwise, parts or percentage data are parts by weight or per cent by weight respectively.

Example 1

A solution of 265 g of 4-(4-n-pentylphenyl)-acetophenone in 300 ml of ethyl acetate is added to 1 l of anhydrous diethyl ether which contains 23 g of sodium in the form of a wire, and the reaction mixture is stirred for 24 hours at room temperature. The sodium salt which has precipitated is then filtered off and washed with diethyl ether and introduced into a shaking vessel, with 500 ml of diethyl ether and 500 ml of water. After shaking for 1 hour, the organic phase is separated off, dried over sodium sulphate and evaporated. The residual 1-[4-n-pentylbiphenyl-(4')-yl]-butane-1,3-dione is recrystallised from ethanol; m.p. 110°, Cl. 135°. 1-[4-(trans-4-methylcyclohexyl)-phenyl]-butane-1,3-dione 1-[4-(trans-4-ethylcyclohexyl)-phenyl]-butane-1,3-dione 1-[4-(trans-4-n-propylcyclohexyl)-phenyl]-butane-1,3-dione, m.p. 99.5°, Cl. 30° 1-[4-(trans-4-n-butylcyclohexyl)-phenyl]-butane-1,3-dione, m.p. 94°, Cl. 87° 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-butane-1,3-dione, m.p. 81°, Cl. 97° 1-[4-(trans-4-n-hexylcyclohexyl)-phenyl]-butane-1,3-dione

(60)

- 13 -

- 1-[4-(trans-4-n-heptylcyclohexyl)-phenyl]-butane-1,3-dione,
m.p. 74°. Cl. 98°
- 1-[4-(trans-4-n-octylcyclohexyl)-phenyl]-butane-1,3-dione
- 1-[4-(trans-4-n-nonylcyclohexyl)-phenyl]-butane-1,3-dione
- 5 1-[4-(trans-4-n-decylcyclohexyl)-phenyl]-butane-1,3-dione
- 1-[4-(trans-4-n-undecylcyclohexyl)-phenyl]-butane-1,3-dione
- 1-[4-(trans-4-n-dodecylcyclohexyl)-phenyl]-butane-1,3-dione
- 1-[4-(4-methylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 10 1-[4-(4-ethylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-propylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-butylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 15 1,3-dione
- 1-[4-(4-n-pentylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-hexylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 20 1-[4-(4-n-heptylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-octylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-nonylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 25 1,3-dione
- 1-[4-(4-n-decylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(4-n-undecylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione

- 14 -

- 1-[4-(4-n-dodecylcyclohexyl)-biphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-(trans-4-methylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-ethylcyclohexyl)-phenyl]-pentane-1,3-dione
- 5 1-[4-(trans-4-n-propylcyclohexyl)-phenyl]-pentane-1,3-dione, m.p. 78°, Cl. 84°
- 1-[4-(trans-4-n-butylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-pentane-1,3-dione, m.p. 59°, Cl. 91°
- 10 1-[4-(trans-4-n-hexylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-heptylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-octylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-nonylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-decylcyclohexyl)-phenyl]-pentane-1,3-dione
- 15 1-[4-(trans-4-n-undecylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(trans-4-n-dodecylcyclohexyl)-phenyl]-pentane-1,3-dione
- 1-[4-(4-methylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 1-[4-(4-ethylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 20 1-[4-(4-n-propylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 1-[4-(4-n-butylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 25 1-[4-(4-n-pentylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 1-[4-(4-n-hexylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 1-[4-(4-n-heptylcyclohexyl)-biphenyl-(4')-yl]-pentane-1,3-dione
- 30 1,3-dione

- 15 -

- 1-[4-(4-n-octylcyclohexyl)-biphenyl-(4')-yl]-pentane-
1,3-dione
- 1-[4-(4-n-nonylcyclohexyl)-biphenyl-(4')-yl]-pentane-
1,3-dione
- 5 1-[4-(4-n-decylcyclohexyl)-biphenyl-(4')-yl]-pentane-
1,3-dione
- 1-[4-(4-n-undecylcyclohexyl)-biphenyl-(4')-yl]-pentane-
1,3-dione
- 1-[4-(4-n-dodecylcyclohexyl)-biphenyl-(4')-yl]-pentane-
10 1,3-dione
- 1-[4-(trans-4-methylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-ethylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-propylcyclohexyl)-phenyl]-hexane-1,3-dione,
m.p. 99°, Cl. 100°
- 15 1-[4-(trans-4-n-butylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-hexylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-heptylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-octylcyclohexyl)-phenyl]-hexane-1,3-dione
- 20 1-[4-(trans-4-n-nonylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-decylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-undecylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(trans-4-n-dodecylcyclohexyl)-phenyl]-hexane-1,3-dione
- 1-[4-(4-methylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-
25 dione
- 1-[4-(4-ethylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-
dione
- 1-[4-(4-n-propylcyclohexyl)-biphenyl-(4')-yl]-hexane-
1,3-dione

- 16 -

- 1-[4-(4-n-butylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
- 1-[4-(4-n-pentylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
- 5 1-[4-(4-n-hexylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
- 1-[4-(4-n-heptylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
- 1-[4-(4-n-octylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
- 10 1-[4-(4-n-nonylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
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- 15 1-[4-(4-n-undecylcyclohexyl)-biphenyl-(4')-yl]-hexane-1,3-dione
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- 17 -

- 1-[4-(trans-4-n-undecylcyclohexyl)-phenyl]-heptane-1,3-dione
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1-[4-(4-n-octylcyclohexyl)-biphenyl-(4')-yl]-heptane-1,3-dione
1-[4-(4-n-nonylcyclohexyl)-biphenyl-(4')-yl]-heptane-1,3-dione
20 1-[4-(4-n-decylcyclohexyl)-biphenyl-(4')-yl]-heptane-1,3-dione
1-[4-(4-n-undecylcyclohexyl)-biphenyl-(4')-yl]-heptane-1,3-dione
25 1-[4-(4-n-dodecylcyclohexyl)-biphenyl-(4')-yl]-heptane-1,3-dione
1-[4-(trans-4-methylcyclohexyl)-phenyl]-4,4,4-trifluoro-

- 18 -

- butane-1,3-dione
1-[4-(trans-4-ethylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-propylcyclohexyl)-phenyl]-4,4,4-trifluoro-
5 butane-1,3-dione
1-[4-(trans-4-n-butylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione, m.p. 65°, Cl. 40°
10 1-[4-(trans-4-n-hexylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-heptylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-octylcyclohexyl)-phenyl]-4,4,4-trifluoro-
15 butane-1,3-dione
1-[4-(trans-4-n-nonylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-decylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
20 1-[4-(trans-4-n-undecylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(trans-4-n-dodecylcyclohexyl)-phenyl]-4,4,4-trifluoro-
butane-1,3-dione
1-[4-(4-methylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-
25 fluorobutane-1,3-dione
1-[4-(4-ethylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-
fluorobutane-1,3-dione

- 1-[4-(4-n-propylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-butylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 5 1-[4-(4-n-pentylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-hexylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-heptylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-
- 10 fluorobutane-1,3-dione
- 1-[4-(4-n-octylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-nonylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 15 1-[4-(4-n-decylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-undecylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-fluorobutane-1,3-dione
- 1-[4-(4-n-dodecylcyclohexyl)-biphenyl-(4')-yl]-4,4,4-tri-
- 20 fluorobutane-1,3-dione
- 1-[4-methylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-ethylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-propylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-butylbiphenyl-(4')-yl]-butane-1,3-dione
- 25 1-[4-n-hexylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-heptylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-octylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-nonylbiphenyl-(4')-yl]-butane-1,3-dione
- 1-[4-n-decylbiphenyl-(4')-yl]-butane-1,3-dione

- 1-[4-n-undecylbiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-dodecylbiphenyl-(4')-yl]-butane-1,3-dione
1-[4-trifluoromethylbiphenyl-(4')-yl]-butane-1,3-dione
1-[4-methoxybiphenyl-(4')-yl]-butane-1,3-dione
5 1-[4-ethoxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-propyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-butyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-pentyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-hexyloxybiphenyl-(4')-yl]-butane-1,3-dione
10 1-[4-n-heptyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-octyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-nonyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-decyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-n-undecyloxybiphenyl-(4')-yl]-butane-1,3-dione
15 1-[4-n-dodecyloxybiphenyl-(4')-yl]-butane-1,3-dione
1-[4-methylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-ethylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-propylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-butylbiphenyl-(4')-yl]-pentane-1,3-dione
20 1-[4-n-pentylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-hexylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-heptylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-octylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-nonylbiphenyl-(4')-yl]-pentane-1,3-dione
25 1-[4-n-decylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-undecylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-dodecylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-trifluoromethylbiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-methoxybiphenyl-(4')-yl]-pentane-1,3-dione

- 1-[4-ethoxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-propyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-butyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-pentyloxybiphenyl-(4')-yl]-pentane-1,3-dione
5 1-[4-n-hexyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-heptyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-octyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-nonyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-decyloxybiphenyl-(4')-yl]-pentane-1,3-dione
10 1-[4-n-undecyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-n-dodecyloxybiphenyl-(4')-yl]-pentane-1,3-dione
1-[4-methylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-ethylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-propylbiphenyl-(4')-yl]-hexane-1,3-dione
15 1-[4-n-butylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-pentylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-hexylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-heptylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-octylbiphenyl-(4')-yl]-hexane-1,3-dione
20 1-[4-n-nonylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-decylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-undecylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-dodecylbiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-trifluoromethylbiphenyl-(4')-yl]-hexane-1,3-dione
25 1-[4-methoxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-ethoxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-propyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-butyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-pentyloxybiphenyl-(4')-yl]-hexane-1,3-dione

- 1-[4-n-hexyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-heptyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-octyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-nonyloxybiphenyl-(4')-yl]-hexane-1,3-dione
5 1-[4-n-decyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-undecyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-n-dodecyloxybiphenyl-(4')-yl]-hexane-1,3-dione
1-[4-methylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-ethylbiphenyl-(4')-yl]-heptane-1,3-dione
10 1-[4-n-propylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-butylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-pentylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-hexylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-heptylbiphenyl-(4')-yl]-heptane-1,3-dione
15 1-[4-n-octylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-nonylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-decylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-undecylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-dodecylbiphenyl-(4')-yl]-heptane-1,3-dione
20 1-[4-trifluoromethylbiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-methoxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-ethoxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-propyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-butyloxybiphenyl-(4')-yl]-heptane-1,3-dione
25 1-[4-n-pentyloxybiphenyl-(4')-yl]-heptane-1,3-dione
10[4-n-hexyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-heptyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-octyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-nonyloxybiphenyl-(4')-yl]-heptane-1,3-dione

- 1-[4-n-decyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-undecyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-n-dodecyloxybiphenyl-(4')-yl]-heptane-1,3-dione
1-[4-methylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-
5 dione
1-[4-ethylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-
dione
1-[4-n-propylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
10 1-[4-n-butylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-n-pentylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-n-hexylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
15 1,3-dione
1-[4-n-heptylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-n-octylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
20 1-[4-n-nonylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-n-decylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-n-undecylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
25 1,3-dione
1-[4-n-dodecylbiphenyl-(4')-yl]-4,4,4-trifluorobutane-
1,3-dione
1-[4-trifluoromethylbiphenyl-(4')-yl]-4,4,4-trifluoro-
butane-1,3-dione

- 1-[4-methoxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-ethoxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 5 1-[4-n-propyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-n-butyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-n-pentyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-
- 10 1,3-dione
- 1-[4-n-hexyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-n-heptyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 15 1-[4-n-octyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-n-nonyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione
- 1-[4-n-decyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-
- 20 1,3-dione
- 1-[4-n-undecyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione and
- 1-[4-n-dodecyloxybiphenyl-(4')-yl]-4,4,4-trifluorobutane-1,3-dione.

25 The examples which follow relate to the use, according to the invention, of the diketones (I) as components of liquid crystal dielectrics:

Example 2

A mixture of 46.7 parts by weight of 4-n-pentyl-

- 25 -

phenyl anisate, 23.3 parts by weight of 4'-n-pentyl-phenyl 4-n-hexyloxybenzoate, 15.0 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-pentane-1,3-dione, 7.5 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-butane-1,3-dione and 7.5 parts by weight of 1-[4-(trans-4-n-butylcyclohexyl)-phenyl]-butane-1,3-dione has a melting point of 5° and a clear point of 64°. 5 parts by weight of the dichroitic dye 1-hydroxy-4-N-(p-n-nonyloxyphenyl)-amino-anthraquinone can be dissolved in this mixture at 25° without difficulty.

Example 3

A mixture of 58.0 parts by weight of 4-n-butyl-4'-methoxyazoxybenzene, 29.0 parts by weight of 4-ethyl-4'-methoxyazoxybenzene, 8.0 parts by weight of 2'-cyano-4'-n-heptylphenyl 4-n-heptylbiphenyl-(1)-carboxylate and 5.0 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-butane-1,3-dione has a melting point of -4° and a clear point of 78°. Ethyl-dodecyl-dimethyl-ammonium 4-(4-n-hexyloxybenzene)-benzoate is readily soluble in the mixture; the dielectric thus obtained is outstandingly suitable for liquid crystal display elements based on the dynamic scattering effect. The dichroitic dye 1-hydroxy-4-N-(p-n-nonyloxyphenyl)-amino-anthraquinone is also readily soluble in this mixture in amounts of up to 5%; these dye-containing dielectrics are particularly well suited for the preparation of coloured display elements which operate on the basis of the deformation of oriented phases (DOP effect).

- 26 -

Example 4

A mixture of 26.1 parts by weight of 4-(4-n-propylcyclohexyl)-benzonitrile, 36.9 parts by weight of 4-(4-n-pentylcyclohexyl)-benzonitrile, 27.0 parts by weight of 4-(4-n-heptylcyclohexyl)-benzonitrile, 5.0 parts by weight of 1-[4-(trans-4-n-propylcyclohexyl)-phenyl]-4,4,4-trifluorobutane-1,3-dione and 5.0 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-4,4,4-trifluorobutane-1,3-dione has a melting point of 0° and a clear point of 50° . Dichroitic dyes such as, for example, 1-hydroxy-4-N-(p-n-nonyloxyphenyl)-aminoanthraquinone, are readily soluble in this mixture; after customary doping with a chiral substance, the dielectrics obtained in this way make it possible to prepare liquid crystal colour samplers with good contrast.

Example 5

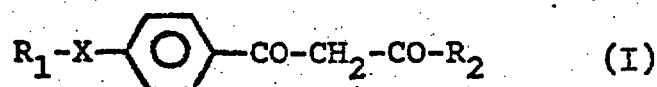
A mixture of 14 parts by weight of 1-[trans-4-(4-n-butylcyclohexyl)-phenyl]-butane-1,3-dione, 14 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-butane-1,3-dione, 14 parts by weight of 1-[4-(trans-4-n-heptylcyclohexyl)-phenyl]-butane-1,3-dione, 29 parts by weight of 1-[4-(trans-4-n-pentylcyclohexyl)-phenyl]-pentane-1,3-dione and 29 parts by weight of 1-(4-heptylphenyl)-butane-1,3-dione has a melting point of 20° and a clear point of 49° . The mixture possesses a negative dielectric anisotropy and a good dissolving power for dichroitic dyes or acetylacetonate complexes of polyvalent metal ions; such solutions possess an electrical conductivity which is carried, on the one hand, by the metal cations

- 27 -

and, on the other hand, by the keto-enolate anions contained in the liquid crystal matrix.

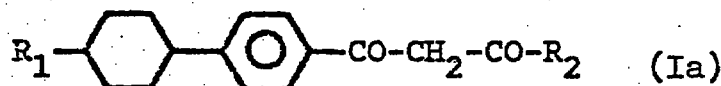
Patent Claims for the contracting states BE, CH, DE, FR, GB, IT, NL and SE

1. Diketones of the formula (I)



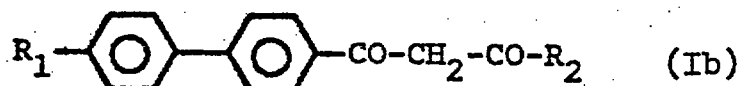
in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl.

2. Diketones according to Claim 1, of the formula (Ia)



in which R_1 is alkyl with 1 to 18 C atoms and R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms.

3. Diketones according to Claim 1, of the formula (Ib)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms and R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms.

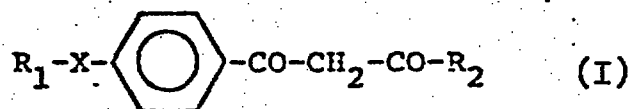
4. Diketones according to Claim 1, of the formula (Ic)



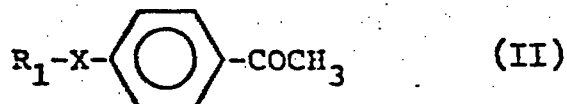
in which R_1 is alkyl with 1 to 18 C atoms and R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms.

- 2 -

5. Process for the preparation of the diketones of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl, characterised in that an acetophenone of the formula (II)

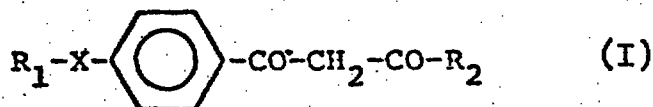


in which R_1 is as defined above, is reacted in the presence of a basic condensing agent with a carboxylic acid ester of the formula (III)



in which Z is a lower alkyl group and R_2 is as defined above, and the resulting salt of the enol form of the diketone (I) is then hydrolysed to this diketone.

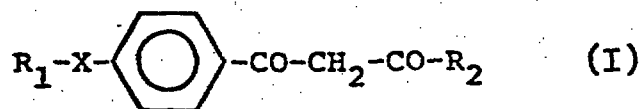
6. Use of a diketone of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl, as a component of a liquid crystal dielectric.

- 3 -

7. Liquid crystal dielectric, characterised in that it contains at least one diketone of the formula (I),

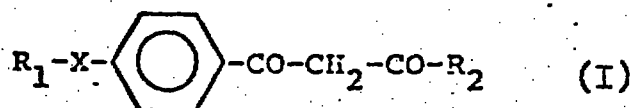


in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl.

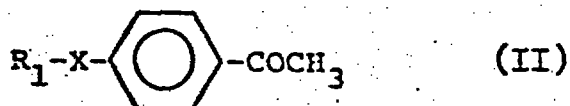
8. Electro-optical display element based on a liquid crystal cell, characterised in that it contains a liquid crystal dielectric according to Claim 7.

Patent Claims for the contracting state AT

1. Process for the preparation of the diketones of the formula (I)

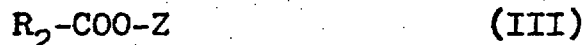


in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl, characterised in that an acetophenone of the formula (II)



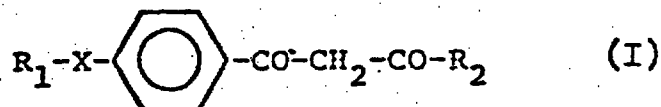
in which R_1 is as defined above, is reacted in the presence of a basic condensing agent with a carboxylic acid ester of the formula (III)

- 4 -



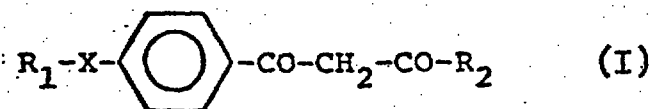
in which Z is a lower alkyl group and R_2 is as defined above, and the resulting salt of the enol form of the diketone (I) is then hydrolysed to this diketone.

2. Use of a diketone of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl; as a component of a liquid crystal dielectric.

3. Liquid crystal dielectric, characterised in that it contains at least one diketone of the formula (I),



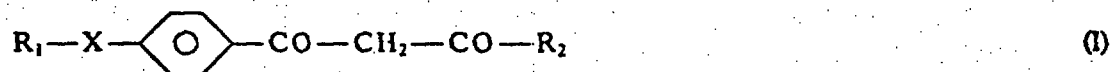
in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1 to 18 C atoms, R_2 is alkyl or perfluoroalkyl with 1 to 12 C atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene or 4,4'-cyclohexylphenyl.

4. Electro-optical display element based on a liquid crystal cell, characterised in that it contains a liquid crystal dielectric according to Claim 3.

(Translation of German text)

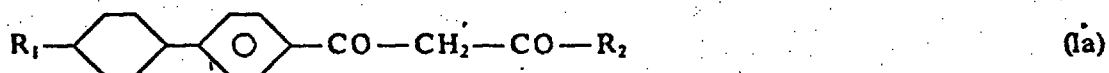
Claims for the Contracting States: BE, CH, DE, FR, GB, IT, NL, SE (As printed)

1. Diketones of the formula (I)



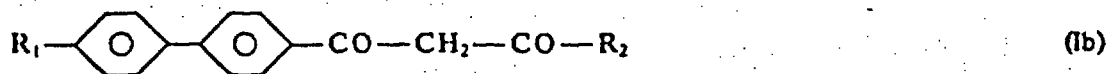
in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl.

2. Diketones according to Claim 1, of the formula (Ia)



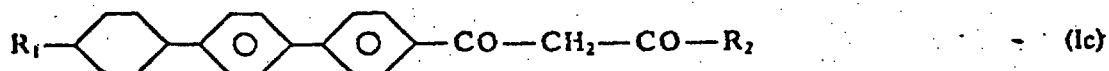
in which R_1 is alkyl with 1-18 C-atoms and R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms.

3. Diketones according to Claim 1, of the formula (Ib)



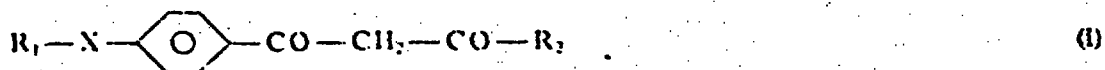
in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms and R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms.

4. Diketones according to Claim 1, of the formula (Ic)



in which R_1 is alkyl with 1-18 C-atoms and R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms.

5. Process for the preparation of the diketones of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl, characterised in that an acetophenone of the formula (II)

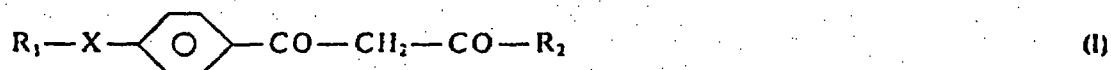


in which R_1 is as defined above, is reacted in the presence of a basic condensing agent with a carboxylic acid ester of the formula (III)



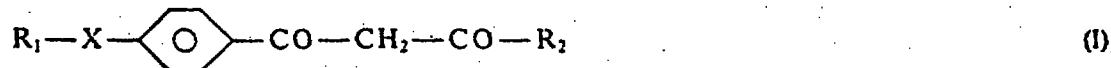
in which Z is a lower alkyl group and R_2 is as defined above, and the resulting salt of the enol form of the diketone (I) is then hydrolysed to this diketone.

6. Use of a diketone of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms; R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl, as a component of a liquid crystal dielectric.

7. Liquid crystal dielectric, characterised in that it contains at least one diketone of the formula (I),

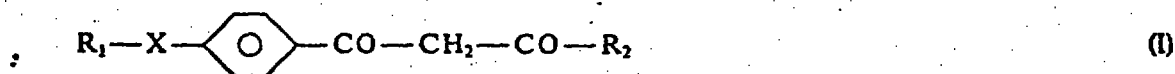


in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl.

8. Electro-optical display element based on a liquid crystal cell, characterised in that it contains a liquid crystal dielectric according to Claim 7.

Claims for the Contracting State: AT (As printed)

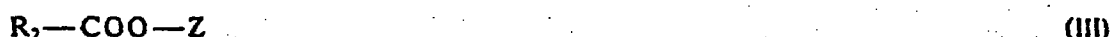
1. Process for the preparation of the diketones of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl, characterised in that an acetophenone of the formula (II)

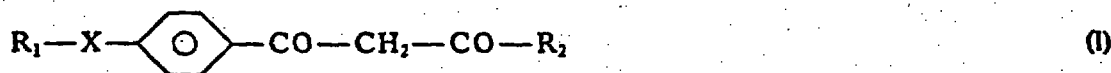


in which R_1 is as defined above, is reacted in the presence of a basic condensing agent with a carboxylic acid ester of the formula (III)



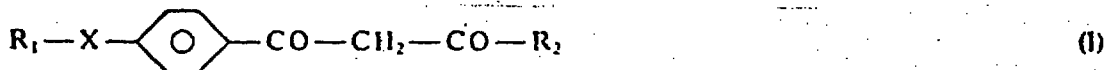
in which Z is a lower alkyl group and R_2 is as defined above, and the resulting salt of the enol form of the diketone (I) is then hydrolysed to this diketone.

2. Use of a diketone of the formula (I)



in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl, as a component of a liquid crystal dielectric.

3. Liquid crystal dielectric, characterised in that it contains at least one diketone of the formula (I),

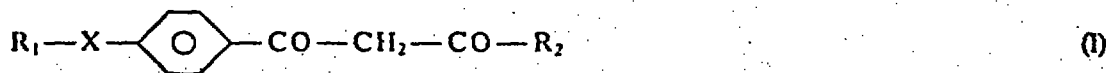


in which R_1 is alkyl, perfluoroalkyl or alkoxy with 1-18 C-atoms, R_2 is alkyl or perfluoroalkyl with 1-12 C-atoms and X is 1,4-trans-cyclohexylene, 1,4-phenylene, or 4,4'-cyclohexylphenyl.

4. Electro-optical display element based on a liquid crystal cell, characterised in that it contains a liquid crystal dielectric according to Claim 3.

Revendications pour les Etats contractants: BE, CH, DE, FR, GB, IT, NL, SE (As printed)

1. Dicétones de formule (I)



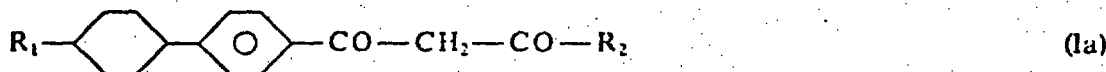
où

R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} ,

R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et

X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle.

2. Dicétones selon la revendication 1 de formule (Ia)



où

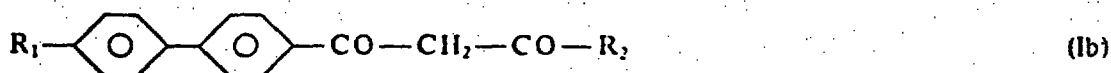
R_1 représente un alcoyle en C_1 à C_{18} et

R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} .

3. Dicétones selon la revendication 1 de formule (Ib)

81

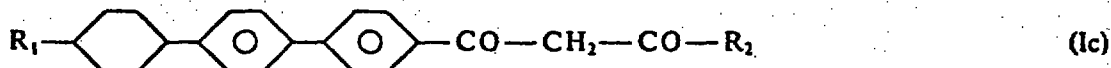
- 7 -



où

 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} et R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} .

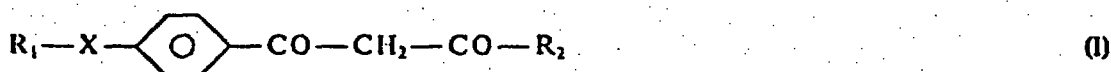
4. Dicétones selon la revendication 1 de formule (Ic)



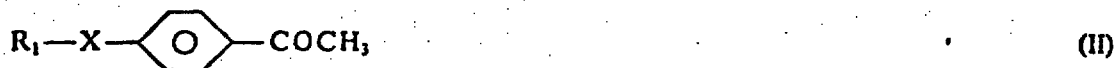
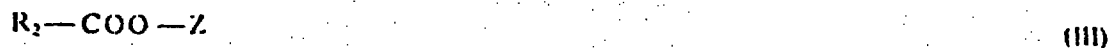
où

 R_1 représente un alcoyle en C_1 à C_{18} et R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} .

5. Procédé de préparation des dicétones de formule (I)



où

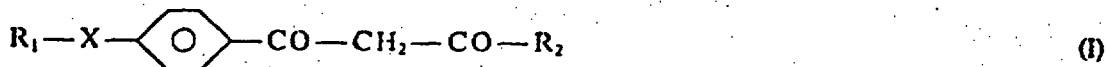
 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle, caractérisé en ce qu'on fait réagir une acétophénone de formule (II)où R_1 a la signification donnée ci-dessus, en présence d'un agent de condensation basique avec un ester d'acide carboxylique de formule (III)

où

 Z est un groupe alcoyle inférieur et R_2 a la signification donnée ci-dessus,

puis en ce qu'on hydrolyse le sel de la forme énol de la dicétone (I) apparu pour donner celle-ci.

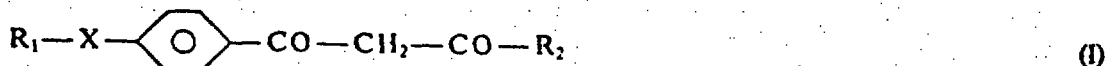
6. Application d'une dicétone de formule (I)



où

 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle, comme composant d'un diélectrique à cristaux liquides.

7. Diélectrique à cristaux liquides, caractérisé en ce qu'il contient au moins une dicétone de formule (I)



où

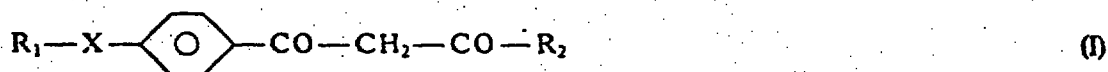
 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, 1,4-phénylène ou 5,4'-cyclohexylphényle.

8. Élément d'affichage électro-optique à base d'une cellule à cristaux liquides, caractérisé en ce qu'il contient un diélectrique à cristaux liquides selon la revendication 7.

- 8 -

Revendications pour l'Etat contractant: AT (As printed)

1. Procédé de préparation des dicétones de formule (I)



où

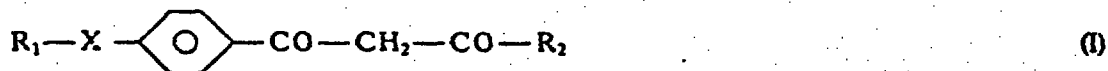
 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle, caractérisé en ce qu'on fait réagir une acétophénone de formule (II)où R_1 a la signification donnée ci-dessus, en présence d'un agent de condensation basique, avec un ester d'acide carboxylique de formule (III)

où

 Z est un groupe alcoyle inférieur et où R_2 a la signification donnée ci-dessus,

puis en ce qu'on hydrolyse le sel de la forme énol de la dicétone (I) apparu pour donner celle-ci.

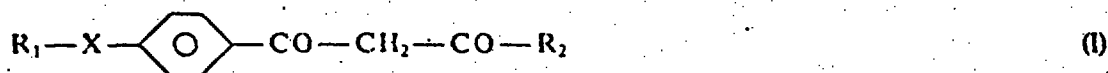
2. Application d'une dicétone de formule (I)



où

 R_1 représente un alcoyle, un perfluoroalcoyle ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle, comme composant d'un diélectrique à cristaux liquides.

3. Diélectrique à cristaux liquides, caractérisé en ce qu'il contient au moins une dicétone de formule (I)



où

 R_1 représente un alcoyle, un perfluoroalcoyle, ou un alcoxy en C_1 à C_{18} , R_2 représente un alcoyle ou un perfluoroalcoyle en C_1 à C_{12} et X représente un 1,4-trans-cyclohexylène, un 1,4-phénylène ou un 4,4'-cyclohexylphényle.

4. Élément d'affichage électro-optique à base d'une cellule à cristaux liquides, caractérisé en ce qu'il contient un diélectrique à cristaux liquides selon la revendication 3.