

Description

(14)

For liquid-crystal displays of the nematic twisted-cell type, also called TN displays, it is known that nematic liquid-crystal materials having positive dielectric constant anisotropy, also called positive DCA, are required.

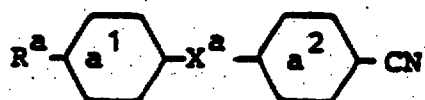
5 The DCA or $\Delta\epsilon$ is defined as $\Delta\epsilon = \epsilon_{\parallel} - \epsilon_{\perp}$, where $\epsilon_{\parallel}$ is the dielectric constant (DC) parallel to the longitudinal molecular axis and $\epsilon_{\perp}$ is the DC perpendicular to the molecular axis.

10 For multiplex operation of such cells, a steepest possible contrast characteristic line of the LC substance is desirable in addition, i.e. a change in light-absorption properties on change of the field voltage applied which is the most sudden possible. This can again be favoured by optimization of two selection criteria for
15 the available anisotropic substances, namely (a) a smallest possible value of the ratio of the elasticity constant for flexion and extension, also called the k_{33}/k_{11} value, and (b) by a smallest possible value for the ratio of the DCA ($\Delta\epsilon$) to DC perpendicular to the nematic axis ($\epsilon_{\perp}$), i.e. the $\Delta\epsilon/\epsilon_{\perp}$. Details on this can be found in
20 the literature (Gharadjedagji, F. et al. in Rev. Phys. Appl. 11/1976/467; Metz, A. R. in SID Digest, Techn. Papers IX/1978/70 and Alt, P.M. et al. in IEEE Trans. El. Dev. Ed. 21/1974/146).

25 For selection of anisotropic compounds according to the criteria mentioned, two types of anisotropic compounds are currently available; these contain in each case two or three rings and have the following structure:

Type I:

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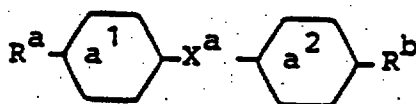


and



(A8)

Type II:



and



5 in which a^1 , a^2 and a^3 are carboaromatic, heteroaromatic or cycloaliphatic rings, such as benzene, pyrimidine and trans-cyclohexane rings; X^a and Y^a are so-called bridging groups, such as $-COO-$, $-CH=N-$, $-CH_2O-$, $-N=N-$, $-CH_2CH_2-$ or a single bond, and R^a and R^b are so-called wing groups,
10 such as alkyl, alkoxy, alkanoyloxy or alkylamino groups, whose alkyl part generally contains 1 to 12 C atoms in a linear or branched chain.

Due to the comparatively strong polarization R^a/CN in the direction of the longitudinal molecular axis (nematic axis or director), substances of type I offer high positive DCA values and accordingly low threshold voltages, but have $\Delta\epsilon/\epsilon_{\parallel}$ values which are disadvantageously high for multiplex operation and k_{33}/k_{11} values which are relatively high and likewise disadvantageous for this purpose.
15 The contrast characteristic lines of these substances are relatively flat.

Substances of type II are less polar or nonpolar and have the small $\Delta\epsilon/\epsilon_{\parallel}$ values necessary for steep contrast characteristic lines with k_{33}/k_{11} values which are small compared to substances of type I (at a comparable chain length). Furthermore, the viscosity of substances of type II is lower than that of type I.
25

For all these reasons, anisotropic substances of type II are essential as components of LC mixtures for multiplex operation of TN displays.
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An essential disadvantage of the known anisotropic substances of type II is their pronounced tendency towards

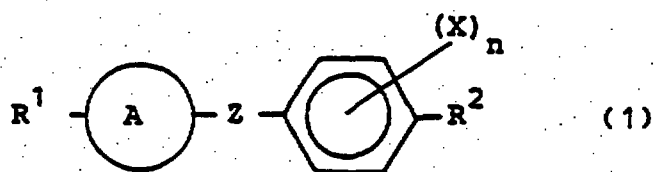
formation of smectic phases, in particular when these substances have relatively long wing groups, for example alkyl parts of some length. Reference should be made here to values which are known from the literature, for example "Flussigkristalle in Tabellen" [Liquid crystals in tables] VEB Deutscher Verlag, Leipzig, 1974.

The appearance of smectic phases in anisotropic compounds narrows the range of the only nematic phase which is suitable for TN displays or causes this phase to disappear completely.

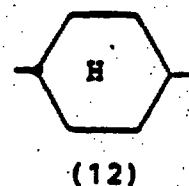
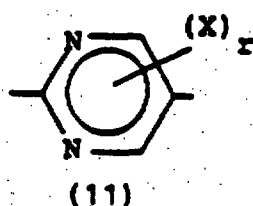
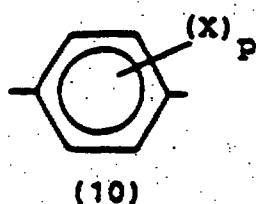
The object of the invention is to specify new anisotropic compounds of type II in which the tendency towards formation of smectic phases is suppressed or eliminated; the criterion for this is that a suitable compound has a nematic phase at all or that the temperature range of the nematic phase increases in the case of comparable structures.

Surprisingly, it has been found that this can be achieved in the case of a precisely limited group of compounds of type II by introducing at least one so-called lateral substituent onto a ring in the basic structure.

The anisotropic compounds of type II used in the liquid-crystal mixtures according to the invention and having a nematic phase are characterized by the formula



In this formula, A is a cyclic radical according to one of the formulae (sic) (10), (11) or (12)



where the formula (11) may be either a 2,5-linked pyrimidine ring or a 5,2-linked pyrimidine ring.

The cyclic radical of the formula (12) is always present in the trans-configuration indicated by the dot, so long as R¹ is not the hydrogen atom and, accordingly, no cis/trans isomerism exists.

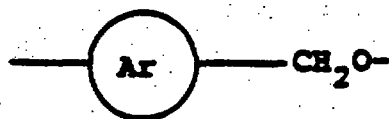
The bridging member Z in formula (1) is a single bond, the ethylene group (-CH₂CH₂-), the methylenoxy group (-CH₂O-) or the oxymethylene group (-OCH₂-), unless excluded below.

The indices have the following meaning: n is 1 or 2; p is zero, 1 or 2; and r is zero or 1.

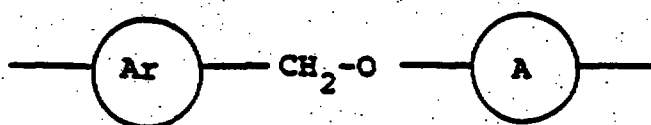
The minimum of one lateral substituent X which is essential to the invention is halogen, i.e. fluorine, chlorine, bromine or iodine, or methyl (-CH₃) or nitrile (-CN). If the molecule in formula (1) contains several lateral substituents X, these may be identical or different.

At the same time, the following provisos apply to compounds of the formula (1):

(A) A methylenoxy or oxymethylene group is not bonded directly to the C atom of any of the aromatic radicals of the formulae (sic) (10), (11), (13), (14) or (15) present in the molecule of formula (1); in other words, the molecule of the formula (1) may not contain a ring of the formula



where Ar is a cyclic radical of the formulae (sic) (10), (11), (13), (14) or (15). This is because it has been determined that such benzyl ethers and corresponding compounds having a group of the formula



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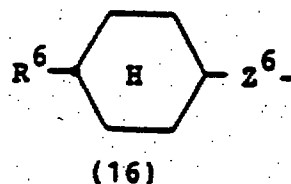
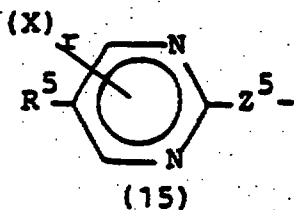
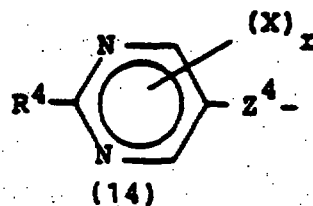
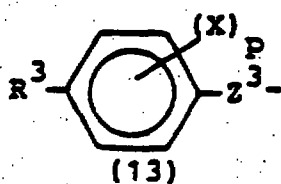
in which Ar and A have the abovementioned meaning, tend towards instability when used as or in liquid crystals.

(B) The proviso furthermore applies to new compounds of the formula (1) that at least one X in the molecule of the formula (1) is methyl if only one or none of the groups R^1 and R^2 is a cyclic radical of the formulae (sic) (13) or (16), at the same time A has the formula (12) and the bridging member Z and the optionally present bridging member Z^3 or Z^6 is a single bond.

For many purposes, it is furthermore preferred that the cyclic radical of the formula (12) or the cyclic groups of the formula (16) are in each case not bonded simultaneously directly to an oxygen atom on the one hand and to an oxygen or nitrogen atom on the other hand.

Finally, it is preferred for particularly stable compounds of the formula (1) that the aromatic rings are not located between two directly ring-bonded oxygen atoms, in particular when a lateral substituent $X = CN$ is attached to this ring.

R^1 and R^2 may be identical or different and are hydrogen atoms, alkyl, alkoxy, alkanoyloxy ($Alk-C(O)-O-$) or alkylamino ($Alk-N(H)-$) in each case having 1 to 12 C atoms in the alkyl part; the alkyl part may be linear or branched and is optionally chiral; R^1 and/or R^2 may furthermore be a cyclic group of the formulae (13) to (16):



In the formula (sic) (13) to (16), the wing groups R^3 to R^6 have the meanings mentioned above for the non-cyclic R^1 and R^2 ; X, p and r are as specified above, and the bridging groups Z^3 to Z^6 have one of the meanings specified for Z, it being possible for the meanings of Z on the one hand and Z^3 to Z^6 on the other hand to be identical or different in a molecule of the formula (1).

In general, the compounds of the formula (1) may be dinuclear, trinuclear or tetranuclear, and preferred new compounds according to the invention have the formulae (22) to (33) specified and defined in patent Claims 2-13.

Liquid-crystal mixtures which contain at least one compound of the formula (1), e.g. one or more compounds of the formulae (22) to (33), are according to the invention. This is described in greater detail below.

In a group of preferred compounds according to the invention, X is the methyl group. In another group of preferred compounds according to the invention, X is fluorine, chlorine, bromine or iodine, fluorine and chlorine being particularly preferred.

In a further preferred group of compounds according to the invention, X is the nitrile group.

If the compound of the formula (1) has a large lateral dipole moment, which, for example, may be the consequence of two or more X as nitrile and/or halogen, it will generally also have a large, negative $\Delta\epsilon$ and can then be used, for example, for liquid-crystal displays which operate according to the so-called inverse guest/host effect or can be used for certain types of dynamic scattering cells, DAP and HN displays.

Compounds according to the invention contain at least one lateral substituent X, but may also contain two or more lateral substituents X, where the particular molecule (1) may carry identical or different, lateral substituents X, for example methyl plus halogen, methyl plus nitrile, halogen plus nitrile or methyl plus halogen plus nitrile.

The compounds of the formula (1) are based on the knowledge that it is essential, in order to prevent or

suppress the tendency towards formation of smectic phases in certain compounds of type II, that the lateral substituent or the lateral substituents must have a certain, but not too great, bulk; the lower limit for the bulk of lateral substituents which are suitable according to the invention depends on the tendency of the basic structure II (i.e. formula (1) without lateral substituents X) towards formation of smectic phases. In general, introduction of a lateral or several lateral substituents X having a relatively large bulk compared to the corresponding basic structure without a lateral substituent leads to a reduction of the clear point; for dinuclear compounds of the formula (1), the less bulky lateral substituents fluorine, chlorine and methyl are therefore preferred. The bulk of the substituents X increases approximately in the following order:



Two synthetic routes are suitable, in particular, for the preparation of the compounds (1), namely, firstly, introduction of the desired substituent(s) X into the appropriate basic compound, for example by chlorination or bromination, if appropriate with subsequent replacement of a substituent X, such as chlorine, by another, such as fluorine, by means of halogen exchange, or by reaction of an appropriate halogen compound with metal cyanide in order to introduce the nitrile group. In an analogous fashion, a carbonyl group can be introduced into the appropriate basic compound, for example by catalyzed reaction with a formylating agent, such as oxalyl chloride, and then reduced to the methyl group.

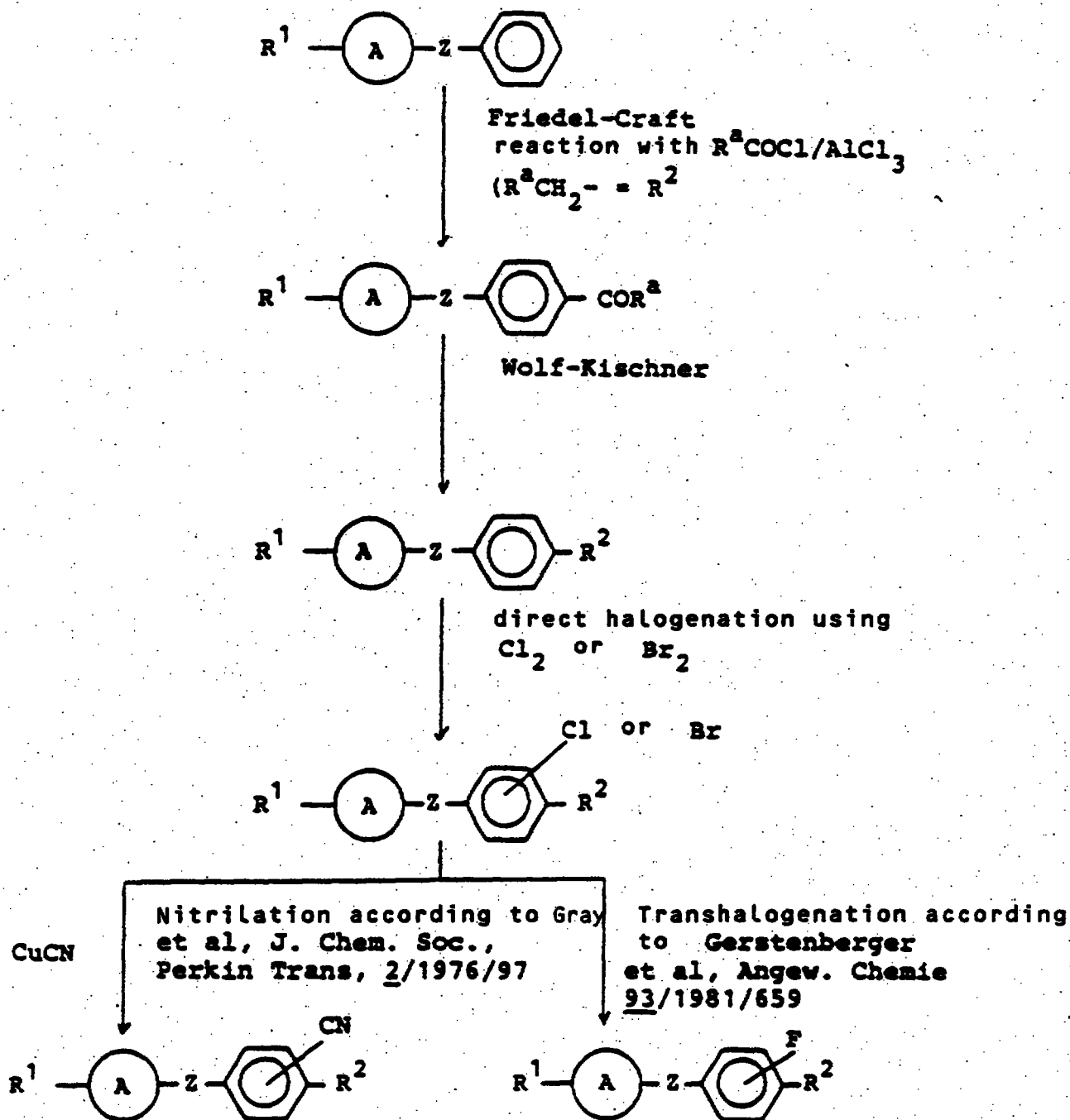
The other synthetic route comprises building up the compound (1) by using part compounds which are already provided with appropriate substituents X and combining them, for example, by condensation.

Furthermore, to modify the wing groups R^1 to R^6 , a compound according to the invention can also be converted into another compound according to the invention by methods which are known per se.

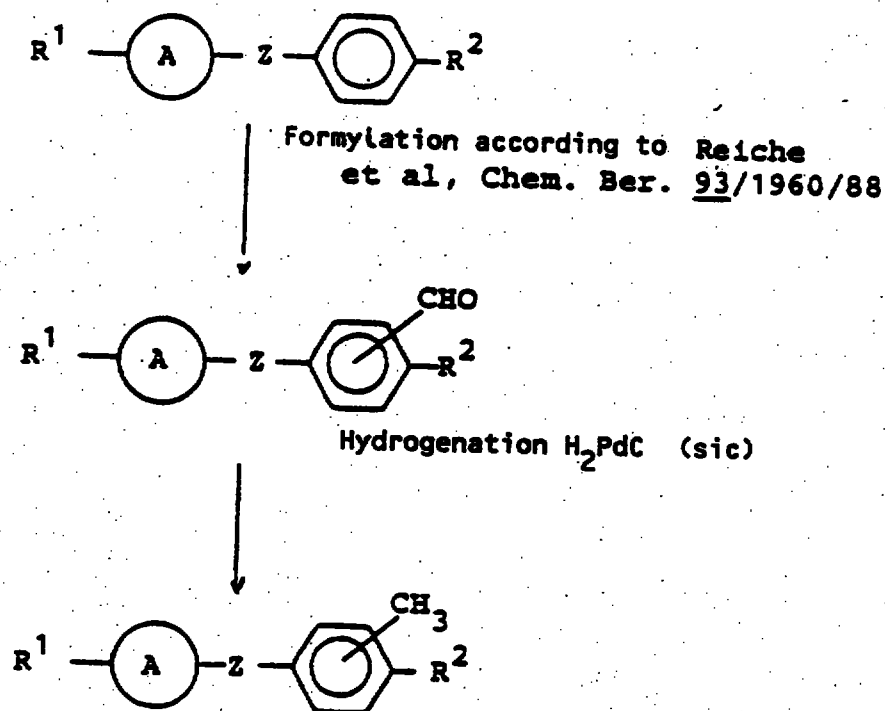
Suitable basic and starting compounds are known or can be obtained by methods analogous to those for the known compounds. Suitable starting compounds having pyrimidine nuclei are described, for example, in DDR Patent 95,892 and German Offenlegungsschrift 2,641,724.

The following reaction equations, in which the general symbols have the meaning specified in formula (1), are given as general examples of the preparation of the new anisotropic compounds.

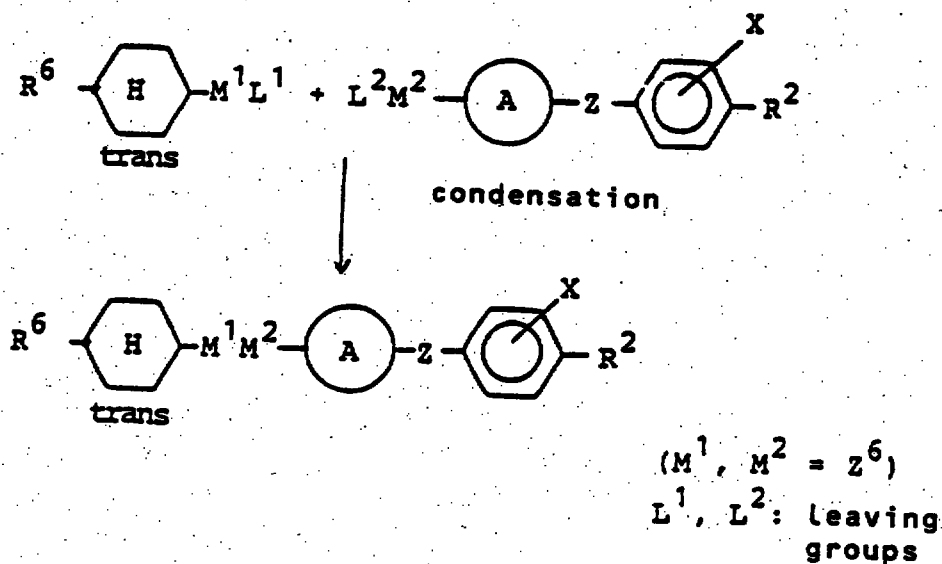
10 EQUATION A



EQUATION B

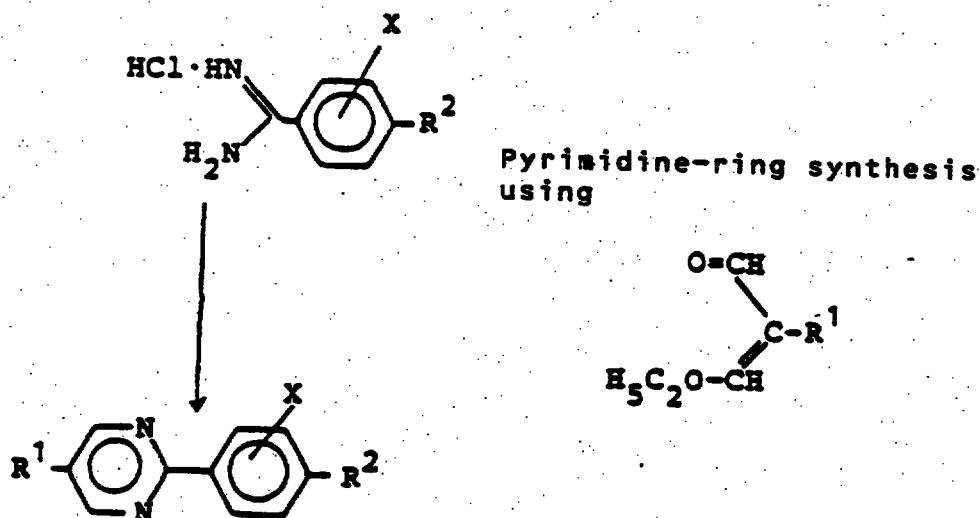


EQUATION C

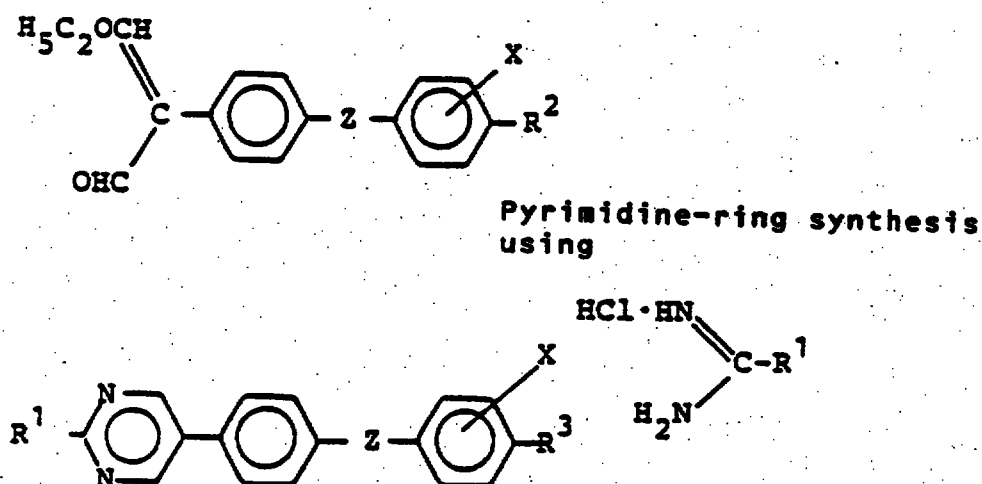


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EQUATION D



EQUATION E



5 The compounds of the formula (1) can be used in an analogous fashion to the known compounds of type II for LC mixtures in TN displays with multiplex operation, and offer the advantage in this use that the problems of smectic phases can be eliminated or substantially reduced.

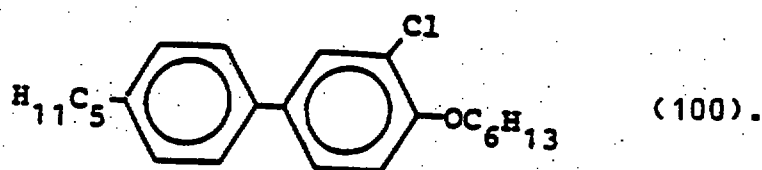
10 LC mixtures according to the invention can contain one or more compounds of the formula (1), for example in proportions of, in total, up to about 60 mol %, where the proportion of the individual compounds of the formula (1) comprises up to about 30 mol % of the mixture.

15 As the remaining proportion, the LC mixtures according to the invention usually contain one or, preferably, several known compounds of type I.

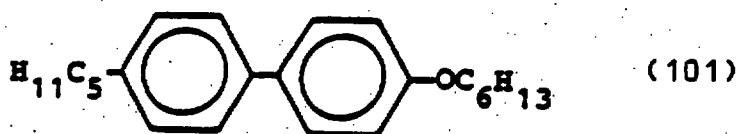
The following examples serve to further illustrate the invention. The temperature properties of the mesophases are specified in a conventional fashion through the appropriate temperatures ($^{\circ}\text{C}$) between the symbols C (crystalline), S (smectic), N (nematic) and I (isotropic).

Example 1

4-Hydroxy-4'-pentyl-diphenyl was reacted with elemental chlorine to form 3-chloro-4-hydroxy-4'-pentyldiphenyl, and converted, by condensation with n-hexyl iodide, into a compound of the formula (1), namely 3-chloro-4-hexyloxy-4'-pentylbiphenyl of the formula (100)



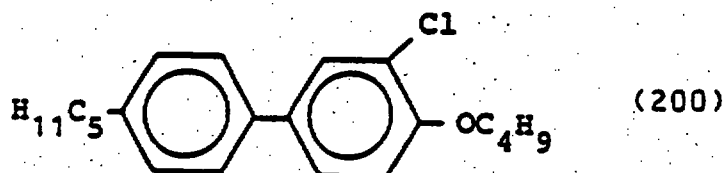
The comparison compound of the formula (101)



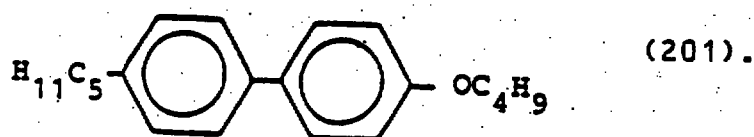
was prepared in an analogous fashion, but without chlorination. Investigation of the mesophase temperatures gave the surprising finding that the compound of the formula (100), with C 1.7 N 11.1 I, exhibited a purely nematic mesophase, whereas the comparison compound of the formula (101), with C 82 S 84 I, had no nematic phase and was smectic over the entire mesophase range.

Example 2

A compound of the formula (200)



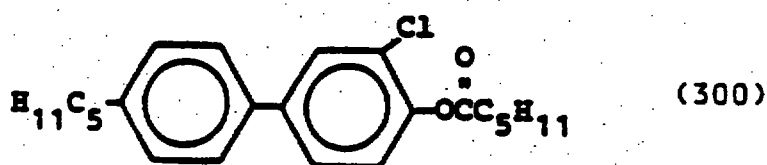
was prepared by the method specified in Example 1 and compared to the corresponding compound of the formula (201)



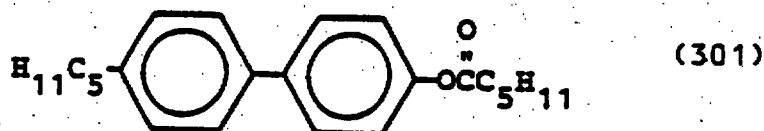
Compound (200) proved to be monotropic nematic (C 38.1 N (7.5) I), whereas comparison compound (201) had only smectic mesophases (C 37 S 80.1 S 88.1 I).

Example 3

The compound of the formula (300)

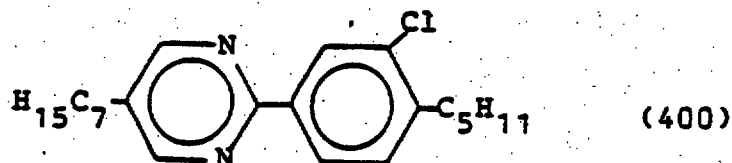


prepared by esterification of 3-chloro-4-hydroxy-4'-pentyl-diphe-nyl proved to be monotropic nematic (C 22.3 N (-5) I), whereas the compound of the formula (301)

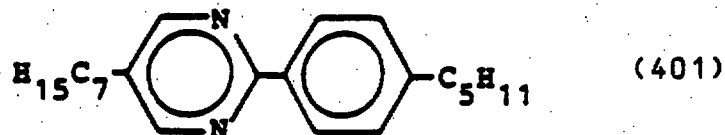


had an merely smectic mesophase (C 45.7 S 87.4 I).

Example 4 The new anisotropic compound of the formula (400)



exhibited no smectic phase, whereas the comparison compound of the formula (401)

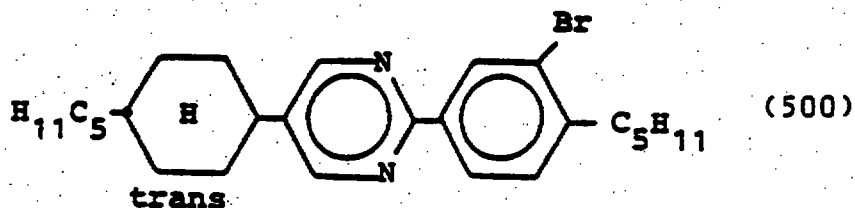


had an exclusively smectic mesophase (C 30.6 S 47.7 I).

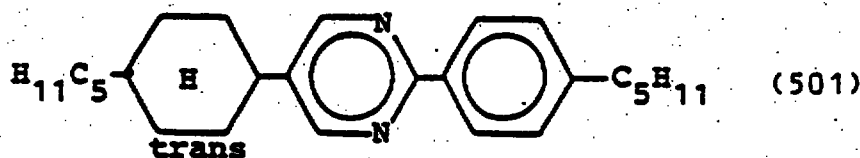
Example 5

The new anisotropic compound of the formula (500).

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had no smectic phase, whereas the comparison compound of the formula (501)

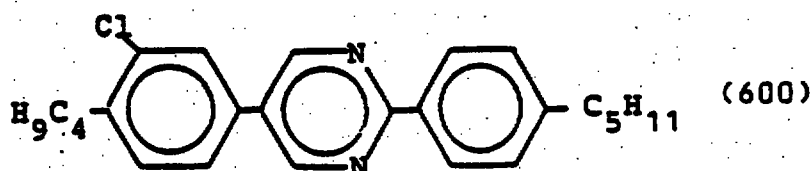


had an exclusively smectic mesophase (C 39.5 S 189.2 I).

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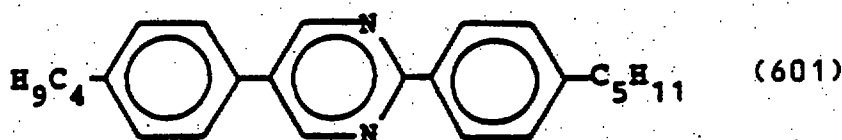
Example 6

The new anisotropic compound of the formula (600)



had no smectic phase (C 111.2 N (103) I), whereas the comparison compound of the formula (601)

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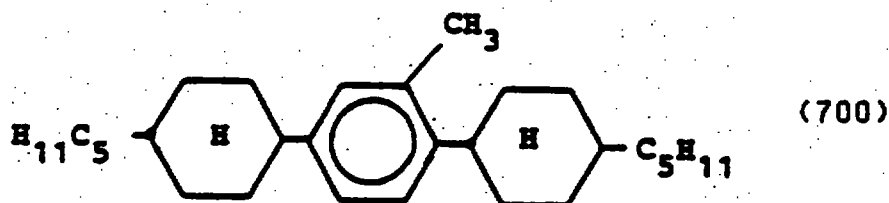
had an exclusively smectic mesophase (C 106.4 S 185.2 I).

Example 7

A cold (about 0°C) mixture of 16 g of oxalyl chloride, 45 g of 1,4-bis-(4-trans-pentylcyclohexyl)-

benzene and 16 g of anhydrous aluminium chloride in 100 ml of sym. tetrachloroethane was stirred in an autoclave insert until the temperature of the mixture had approximately reached room temperature (10-20 minutes). 10 g of anhydrous sodium acetate and 1 g of Pd/C catalyst were then added. After expelling the air by means of nitrogen, hydrogen was introduced to an excess pressure of 30 bar whilst stirring the reaction mixture. After about 120 minutes at this pressure, the autoclave contents were warmed to 50°C. After 30 minutes at this temperature, the reaction mixture was cooled to room temperature, and the excess pressure of hydrogen was then blown out, and the autoclave was flushed with nitrogen and opened.

The reaction mixture was washed with water, if necessary with cooling, and the separated-off organic phase freed from solvent. The residue was recrystallized. The product of the formula (700)



obtained had a melting point of 555°C (sic) and exhibited a nematic phase up to 86.5°C.

Example 8

The two compounds

2'-fluoro-4-butyloxy-4'-pentyl-diphenyl
and

3'-fluoro-4-butyloxy-4'-pentyl-diphenyl

exhibit a significant nematic phase, whereas the corresponding compounds without fluorine in the 2'- or 3'-position have no significant nematic phase.

The following compounds may be mentioned as further compounds of the formula (1):

- 2-fluoro-4,4'-dipropyl-diphenyl
- 2-fluoro-4,4'-dipentyl-diphenyl
- 3-fluoro-4,4'-dipropyl-diphenyl
- 3-fluoro-4,4'-dipentyl-diphenyl
- 5 2-fluoro-4-propyl-4'-pentyl-diphenyl
- 2'-fluoro-4-propyl-4'-pentyl-diphenyl
- 3-fluoro-4-propyl-4'-pentyl-diphenyl
- 3'-fluoro-4-propyl-4'-pentyl-diphenyl
- 2-fluoro-4-pentyl-4'-heptyl-diphenyl
- 10 2'-fluoro-4-pentyl-4'-heptyl-diphenyl
- 3-fluoro-4-pentyl-4'-heptyl-diphenyl
- 3'-fluoro-4-pentyl-4'-heptyl-diphenyl
- 2-chloro-4-pentyl-4'-heptyl-diphenyl
- 2'-chloro-4-pentyl-4'-heptyl-diphenyl
- 15 3-chloro-4-pentyl-4'-heptyl-diphenyl
- 3'-chloro-4-pentyl-4'-heptyl-diphenyl
- 3-fluoro-4-butyloxy-4'-pentyl-diphenyl
- 3-fluoro-4-hexyloxy-4'-pentyl-diphenyl
- 3-fluoro-4-butyloxy-4'-heptyl-diphenyl
- 20 3-fluoro-4-hexyloxy-4'-heptyl-diphenyl
- 3-chloro-4-propanoyloxy-4'-heptyl-diphenyl
- 3-chloro-4-propanoyloxy-4'-pentyl-diphenyl
- 3-chloro-4-propanoyloxy-4'-nonyl-diphenyl
- 3-chloro-4-pentanoyloxy-4'-heptyl-diphenyl
- 25 3-fluoro-4-butylamino-4'-pentyl-diphenyl
- 3-fluoro-4-hexylamino-4'-pentyl-diphenyl
- 3-fluoro-4-butylamino-4'-heptyl-diphenyl
- 2,5-difluoro-4,4'-dipentyl-diphenyl
- 2,5-difluoro-4,4'-diheptyl-diphenyl
- 30 2,5-difluoro-4,4'-dinonyl-diphenyl
- 2,5-dichloro-4,4'-dinonyl-diphenyl
- 2,5-difluoro-4-pentyl-4'-heptyl-diphenyl
- 2,5-difluoro-4-heptyl-4'-pentyl-diphenyl
- 3,5-difluoro-4-butyloxy-4'-pentyl-diphenyl
- 35 3,5-difluoro-4-hexyloxy-4'-pentyl-diphenyl
- 3,5-difluoro-4-hexyloxy-4'-heptyl-diphenyl
- 3,3'-difluoro-4,4'-dibutyloxy-diphenyl
- 3,3'-difluoro-4-butyloxy-4'-hexyloxy-diphenyl
- 3,3'-dichloro-4,4'-dihexyloxy-diphenyl



- 3,3'-dichloro-4-hexyloxy-4'-octyloxy-diphenyl
3,3'-difluoro-4,4'-di(butylamino)-diphenyl
3,3'-dichloro-4,4'-di(hexylamino)-diphenyl
1-(2-fluoro-4-pentylphenyl)-2-(4-pentylphenyl)-ethane
5 1-(3-fluoro-4-pentylphenyl)-2-(4-pentylphenyl)-ethane
1-(2-chloro-4-heptylphenyl)-2-(4-heptylphenyl)-ethane
1-(3-chloro-4-heptylphenyl)-2-(4-heptylphenyl)-ethane
1-(3-fluoro-4-butyloxyphenyl)-2-(4-heptylphenyl)-ethane
1-(3-chloro-4-hexyloxyphenyl)-2-(4-heptylphenyl)-ethane
10 1,2-bis-(2-fluoro-4-pentylphenyl)-ethane
1,2-bis-(3-fluoro-4-pentylphenyl)-ethane
1,2-bis-(3-fluoro-4-butyloxyphenyl)-ethane
1,2-bis-(3-fluoro-4-hexyloxyphenyl)-ethane
1,2-bis-(3-chloro-4-hexyloxyphenyl)-ethane
15 1-(3,5-difluoro-4-butyloxyphenyl)-2-(4-pentylphenyl)-ethane
1-(3-fluoro-4-pentanoyloxyphenyl)-2-(4-pentylphenyl)-ethane
1-(3,5-difluoro-4-pentanoyloxyphenyl)-2-(4-pentylphenyl)-ethane
2-fluoro-4-propyl-4'-(4-pentylphenyl)-diphenyl
2-fluoro-4-pentyl-4'-(4-pentylphenyl)-diphenyl
20 3-fluoro-4-pentyl-4'-(4-pentylphenyl)-diphenyl
2-chloro-4-pentyl-4'-(4-pentylphenyl)-diphenyl
3-chloro-4-pentyl-4'-(4-pentylphenyl)-diphenyl
2-bromo-4-pentyl-4'-(4-pentylphenyl)-diphenyl
3-bromo-4-pentyl-4'-(4-pentylphenyl)-diphenyl
25 2-iodo-4-pentyl-4'-(4-pentylphenyl)-diphenyl
3-iodo-4-pentyl-4'-(4-pentylphenyl)-diphenyl
2-cyano-4-pentyl-4'-(4-pentylphenyl)-diphenyl (sic)
3-cyano-4-pentyl-4'-(4-pentylphenyl)-diphenyl
2-methyl-4-pentyl-4'-(4-pentylphenyl)-diphenyl
30 3-methyl-4-pentyl-4'-(4-pentylphenyl)-diphenyl
3-fluoro-4-butyloxy-4'-(4-pentylphenyl)-diphenyl (sic)
3-chloro-4-butyloxy-4'-(4-pentylphenyl)-diphenyl (sic)
3-bromo-4-butyloxy-4'-(4-pentylphenyl)-diphenyl (sic)
3-iodo-4-butyloxy-4'-(4-pentylphenyl)-diphenyl
35 3-cyano-4-butyloxy-4'-(4-pentylphenyl)-diphenyl
3-methyl-4-butyloxy-4'-(4-pentylphenyl)-diphenyl
3-fluoro-4-butyloxy-4'-(3-fluoro-4-butyloxyphenyl)-diphenyl
3-chloro-4-butyloxy-4'-(3-chloro-4-butyloxyphenyl)-diphenyl
3-bromo-4-butyloxy-4'-(3-bromo-4-butyloxyphenyl)-diphenyl

- 3-iodo-4-butyloxy-4'-(3-iodo-4-butyloxyphenyl)-diphenyl
3-methyl-4-butyloxy-4'-(3-methyl-4-butyloxyphenyl)-diphenyl
2-fluoro-1,4-bis-(4',4"-dipentylphenyl)-benzene
C 51.5 Sg 62 SA 109.5 N 136.5 I
- 5 2-chloro-1,4-bis-(4',4"-dipentylphenyl)-benzene
2-bromo-1,4-bis-(4',4"-dipentylphenyl)-benzene
2-iodo-1,4-bis-(4',4"-dipentylphenyl)-benzene
2-cyano-1,4-bis-(4',4"-dipentylphenyl)-benzene
2-methyl-1,4-bis-(4',4"-dipentylphenyl)-benzene
- 10 2,5-difluoro-1,4-bis-(4',4"-dipentylphenyl)-benzene (sic)
2,5-dichloro-1,4-bis-(4',4"-dipentylphenyl)-benzene
2,5-dibromo-1,4-bis-(4',4"-dipentylphenyl)-benzene
2,5-diiodo-1,4-bis-(4',4"-dipentylphenyl)-benzene
2,5-dimethyl-1,4-bis-(4',4"-dipentylphenyl)-benzene
- 15 1-(2-fluoro-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
1-(3-fluoro-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
1-(2-chloro-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
1-(3-chloro-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
1-(3-bromo-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
- 20 1-(3-cyano-4-pentylphenyl)-2-(4'-pentyldiphenyl)-ethane
1-(2-fluoro-4-pentylphenyl)-2-(3-fluoro-4'-pentyldiphenyl)-ethane (sic)
1-(2-fluoro-4-pentylphenyl)-2-(3'-fluoro-4'-pentyldiphenyl)-ethane
- 25 1,4-bis-[β-(4-pentyl-2-fluorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-pentyl-3-fluorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-pentyl-2-chlorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-pentyl-3-chlorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-pentyl-2-bromophenyl)-ethyl]-benzene
- 30 1,4-bis-[β-(4-pentyl-3-bromophenyl)-ethyl]-benzene
1,4-bis-[β-(4-butyloxy-2-fluorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-butyloxy-3-fluorophenyl)-ethyl]-benzene
1,4-bis-[β-(4-butyloxy-3-chlorophenyl)-ethyl]-benzene
1-(4'-pentylphenyl)-2-[2-fluoro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 35 1-(4'-pentylphenyl)-2-[2-chloro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
1-(4'-pentylphenyl)-2-[2-bromo-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane

- 1-(4'-pentylphenyl)-2-[3-fluoro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4'-pentylphenyl)-2-[3-chloro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 5 1-(4'-pentylphenyl)-2-[3-bromo-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4'-pentylphenyl)-2-[3-cyano-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4'-pentylphenyl)-2-[3-methyl-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 10 1-(4-butyloxyphenyl)-2-[2-cyano-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4-butyloxyphenyl)-2-[3-cyano-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 15 1-(4-butyloxy-3-fluorophenyl)-2-[2-fluoro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4-butyloxy-3-chlorophenyl)-2-[2-chloro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4-butyloxy-3-fluorophenyl)-2-[3-fluoro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane (sic)
- 20 1-(4-butyloxy-3-chlorophenyl)-2-[3-chloro-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4-butyloxy-3-bromophenyl)-2-[3-bromo-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 25 1-(4-butyloxy-3-methylphenyl)-2-[3-methyl-4-(4'-trans-pentylcyclohexyl)-phenyl]-ethane
- 1-(4-pentylphenyl)-2-[2-fluoro-4-(4'-trans-pentylcyclohexyl-methoxy)-phenyl]-ethane
- 1-(4-pentylphenyl)-2-[3-fluoro-4-(4'-trans-pentylcyclohexyl-methoxy)-phenyl]-ethane
- 30 41-(5-Pentylphenyl)-2-[2-chloro-4-(4'-trans-pentylcyclohexyl-methoxy)-phenyl]-ethane (sic)
- 1-(4-pentylphenyl)-2-[3-chloro-4-(4'-trans-pentylcyclohexyl-methoxy)-phenyl]-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(2-fluoro-4'-pentyldiphenyl)-ethane, melting point 56°, clear point 110°
- 35 1-(4-trans-pentylcyclohexyl)-2-(2-chloro-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(2-bromo-4'-pentyldiphenyl)-ethane

- 1-(4-trans-pentylcyclohexyl)-2-(2-iodo-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4'-pentyldiphenyl)-ethane
- 5 1-(4-trans-pentylcyclohexyl)-2-(2-cyano-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(2,2'-difluoro-4'-pentyldiphenyl)-ethane, $\Delta n = 0.15$
- 1-(4-trans-pentylcyclohexyl)-2-(2,2'-dichloro-4'-pentyldiphenyl)-ethane
- 10 1-(4-trans-pentylcyclohexyl)-2-(3,3'-difluoro-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(3,3'-dichloro-4'-pentyldiphenyl)-ethane
- 15 1-(4-trans-pentylcyclohexyl)-2-(3-fluoro-4'-pentyldiphenyl)-ethane, $\Delta n = 0.15$
- 1-(4-trans-pentylcyclohexyl)-2-(3-chloro-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4'-pentyldiphenyl)-ethane
- 20 1-(4-trans-pentylcyclohexyl)-2-(3-cyano-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(3,3'-difluoro-4'-pentyldiphenyl)-ethane $\Delta n = 0.14$
- 25 1-(4-trans-pentylcyclohexyl)-2-(3,3'-dichloro-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(2'-fluoro-4'-pentyldiphenyl)-ethane C 17 S 33 S_A 37 N 108.5 I
- 1-(4-trans-pentylcyclohexyl)-2-(2'-chloro-4'-pentyldiphenyl)-ethane
- 30 1-(4-trans-pentylcyclohexyl)-2-(3'-fluoro-4'-pentyldiphenyl)-ethane, $\Delta n = 0.15$
- 1-(4-trans-pentylcyclohexyl)-2-(3'-chloro-4'-pentyldiphenyl)-ethane
- 35 1-(4-trans-pentylcyclohexyl)-2-(3'-methyl-4'-pentyldiphenyl)-ethane
- 1-(4-trans-pentylcyclohexyl)-2-(3'-cyano-4'-pentyldiphenyl)-ethane

- 1-(4-trans-pentylcyclohexyl)-2-(3'-fluoro-4'-butyloxy-diphe-nyl)-ethane, $\Delta n = 0.16$
1-(4-trans-pentylcyclohexyl)-2-(3'-chloro-4'-butyloxy-diphe-nyl)-ethane
5 1-(4-trans-pentylcyclohexyl)-2-(3'-bromo-4'-butyloxy-diphenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(3'-iodo-4'-butyloxydi-phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(3'-cyano-4'-butyloxydi-phenyl)-ethane
10 1-(4-trans-pentylcyclohexyl)-2-(3'-methyl-4'-butyloxy-diphe-nyl)-ethane
1-(4-trans-pentylcyclohexylethyl)-2-(3-fluoro-4'-butyloxy-diphenyl)-ethane
15 1-(4-trans-pentylcyclohexylethyl)-2-(3'-chloro-4'-butyloxy-diphenyl)-ethane
1-(4-trans-pentylcyclohexylethyl)-2-(3'-fluoro-4'-propanoyl-oxydiphenyl)-ethane
5-propyl-2-(2-fluoro-4-propylphenyl)-pyrimidine
20 5-pentyl-2-(2-fluoro-4-propylphenyl)-pyrimidine
5-pentyl-2-(2-fluoro-4-pentylphenyl)-pyrimidine
5-heptyl-2-(2-fluoro-4-pentylphenyl)-pyrimidine
5-pentyl-2-(3-fluoro-4-pentylphenyl)-pyrimidine, c 28 N,
 $\Delta n = 0.18$
25 5-heptyl-2-(3-fluoro-9-heptylphenyl)-pyrimidine
5-pentyl-2-(2-chloro-4-heptylphenyl)-pyrimidine
5-heptyl-2-(3-chloro-4-heptylphenyl)-pyrimidine
5-pentyl-2-(3-fluoro-4-butyloxyphenyl)-pyrimidine
5-heptyl-2-(3-fluoro-4-butyloxyphenyl)-pyrimidine
30 5-heptyl-2-(3-fluoro-4-hexyloxyphenyl)-pyrimidine,
c 56 N, $\Delta n = 0.17$
5-pentyl-2-(3-chloro-4-butyloxyphenyl)-pyrimidine
5-heptyl-2-(3-chloro-4-butyloxyphenyl)-pyrimidine
5-heptyl-2-(3-chloro-4-hexyloxyphenyl)-pyrimidine
35 5-pentyl-2-(3-fluoro-4-propanoyloxyphenyl)-pyrimidine
5-pentyl-2-(3-fluoro-4-pentanoyloxyphenyl)-pyrimidine
5-heptyl-2-(3-fluoro-4-pentanoyloxyphenyl)-pyrimidine
5-pentyl-2-(3-chloro-4-pentanoyloxyphenyl)-pyrimidine

- 5-heptyl-2-(3-chloro-4-pentanoyloxyphenyl)-pyrimidine
2-propyl-5-(2-fluoro-4-propylphenyl)-pyrimidine
2-pentyl-5-(2-fluoro-4-propylphenyl)-pyrimidine
2-pentyl-5-(2-fluoro-4-pentylphenyl)-pyrimidine
5 2-heptyl-5-(2-fluoro-4-pentylphenyl)-pyrimidine
2-pentyl-5-(3-fluoro-4-pentylphenyl)-pyrimidine
2-heptyl-5-(3-fluoro-4-heptylphenyl)-pyrimidine
2-pentyl-5-(2-chloro-4-heptylphenyl)-pyrimidine
2-heptyl-5-(3-chloro-4-heptylphenyl)-pyrimidine
10 2-pentyl-5-(3-fluoro-4-butyloxyphenyl)-pyrimidine
2-heptyl-5-(3-fluoro-4-butyloxyphenyl)-pyrimidine
2-heptyl-5-(3-fluoro-4-hexyloxyphenyl)-pyrimidine (sic)
2-pentyl-5-(3-chloro-4-butyloxyphenyl)-pyrimidine
2-heptyl-5-(3-chloro-4-butyloxyphenyl)-pyrimidine
15 2-heptyl-5-(3-chloro-4-hexyloxyphenyl)-pyrimidine
2-pentyl-5-(3-fluoro-4-propanoyloxyphenyl)-pyrimidine
2-pentyl-5-(3-fluoro-4-pentanoyloxyphenyl)-pyrimidine
2-heptyl-5-(3-fluoro-4-pentanoyloxyphenyl)-pyrimidine
2-pentyl-5-(3-chloro-4-pentanoyloxyphenyl)-pyrimidine
20 2-heptyl-5-(3-chloro-4-pentanoyloxyphenyl)-pyrimidine
1-(5-pentyl-2-pyrimidinyl)-2-(2-fluoro-4-pentylphenyl)-ethane
1-(5-pentyl-2-pyrimidinyl)-2-(3-fluoro-4-pentylphenyl)-ethane
1-(5-pentyl-2-pyrimidinyl)-2-(2-chloro-4-pentylphenyl)-ethane
1-(5-pentyl-2-pyrimidinyl)-2-(3-chloro-4-pentylphenyl)-ethane
25 1-(5-pentyl-2-pyrimidinyl)-2-(3-fluoro-4-butyloxyphenyl)-ethane
1-(5-pentyl-2-pyrimidinyl)-2-(3-chloro-4-butyloxyphenyl)-ethane
1-(5-pentyl-2-pyrimidinyl)-2-(3-fluoro-4-propanoyloxyphenyl)-
ethane
1-(5-pentyl-2-pyrimidinyl)-2-(3-chloro-4-propanoyloxyphenyl)-
30 ethane
5-(4-pentylphenyl)-2-(2-fluoro-4-pentylphenyl)-pyrimidine
5-(4-pentylphenyl)-2-(3-fluoro-4-pentylphenyl)-pyrimidine
5-(4-pentylphenyl)-2-(3-chloro-4-pentylphenyl)-pyrimidine
5-(4-pentylphenyl)-2-(3-fluoro-4-butyloxyphenyl)-pyrimidine
35 5-(4-pentylphenyl)-2-(3-chloro-4-butyloxyphenyl)-pyrimidine
5-(4-pentylphenyl)-2-(3-fluoro-4-propanoyloxyphenyl)-pyrimidine
2,5-bis-(2-fluoro-4-pentylphenyl)-pyrimidine
2,5-bis-(3-fluoro-4-pentylphenyl)-pyrimidine
2,5-bis-(3-chloro-4-pentylphenyl)-pyrimidine
40 2,5-bis-(3-fluoro-4-butyloxyphenyl)-pyrimidine

- 2,5-bis-(3-chloro-4-butyloxyphenyl)-pyrimidine
2,5-bis-(3-fluoro-4-propanoyloxyphenyl)-pyrimidine
2,5-bis-(3-chloro-4-propanoyloxyphenyl)-pyrimidine
1-(2-pentyl-5-pyrimidinyl)-2-(2-fluoro-4-pentylphenyl)-ethane
5 1-(2-pentyl-5-pyrimidinyl)-2-(3-fluoro-4-pentylphenyl)-ethane
1-(2-pentyl-5-pyrimidinyl)-2-(2-chloro-4-pentylphenyl)-ethane
1-(2-pentyl-5-pyrimidinyl)-2-(3-chloro-4-pentylphenyl)-ethane
1-(2-pentyl-5-pyrimidinyl)-2-(3-fluoro-4-butyloxyphenyl)-ethane
1-(2-pentyl-5-pyrimidinyl)-2-(3-chloro-4-butyloxyphenyl)-ethane
10 1-(2-pentyl-5-pyrimidinyl)-2-(3-fluoro-4-propanoyloxy-
phenyl)-ethane
1-(2-pentyl-5-pyrimidinyl)-2-(3-chloro-4-propanoyloxy-
phenyl)-ethane
2-(4-pentylphenyl)-5-(2-fluoro-4-pentylphenyl)-pyrimidine
15 2-(4-pentylphenyl)-5-(3-fluoro-4-pentylphenyl)-pyrimidine
2-(4-pentylphenyl)-5-(3-chloro-4-pentylphenyl)-pyrimidine
2-(4-pentylphenyl)-5-(3-fluoro-4-butyloxyphenyl)-pyrimidine
2-(4-pentylphenyl)-5-(3-chloro-4-butyloxyphenyl)-pyrimidine
2-(4-pentylphenyl)-5-(3-fluoro-4-propanoyloxyphenyl)-
20 pyrimidine
2-pentyl-5-(2-fluoro-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(2-chloro-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(2-bromo-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(3-fluoro-4'-pentyldiphenyl)-pyrimidine
25 2-pentyl-5-(3-chloro-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(3-bromo-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(3-cyano-4'-pentyldiphenyl)-pyrimidine
2-pentyl-5-(3'-fluoro-4'-butyloxydiphenyl)-pyrimidine
2-pentyl-5-(3'-chloro-4'-butyloxydiphenyl)-pyrimidine
30 2-pentyl-5-(3'-bromo-4'-butyloxydiphenyl)-pyrimidine
2-pentyl-5-(3'-cyano-4'-butyloxydiphenyl)-pyrimidine
2-pentyl-5-(3'-methyl-4'-butyloxydiphenyl)-pyrimidine
2-pentyl-5-(3'-chloro-4'-propanoyloxydiphenyl)-pyrimidine
5-pentyl-2-[2-fluoro-4-(4-pentylphenylethyl)-phenyl]-
35 pyrimidine
5-pentyl-2-[2-chloro-4-(4-pentylphenylethyl)-phenyl]-
pyrimidine
5-pentyl-2-[2-bromo-4-(4-pentylphenylethyl)-phenyl]-
pyrimidine

- 5-pentyl-2-[2-cyano-4-(4-pentylphenylethyl)-phenyl]-pyrimidine
- 5-pentyl-2-(2-fluoro-4'-pentyldiphenyl)-pyrimidine
- 5-pentyl-2-(2-chloro-4'-pentyldiphenyl)-pyrimidine
- 5 5-pentyl-2-(2-bromo-4'-pentyldiphenyl)-pyrimidine
- 5-pentyl-2-(3-fluoro-4'-pentyldiphenyl)-pyrimidine
- 5-pentyl-2-(3-chloro-4'-pentyldiphenyl)-pyrimidine
- 5-pentyl-2-(3-bromo-4'-pentyldiphenyl)-pyrimidine
- 5-pentyl-2-(3-cyano-4'-pentyldiphenyl)-pyrimidine
- 10 5-pentyl-2-(3'-fluoro-4'-butyloxydiphenyl)-pyrimidine
- 5-pentyl-2-(3'-chloro-4'-butyloxydiphenyl)-pyrimidine
- 5-pentyl-2-(3'-bromo-4'-butyloxydiphenyl)-pyrimidine
- 5-pentyl-2-(3'-cyano-4'-butyloxydiphenyl)-pyrimidine
- 5-pentyl-2-(3'-methyl-4'-butyloxydiphenyl)-pyrimidine
- 15 5-pentyl-2-(3'-chloro-4'-propanoyloxydiphenyl)-pyrimidine
- 2-pentyl-5-[2-fluoro-4-(4-pentylphenylethyl)-phenyl]-pyrimidine
- 2-pentyl-5-[2-chloro-4-(4-pentylphenylethyl)-phenyl]-pyrimidine
- 20 2-pentyl-5-[2-bromo-4-(4-pentylphenylethyl)-phenyl]-pyrimidine
- 2-pentyl-5-[2-cyano-4-(4-pentylphenylethyl)-phenyl]-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(2-fluoro-4-pentylphenyl)-pyrimidine (sic)
- 25 5-(trans-4-pentylcyclohexyl)-2-(2-chloro-4-pentylphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(2-bromo-4-pentylphenyl)-pyrimidine
- 30 5-(trans-4-pentylcyclohexyl)-2-(2-cyano-4-pentylphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(2-methyl-4-pentylphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-fluoro-4-pentylphenyl)-pyrimidine
- 35 5-(trans-4-pentylcyclohexyl)-2-(3-chloro-4-pentylphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-bromo-4-pentylphenyl)-pyrimidine

- 5-(trans-4-pentylcyclohexyl)-2-(3-cyano-4-pentylphenyl)-
pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-methyl-4-pentylphenyl)-
pyrimidine
- 5 5-(trans-4-pentylcyclohexyl)-2-(3-fluoro-4-butyloxyphenyl)-
pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-chloro-4-butyloxyphenyl)-
pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-bromo-4-butyloxyphenyl)-
10 pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-cyano-4-butyloxyphenyl)-
pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-fluoro-4-propanoyloxy-
phe-nyl)-pyrimidine
- 15 5-(trans-4-pentylcyclohexyl)-2-(3-chloro-4-propanoyloxyphe-
nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-bromo-4-propanoyloxyphe-
nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexyl)-2-(3-cyano-4-propanoyloxyphe-
20 ny)-pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(2-fluoro-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(2-chloro-4-pentylphenyl)-
pyrimidine
- 25 2-(trans-4-pentylcyclohexyl)-5-(2-bromo-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(2-cyano-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(2-methyl-4-pentylphenyl)-
30 pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-fluoro-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-chloro-4-pentylphenyl)-
pyrimidine
- 35 2-(trans-4-pentylcyclohexyl)-5-(3-bromo-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-cyano-4-pentylphenyl)-
pyrimidine



- 2-(trans-4-pentylcyclohexyl)-5-(3-methyl-4-pentylphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-fluoro-4-butyloxyphenyl)-
pyrimidine
- 5 2-(trans-4-pentylcyclohexyl)-5-(3-chloro-4-butyloxyphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-bromo-4-butyloxyphenyl)-
pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-cyano-4-butyloxyphenyl)-
10 pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-fluoro-4-propanoyloxyph-
enyl)-pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-chloro-4-propanoyloxyph-
enyl)-pyrimidine
- 15 2-(trans-4-pentylcyclohexyl)-5-(3-bromo-4-propanoyloxyph-
enyl)-pyrimidine
- 2-(trans-4-pentylcyclohexyl)-5-(3-cyano-4-propanoyloxyph-
enyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(2-fluoro-4-pentylphe-
20 nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(2-chloro-4-pentylphe-
nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(2-bromo-4-pentyl-
phenyl)-pyrimidine
- 25 5-(trans-4-pentylcyclohexylethyl)-2-(2-cyano-4-pentylphenyl)-
pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(2-methyl-4-pentylphe-
nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-fluoro-4-pentylphe-
30 nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-chloro-4-pentylphe-
nyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-bromo-4-pentyl-
phenyl)-pyrimidine
- 35 5-(trans-4-pentylcyclohexylethyl)-2-(3-cyano-4-pentyl-
phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-methyl-4-pentylphe-
nyl)-pyrimidine

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- 5-(trans-4-pentylcyclohexylethyl)-2-(3-fluoro-4-butyloxy-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-chloro-4-butyloxy-phenyl)-pyrimidine
- 5 5-(trans-4-pentylcyclohexylethyl)-2-(3-bromo-4-butyloxyphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-cyano-4-butyloxyphenyl)-pyrimidine (sic)
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-fluoro-4-propanoyloxyphenyl)-pyrimidine
- 10 5-(trans-4-pentylcyclohexylethyl)-2-(3-chloro-4-propanoyloxyphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylethyl)-2-(3-bromo-4-propanoyloxyphenyl)-pyrimidine
- 15 5-(trans-4-pentylcyclohexylethyl)-2-(3-cyano-4-propanoyloxyphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(2-fluoro-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(2-chloro-4-pentylphenyl)-pyrimidine
- 20 2-(trans-4-pentylcyclohexylethyl)-5-(2-bromo-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(2-cyano-4-pentylphenyl)-pyrimidine
- 25 2-(trans-4-pentylcyclohexylethyl)-5-(2-methyl-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-fluoro-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-chloro-4-pentylphenyl)-pyrimidine
- 30 2-(trans-4-pentylcyclohexylethyl)-5-(3-bromo-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-cyano-4-pentylphenyl)-pyrimidine
- 35 2-(trans-4-pentylcyclohexylethyl)-5-(3-methyl-4-pentylphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-fluoro-4-butyloxyphenyl)-pyrimidine

- 2-(trans-4-pentylcyclohexylethyl)-5-(3-chloro-4-butyloxy-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-bromo-4-butyloxy-phenyl)-pyrimidine
- 5 2-(trans-4-pentylcyclohexylethyl)-5-(3-cyano-4-butyloxy-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-fluoro-4-propanoyl-oxyphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-chloro-4-propanoyl-oxyphenyl)-pyrimidine
- 10 2-(trans-4-pentylcyclohexylethyl)-5-(3-bromo-4-propanoyl-oxyphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylethyl)-5-(3-cyano-4-propanoyl-oxyphenyl)-pyrimidine
- 15 5-(trans-4-pentylcyclohexylmethoxy)-2-(2-fluoro-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(2-chloro-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(2-bromo-4-pentyl-phenyl)-pyrimidine
- 20 5-(trans-4-pentylcyclohexylmethoxy)-2-(2-cyano-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(2-methyl-4-pentyl-phenyl)-pyrimidine
- 25 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-fluoro-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-chloro-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-bromo-4-pentyl-phenyl)-pyrimidine
- 30 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-cyano-4-pentyl-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-methyl-4-pentyl-phenyl)-pyrimidine
- 35 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-fluoro-4-butyloxy-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-chloro-4-butyloxy-phenyl)-pyrimidine



- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-bromo-4-butyloxy-phenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-cyano-4-butyloxy-phenyl)-pyrimidine
- 5 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-fluoro-4-propanoyl-oxyphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-chloro-4-propanoyl-oxyphenyl)-pyrimidine
- 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-bromo-4-propanoyl-oxyphenyl)-pyrimidine
- 10 5-(trans-4-pentylcyclohexylmethoxy)-2-(3-cyano-4-propanoyl-oxyphenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(2-fluoro-4-pentyl-phenyl)-pyrimidine
- 15 2-(trans-4-pentylcyclohexylmethoxy)-5-(2-chloro-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(2-bromo-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(2-cyano-4-pentyl-phenyl)-pyrimidine
- 20 2-(trans-4-pentylcyclohexylmethoxy)-5-(2-methyl-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-fluoro-4-pentyl-phenyl)-pyrimidine
- 25 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-chloro-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-bromo-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-cyano-4-pentyl-phenyl)-pyrimidine
- 30 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-methyl-4-pentyl-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-fluoro-4-butyloxy-phenyl)-pyrimidine
- 35 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-chloro-4-butyloxy-phenyl)-pyrimidine
- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-bromo-4-butyloxy-phenyl)-pyrimidine

- 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-cyano-4-butyloxy-phenyl)-pyrimidine
2-(trans-4-pentylcyclohexylmethoxy)-5-(3-fluoro-4-propanoyl-oxyphenyl)-pyrimidine
5 2-(trans-4-pentylcyclohexylmethoxy)-5-(3-chloro-4-propanoyl-oxyphenyl)-pyrimidine
2-(trans-4-pentylcyclohexylmethoxy)-5-(3-bromo-4-propanoyl-oxyphenyl)-pyrimidine
2-(trans-4-pentylcyclohexylmethoxy)-5-(3-cyano-4-propanoyl-oxyphenyl)-pyrimidine
10 2-chloro-4-propyl-4'-(4-propylphenyl)terphenyl
2-chloro-3-pentyl-4'-(4-propylphenyl)terphenyl
2-chloro-4-pentyl-4'-(5-pentylphenyl)terphenyl
3-chloro-4-pentyl-4'-(4-pentylphenyl)terphenyl
15 2-bromo-4-pentyl-4'-(4-pentylphenyl)terphenyl
3-bromo-4-pentyl-4'-(4-pentylphenyl)terphenyl
2-methyl-4-pentyl-4'-(4-pentylphenyl)terphenyl
3-methyl-4-pentyl-4'-(4-pentylphenyl)terphenyl
2-bromo-4-butyloxy-4'-(4-pentylphenyl)terphenyl
20 2-methyl-4-butyloxy-4'-(4-pentylphenyl)terphenyl
2-cyano-4-butyloxy-4'-(4-pentylphenyl)terphenyl
2-chloro-1,4-bis(4',4"-dipentylphenyl)diphenyl
2-bromo-1,4-bis(4',4"-dipentylphenyl)diphenyl
2-cyano-1,4-bis(4',4"-dipentylphenyl)diphenyl
25 2-methyl-1,4-bis(4',4"-dipentylphenyl)diphenyl
1,4-bis(3-chloro-4-pentylphenyl)diphenyl
1,4-bis(3-bromo-4-pentylphenyl)diphenyl
1,4-bis(3-methyl-4-pentylphenyl)diphenyl
1-(2-chloro-4-pentyldiphenyl)-2-(4'-pentyldiphenyl)ethane
30 1-(2-bromo-4-pentyldiphenyl)-2-(4'-pentyldiphenyl)ethane
1-(2-cyano-4-pentyldiphenyl)-2-(4'-pentyldiphenyl)ethane
1-(2-methyl-4-pentyldiphenyl)-2-(4'-pentyldiphenyl)ethane
1-(4'-pentyldiphenyl)-2-[2-bromo-4'-trans-pentylcyclohexyl)phenyl]ethane
35 1-(4-butyloxy-3-methyldiphenyl)-2-[3-methyl-4-(4'-trans-pentylcyclohexyl)phenyl]ethane
1-(3-pentyldiphenyl)-2-[2-bromo-4-(4'-trans-pentylcyclohexyl-methoxy)-phenyl]ethane

- 5-(4-pentylphenyl)-2-(2-chloro-4-pentylphenyl)pyrimidine
5-(4-pentylphenyl)-2-(2-bromo-4-pentylphenyl)pyrimidine
5-(4-pentylphenyl)-2-(2-methyl-4-pentylphenyl)pyrimidine
5-(4-pentylphenyl)-2-(2-iodo-4-pentylphenyl)pyrimidine
5 5-(3-chloro-4-pentylphenyl)-2-(2-chloro-4-pentylphenyl)-
pyrimidine
2-(4-pentylphenyl)-5-(3'-bromo-4'-butyloxydiphenyl)-
pyrimidine
2-(4-pentylphenyl)-5-(3'-iodo-4'-butyloxydiphenyl)-pyrimidine
10 2-(4-pentylphenyl)-5-(3'-methyl-4'-butyloxydiphenyl)-
pyrimidine
5-(4-pentylphenyl)-2-[2-bromo-4-(4'-pentylphenylethyl)-
phenyl]pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(2-bromo-4-pentylphenyl)-
15 pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(2-methyl-4-pentylphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(2-cyano-4-pentylphenyl)-
pyrimidine
20 5-(trans-4-pentylcyclohexyl)-2-(2-iodo-4-pentylphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-chloro-4-butyloxydiphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-bromo-4-butyloxydiphenyl)-
25 pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-cyano-4-butyloxydiphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-methyl-4-butyloxydiphenyl)-
pyrimidine
30 5-(trans-4-pentylcyclohexyl)-2-(3-bromo-4-pentylphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-cyano-4-pentylphenyl)-
pyrimidine
5-(trans-4-pentylcyclohexyl)-2-(3-methyl-4-pentylphenyl)-
35 pyrimidine
5-(trans-4-pentylcyclohexylethyl)-2-(2-chloro-4-pentyl-
diphenyl)-pyrimidine
5-(trans-4-pentylcyclohexylethyl)-2-(2-bromo-4-pentyl-



- diphenyl)-pyrimidine
5-(trans-4-pentylcyclohexylethyl)-2-)2-cyano-4-pentyl-
diphenyl)-pyrimidine
5-(trans-4-pentylcyclohexylethyl)-2-)2-methyl-4-pentyl-
5 diphenyl)-pyrimidine
2-cyano-4,4'-dipentyl-diphenyl
3-cyano-4,4'-dipentyl-diphenyl
3-cyano-4-butyloxy-4'-pentyldiphenyl, C 35 N (-40) 1
2-cyano-4-(4-trans-pentylcyclohexyl)-butyloxybenzene,
10 melting point 35°
1-(2-cyano-4-pentylphenyl)-2-(4-pentylphenyl)-ethane
2,3-dicyano-1,4-bis(4',4''-dipentylphenyl)-benzol[sic]
1-butyloxy-2,3-dicyano-4-(4'-pentylbiphenyl)-benzene
1-pentyl-2,3-dicyano-4-(4'-pentylbiphenyl)-benzene
15 1-(2,3-dicyano-4-pentylphenyl)-2-(4'-pentylbiphenyl)-
ethane
1-(2,3-dicyano-4-butyloxyphenyl)-2-(4'-pentylbiphenyl)-
ethane
1-(2,3-dicyano-4-butyloxyphenyl)-2-[4-(4'-trans-pentyl-
20 cyclohexyl)-phenyl]-ethane
1-(2,3-dicyano-4-pentylphenyl)-2-[4-(4'-trans-pentylcyclo-
hexyl)-phenyl]-ethane
1-(4-pentylphenyl)-2-[4-(4'-trans-pentylcyclohexyl)-2,3-
dicyano-phenyl]-ethane (sic)
25 1-(2,3-dicyano-4-pentylphenyl)-2-(4,4'-trans,trans-pentyl-
bicyclohexyl)-ethane
1-(2,3-dicyano-4-butyloxyphenyl)-2-(4,4'-trans,trans-pentyl-
bicyclohexyl)-ethane
2-methyl-1-pentyl-4-(4-trans-pentylcyclohexyl)-benzene,
30 $\Delta n = 0.08$
3-methyl-1-pentyl-4-(4-trans-pentylcyclohexyl)-benzene
2-methyl-1-nonyl-4-(4-trans-pentylcyclohexyl)-benzene
3-methyl-1-nonyl-4-(4-trans-pentylcyclohexyl)-benzene
2-methyl-1-nonyl-4-(4-trans-nonylcyclohexyl)-benzene
35 3-methyl-1-nonyl-4-(4-trans-nonylcyclohexyl)-benzene
2-methyl-4-(4-trans-nonylcyclohexyl)-1-pentyl-benzene
3-methyl-4-(4-trans-nonylcyclohexyl)-1-pentyl-benzene
1-butoxy-2-methyl-4-(4-trans-pentylcyclohexyl)-benzene

- 1-butoxy-3-methyl-4-(4-trans-pentylcyclohexyl)-benzene
1-butoxy-2-methyl-4-(4-trans-nonylcyclohexyl)-benzene
1-butoxy-3-methyl-4-(4-trans-nonylcyclohexyl)-benzene
2-methyl-4-(4-trans-nonylcyclohexyl)-1-octyloxy-benzene
5 3-methyl-4-(4-trans-nonylcyclohexyl)-1-octyloxy-benzene
2-methyl-1-octyloxy-4-(4-trans-pentylcyclohexyl)-benzene
3-methyl-1-octyloxy-4-(4-trans-pentylcyclohexyl)-benzene
2-methyl-4-(4-trans-pentylcyclohexyl)-phenyl butanoate
3-methyl-4-(4-trans-pentylcyclohexyl)-phenyl butanoate
10 2-methyl-4-(4-trans-nonylcyclohexyl)-phenyl butanoate
3-methyl-4-(4-trans-nonylcyclohexyl)-phenyl butanoate
2-methyl-4-(4-trans-pentylcyclohexyl)-phenyl octanoate
3-methyl-4-(4-trans-pentylcyclohexyl)-phenyl octanoate
2-methyl-4-(4-trans-nonylcyclohexyl)-phenyl octanoate
15 3-methyl-4-(4-trans-nonylcyclohexyl)-phenyl octanoate
N-butyl-2-methyl-4-(4-trans-pentylcyclohexyl)-aniline
N-butyl-3-methyl-4-(4-trans-pentylcyclohexyl)-aniline
N-butyl-2-methyl-4-(4-trans-nonylcyclohexyl)-aniline
N-butyl-3-methyl-4-(4-trans-nonylcyclohexyl)-aniline
20 N-octyl-2-methyl-4-(4-trans-pentylcyclohexyl)-aniline
N-octyl-3-methyl-4-(4-trans-pentylcyclohexyl)-aniline
N-octyl-2-methyl-4-(4-trans-nonylcyclohexyl)-aniline
N-octyl-3-methyl-4-(4-trans-nonylcyclohexyl)-aniline
1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4-pentylphenyl)-
25 ethane
1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4-pentylphenyl)-
ethane
1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4-nonylphenyl)-
ethane
30 1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4-nonylphenyl)-
ethane
1-(4-trans-nonylcyclohexyl)-2-(2-methyl-4-pentylphenyl)-
ethane
1-(4-trans-nonylcyclohexyl)-2-(3-methyl-4-pentylphenyl)-
35 ethane
1-(4-trans-nonylcyclohexyl)-2-(2-methyl-4-nonylphenyl)-
ethane
1-(4-trans-nonylcyclohexyl)-2-(3-methyl-4-nonylphenyl)-



- ethane
1-(4-trans-pentylcyclohexyl)-2-(4-butoxy-2-methylphenyl)-
ethane
1-(4-trans-pentylcyclohexyl)-2-(4-butoxy-3-methylphenyl)-
5 ethane
1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4-octyloxyphenyl)-
ethane
1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4-octyloxy-
phenyl)-ethane
10 1-(4-trans-nonylcyclohexyl)-2-(4-butoxy-2-methylphenyl)-
ethane
1-(4-trans-nonylcyclohexyl)-2-(4-butoxy-3-methylphenyl)-
ethane
1-(4-trans-nonylcyclohexyl)-2-(2-methyl-4-octyloxyphenyl)-
15 ethane
1-(4-trans-nonylcyclohexyl)-2-(3-methyl-4-octyloxyphenyl)-
ethane
1-(4-trans-pentylcyclohexyl)-2-(4-N-butylamino-2-methyl-
phenyl)-ethane
20 1-(4-trans-pentylcyclohexyl)-2-(4-N-butylamino-3-methyl-
phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4-N-octylamino-
phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4-N-octylamino-
25 phenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-N-butylamino-2-methyl-
phenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-N-butylamino-3-methyl-
phenyl)-ethane
30 1-(4-trans-nonylcyclohexyl)-2-(2-methyl-4-N-octylamino-
phenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(3-methyl-4-N-octylamino-
phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(4-butanoyloxy-2-methyl-
35 phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(4-butanoyloxy-3-methyl-
phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(2-methyl-4-octanoyloxy-

- phenyl)-ethane
1-(4-trans-pentylcyclohexyl)-2-(3-methyl-4-octanoyloxy-phenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-butanoyloxy-2-methyl-phenyl)-ethane
5 1-(4-trans-nonylcyclohexyl)-2-(4-butanoyloxy-3-methyl-phenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(2-methyl-4-octanoyloxy-phenyl)-ethane
10 1-(4-trans-nonylcyclohexyl)-2-(3-methyl-4-octanoyloxy-phenyl)-ethane
4-trans-pentylcyclohexylmethyl 2-methyl-4-pentyl-phenyl ether
4-trans-pentylcyclohexylmethyl 3-methyl-4-pentyl-phenyl ether
4-trans-pentylcyclohexylmethyl 4-butoxy-2-methyl-phenyl ether
15 4-trans-pentylcyclohexylmethyl 4-butoxy-3-methyl-phenyl ether
4-trans-pentylcyclohexylmethyl 4-N-butylamino-2-methyl-phenyl ether
4-trans-pentylcyclohexylmethyl 4-N-butylamino-3-methyl-phenyl ether
20 4-trans-pentylcyclohexylmethyl 2-methyl-4-octanoyloxy-phenyl ether
4-trans-pentylcyclohexylmethyl 3-methyl-4-octanoyloxy-phenyl ether
4-(4-trans-pentylcyclohexyl)-2-methyl-4'-pentyl-biphenyl,
25 $\Delta n = 0.16$
4-(4-trans-pentylcyclohexyl)-3-methyl-4'-pentyl-biphenyl
4-(4-trans-pentylcyclohexyl)-2-methyl-4'-octanoyloxy-biphenyl
4-(4-trans-pentylcyclohexyl)-3-methyl-4'-octanoyloxy-bi-
30 4'-butoxy-4-(4-trans-pentylcyclohexyl)-2-methyl-biphenyl
4'-butoxy-4-(4-trans-pentylcyclohexyl)-3-methyl-biphenyl
4'-N-butylamino-4-(4-trans-pentylcyclohexyl)-2-methyl-bi-phenyl
4'-N-butylamino-4-(4-trans-pentylcyclohexyl)-3-methyl-bi-
35 phenyl
4-(4-trans-pentylcyclohexyl)-3,3'-dimethyl-4'-pentyl-biphenyl
4-(4-trans-pentylcyclohexyl)-3,3'-dimethyl-4'-octanoyloxy-

- biphenyl
4'-N-butylamino-4-(4-trans-pentylcyclohexyl)-3,3'-dimethyl-
biphenyl
4'-butoxy-4-(4-trans-pentylcyclohexyl)-3,3'-dimethyl-
5 biphenyl
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
pentyl-phenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
pentyl-phenyl)-ethane
10 1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
butoxy-phenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
butoxy-phenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
15 N-butyl-aminophenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
N-butyl-aminophenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
octa-noylphenyl)-ethane
20 1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
octa-noylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(2-
methyl-4-pentylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-(methylphenyl)-2-(2-
25 methyl-4-pentylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(3-
methyl-4-pentylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(3-
methyl-4-pentylphenyl)-ethane
30 1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
butoxy-2-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
butoxy-2-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-
35 butoxy-3-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-
butoxy-3-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-N-

- butyl-amino-2-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-N-butyl-amino-2-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(4-N-butyl-amino-3-methylphenyl)-ethane
5 1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(4-N-butyl-amino-3-methylphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(2-methyl-4-octanoyloxyphenyl)-ethane
10 1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(2-methyl-4-octanoyloxyphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-(3-methyl-4-octanoyloxyphenyl)-ethane
1-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-(3-methyl-4-octanoyloxyphenyl)-ethane
15 1-(3,3'-dimethyl-4'-pentylbiphenyl-4-yl)-2-(4-trans-pentylcyclohexyl)-ethane
1-(3,3'-dimethyl-4'-octanoyloxybiphenyl-4-yl)-2-(4-trans-pentylcyclohexyl)-ethane
20 1-(4'-butoxy-3,3'-dimethylbiphenyl-4-yl)-2-(4-trans-pentylcyclohexyl)-ethane
1-(4'-N-butylamino-3,3'-dimethylbiphenyl-4-yl)-2-(4-trans-pentylcyclohexyl)-ethane
(3,3'-dimethyl-4'-pentyl)-biphenyl-4-yl (4-trans-pentylcyclohexyl)-methyl ether
25 (3,3'-dimethyl-4'-octanoyloxy)-biphenyl-4-yl (4-trans-pentylcyclohexyl)-methyl ether
(4'-butoxy-3,3'-dimethyl)-biphenyl-4-yl (4-trans-pentylcyclohexyl)-methyl ether
30 (4'-N-butylamino-3,3'-dimethyl)-biphenyl-4-yl (4-trans-pentylcyclohexyl)-methyl ether
1,4-bis-(4-trans-propylcyclohexyl)-2-methyl-benzene, n = 0.11
1,4-bis-(4-trans-nonylcyclohexyl)-2-methyl-benzene
1-(4-trans-nonylcyclohexyl)-4-(4-trans-propylcyclohexyl)-
35 2-methyl-benzene
1-(4-trans-nonylcyclohexyl)-4-(4-trans-propylcyclohexyl)-3-methyl-benzene
1-(4-trans-propylcyclohexyl)-2-(4-(4-trans-propylcyclo-



- hexyl)-2-methylphenyl)-ethane
1-(4-trans-propylcyclohexyl)-2-(4-(4-trans-propylcyclo-
hexyl)-3-methylphenyl)-ethane
1-(4-trans-propylcyclohexyl)-2-(4-(4-trans-nonylcyclohexyl)-
5 2-methylphenyl)-ethane
1-(4-trans-propylcyclohexyl)-2-(4-(4-trans-nonylcyclo-
hexyl)-3-methylphenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-(4-trans-propylcyclo-
hexyl)-2-methylphenyl)-ethane
10 1-(4-trans-nonylcyclohexyl)-2-(4-(4-trans-propylcyclo-
hexyl)-3-methylphenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-(4-trans-nonylcyclo-
hexyl)-2-methylphenyl)-ethane
1-(4-trans-nonylcyclohexyl)-2-(4-(4-trans-nonylcyclohexyl)-
15 3-methylphenyl)-ethane
(4-trans-propylcyclohexyl)-methyl (4-(4-trans-propyl-
cyclo-hexyl)-2-methyl)-phenyl ether
(4-trans-propylcyclohexyl)-methyl (4-(4-trans-propylcyclo-
hexyl)-3-methyl)-phenyl ether
20 (4-trans-propylcyclohexyl)-methyl (4-(4-trans-nonylcyclo-
hexyl)-2-methyl)-phenyl ether
(4-trans-propylcyclohexyl)-methyl (4-(4-trans-nonylcyclo-
hexyl)-3-methyl)-phenyl ether
(4-trans-nonylcyclohexyl)-methyl (4-(4-trans-propylcyclo-
25 hexyl)-2-methyl)-phenyl ether
(4-trans-nonylcyclohexyl)-methyl (4-(4-trans-propylcyclo-
hexyl)-3-methyl)-phenyl ether
(4-trans-nonylcyclohexyl)-methyl (4-(4-trans-nonylcyclo-
hexyl)-2-methyl)-phenyl ether
30 (4-trans-nonylcyclohexyl)-methyl (4-(4-trans-nonylcyclo-
hexyl)-3-methyl)-phenyl ether
1,4-bis-(2-(4-trans-propylcyclohexyl)-ethyl)-2-methyl-
benzene
1,4-bis-(2-(4-trans-nonylcyclohexyl)-ethyl)-2-methyl-
35 benzene
1-(2-(4-trans-nonylcyclohexyl)-ethyl)-4-(2-(4-trans-propyl-
cyclohexyl)-ethyl)-2-methyl-benzene
1-(2-(4-trans-nonylcyclohexyl)-ethyl)-4-(2-(4-trans-propyl-

- cyclohexyl)-ethyl-3-methyl-benzene
1,4-bis-(2-(4-trans-propylcyclohexyl)-ethyl)-2,3-dimethyl-benzene
1,4-bis-(2-(4-trans-nonylcyclohexyl)-ethyl)-2,3-dimethyl-benzene
5 1-(2-(4-trans-nonylcyclohexyl)-ethyl)-4-(2-(4-trans-propylcyclohexyl)-ethyl)-2,3-dimethyl-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-methyl-4-pentyl-benzene
10 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-3-methyl-4-pentyl-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4-butoxy-2-methyl-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4-butoxy-3-methyl-benzene
15 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4-N-butylamino-2-methyl-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4-N-butylamino-3-methyl-benzene
20 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-methyl-4-octanoyloxy-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-3-methyl-4-octanoyloxy-benzene
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2-methyl-4-pentylphenyl)-ethane
25 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3-methyl-4-pentylphenyl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4-butoxy-2-methylphenyl)-ethane
30 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4-butoxy-3-methylphenyl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4-N-butylamino-2-methylphenyl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4-N-butylamino-3-methylphenyl)-ethane
35 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2-methyl-4-octanoyloxyphenyl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3-methyl-4-



- octa-noyloxyphenyl)-ethane
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2-methyl-4-pentyl)-phenyl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (3-methyl-4-pentyl)-phenyl ether
5 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2-methyl-4-octanoyloxy)-phenyl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (3-methyl-4-octanoyloxy)-phenyl ether
10 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4-butoxy-2-methyl)-phenyl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4-butoxy-3-methyl)-phenyl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4-N-butyl-amino-2-methyl)-phenyl ether
15 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4-N-butyl-amino-3-methyl)-phenyl ether
5-(4-(4-trans-pentylcyclohexyl)-2-methylphenyl)-2-heptyl-pyrimidine
20 5-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-2-heptyl-pyrimidine
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2-(4-(4-trans-pentylcyclohexyl)-3-methylphenyl)-5-heptyl-pyrimidine
25 pyrimidine, C 58 N
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- 2-propyl-pyrimidine
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2-(4-(4-trans-nonylcyclohexylmethoxy)-2-methylphenyl)-



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5-butoxy-pyrimidine
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 $\Delta n = 0.16$
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3-methyl-biphenyl
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4-(4-trans-nonylcyclohexyl)-4'-(4-trans-propylcyclohexyl)-
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4-(4-trans-nonylcyclohexyl)-4'-(4-trans-propylcyclohexyl)-
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4-(4-trans-nonylcyclohexyl)-4'-(4-trans-propylcyclohexyl)-
2,3'-dimethyl-biphenyl
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3,3'-dimethyl-biphenyl
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methyl-biphenyl
4,4'-bis-(2-4-trans-propylcyclohexyl)-ethyl)-3,3'-dimethyl-
biphenyl

- 4,4'-bis-(2-(4-trans-nonylcyclohexyl)-ethyl)-2,3'-dimethyl-biphenyl
- 4,4'-bis-(2-(4-trans-nonylcyclohexyl)-ethyl)-3,3'-dimethyl-biphenyl
- 5 4-(2-(4-trans-nonylcyclohexyl)-ethyl)-4'-(2-(4-trans-propyl-cyclohexyl)-ethyl)-2,3'-dimethyl-biphenyl
- 4-(2-(4-trans-nonylcyclohexyl)-ethyl)-4'-(2-(4-trans-propyl-cyclohexyl)-ethyl)-2',3-dimethyl-biphenyl
- 4-(2-(4-trans-nonylcyclohexyl)-ethyl)-4'-(2-(4-trans-propyl-cyclohexyl)-ethyl)-3,3'-dimethyl-biphenyl
- 10 4,4'-bis-(4-trans-propylcyclohexylmethoxy)-2,3'-dimethyl-biphenyl
- 4,4'-bis-(4-trans-propylcyclohexylmethoxy)-3,3'-dimethyl-biphenyl
- 15 4,4'-bis-(4-trans-nonylcyclohexylmethoxy)-2,3'-dimethyl-biphenyl
- 4,4'-bis-(4-trans-nonylcyclohexylmethoxy)-3,3'-dimethyl-biphenyl
- 4-(4-trans-nonylcyclohexylmethoxy)-4'-(4-trans-propylcyclohexylmethoxy)-2,3'-dimethyl-biphenyl
- 20 4-(4-trans-nonylcyclohexylmethoxy)-4'-(4-trans-propylcyclohexylmethoxy)-2',3-dimethyl-biphenyl
- 4-(4-trans-nonylcyclohexylmethoxy)-4'-(4-trans-propylcyclohexylmethoxy)-3,3'-dimethyl-biphenyl
- 25 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2,3'-dimethyl-4'-pentyl-biphenyl
- 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2',3-dimethyl-4'-pentyl-biphenyl
- 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-3,3'-dimethyl-4'-pentyl-biphenyl (sic)
- 30 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-butoxy-2,3'-dimethyl-biphenyl (sic)
- 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-butoxy-2',3-dimethyl-biphenyl (sic)
- 35 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-butoxy-3,3'-dimethyl-biphenyl
- 4-(4-trans-pentyl-trans-bicyclohex-4-yl)-4'-N-butylamino-2,3'-dimethyl-biphenyl

- 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-N-butylamino-2',3'-dimethyl-biphenyl
4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-N-butylamino-3,3'-dimethyl-biphenyl
5 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2,3'-dimethyl-4'-octanoyloxy-biphenyl
4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2',3'-dimethyl-4'-octanoyloxy-biphenyl
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4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-methyl-4'-pentyl-biphenyl
4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-3-methyl-4'-pentyl-biphenyl
15 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-methyl-4'-octa noyloxy-biphenyl
4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-3-methyl-4'-octa-noyloxy-biphenyl
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25 4-(4'-trans-pentyl-trans-bicyclohex-4-yl)-4'-N-butyloxy-3-methyl-biphenyl
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2-methyl-4'-pentylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3-methyl-4'-30 pentylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2,3'-dimethyl-4'-pentylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2',3'-dimethyl-4'-pentylbiphenyl-4-yl)-ethane
35 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3,3'-dimethyl-4'-pentylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butoxy-2-methylbiphenyl-4-yl)-ethane

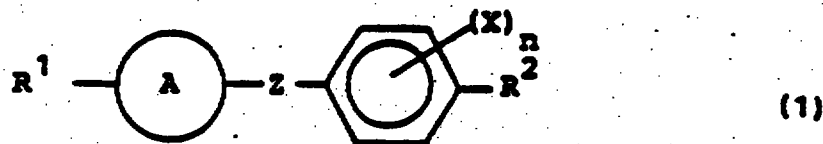
- 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-butoxy-3-methylbiphenyl-4-yl)-ethane
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5 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-butoxy-2',3-dimethylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-butoxy-3,3'-dimethylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butyl-10 amino-2-methylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butyl-amino-3-methylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butyl-amino-2,3'-dimethylbiphenyl-4-yl)-ethane
15 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butylamino-2',3-dimethylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(4'-N-butyl-amino-3,3'-dimethylbiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2-methyl-4'-20 octanoyloxybiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3-methyl-4'-octanoyloxybiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2,3'-dimethyl-4'-octanoyloxybiphenyl-4-yl)-ethane
25 1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(2',3-dimethyl-4'-octanoyloxybiphenyl-4-yl)-ethane
1-(4'-trans-pentyl-trans-bicyclohex-4-yl)-2-(3,3'-dimethyl-4'-octanoyloxybiphenyl-4-yl)-ethane
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2-methyl-30 4'-pentyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (3-methyl-4'-pentyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2,3'-dimethyl-4'-pentyl)-biphenyl-4-yl ether
35 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2',3-dimethyl-4'-pentyl)-biphenyl-4-yl ether
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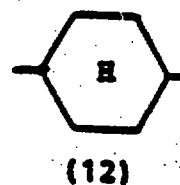
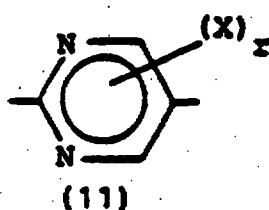
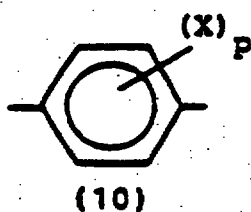
- (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-butoxy-2-methyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-butoxy-3-methyl)-biphenyl-4-yl ether
5 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-butoxy-2,3'-dimethyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-butoxy-2',3-dimethyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-butoxy-3,3'-dimethyl)-biphenyl-4-yl ether
10 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-N-butyl-amino-2-methyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-N-butyl-amino-3-methyl)-biphenyl-4-yl ether
15 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-N-butyl-amino-2,3'-dimethyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-N-butyl-amino-2',3-dimethyl)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (4'-N-butyl-amino-3,3'-dimethyl)-biphenyl-4-yl ether
20 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2-methyl-4'-octanoyloxy)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (3-methyl-4'-octanoyloxy)-biphenyl-4-yl ether
25 (4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2,3'-dimethyl-4'-octanoyloxy)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (2',3-dimethyl-4'-octanoyloxy)-biphenyl-4-yl ether
(4'-trans-pentyl-trans-bicyclohex-4-yl)-methyl (3,3'-dimethyl-4'-octanoyloxy)-biphenyl-4-yl ether.
30

Patent claims:

1. Liquid-crystal mixture containing at least one anisotropic compound, having a nematic phase, of the formula (1)



in which A is a cyclic radical according to one of the formulae (10) to (12)



Z is a single bond or the $-\text{CH}_2\text{CH}_2-$ group,

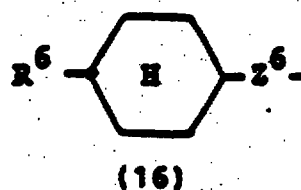
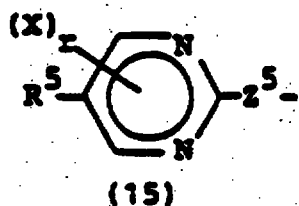
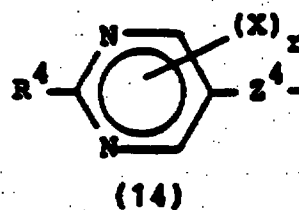
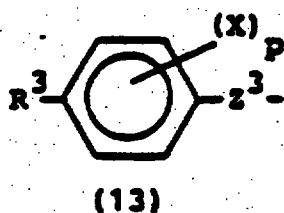
n is 1 or 2,

p is 0, 1 or 2,

r is 0 or 1,

X is the fluorine, chlorine, bromine or iodine atom or a nitrile or methyl group, and

R^1 and R^2 are alkyl, alkoxy, or alkanoyloxy groups in each case having 1 to 12 C atoms in the alkyl part, where the alkyl part is straight-chain or branched and optionally chiral, or cyclic groups of the formulae (13) to (16)



in which R^3 to R^6 are an alkyl, alkoxy or alkanoyloxy group in each case having 1 to 12 C atoms in the alkyl part,

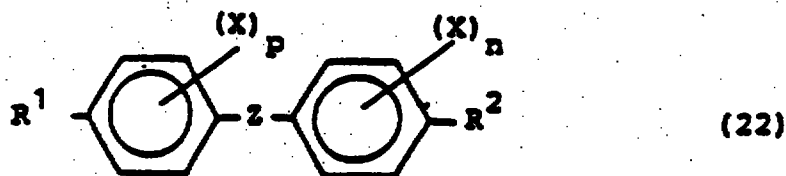


where the alkyl part is straight-chain or branched and optionally chiral, Z^2 to Z^6 have one of the meanings specified for Z, and X, p and r have the abovementioned meaning, with the proviso that at least one X in the molecule of the formula (1) is methyl when

(A) one or both of groups R^1 and R^2 is a cyclic radical of the formula (16), at the same time A has the formula (10) and the bridging members Z and Z^6 are a single bond, and/or

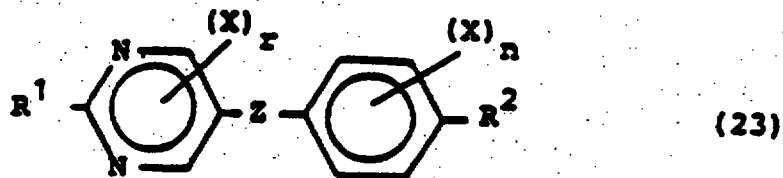
(B) only one or none of the groups R^1 and R^2 is a cyclic radical of the formulae (sic) (13) or (16), at the same time A has the formula (12) and the bridging member Z and the bridging member Z^3 or Z^6 which is optionally present is a single bond.

2. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (22)



in which R^1 , R^2 , X, Z, p and n have the meaning specified in Claim 1.

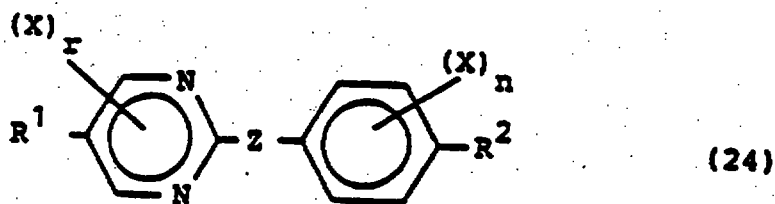
3. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (23)



in which R^1 , R^2 , X, Z, n and r have the meaning specified in Claim 1.

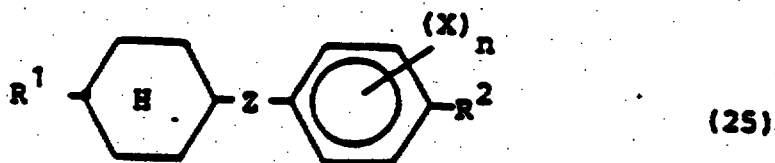
4. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (24)





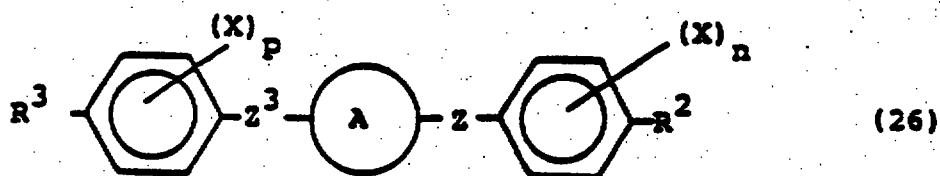
in which R^1 , R^2 , X , Z , r and n have the meaning specified in Claim 1.

5. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (25)



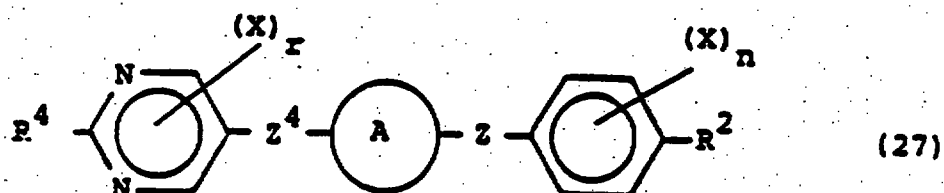
in which R^1 , R^2 , Z , X and n have the meaning specified in Claim 1.

6. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (26)



in which R^1 , R^3 , Z , Z^3 , A , X , p and n have the meaning specified in Claim 1.

7. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (27)

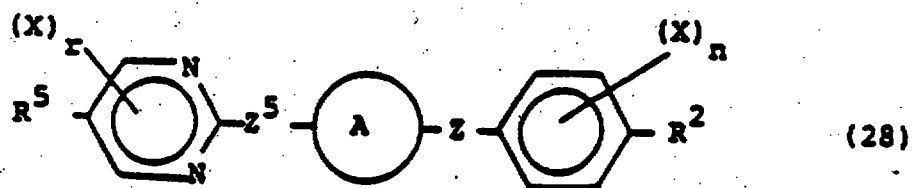


in which R^2 , R^4 , Z , Z^4 , A , X , n and r have the meaning specified in Claim 1.

8. Liquid-crystal mixture according to Claim 1,

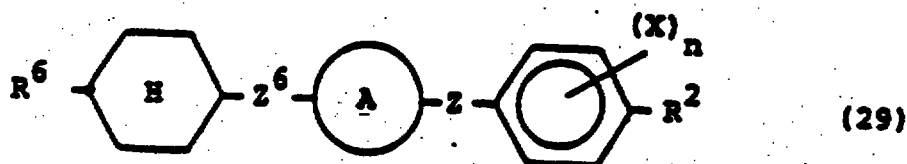


characterized in that it contains a compound of the formula (28)



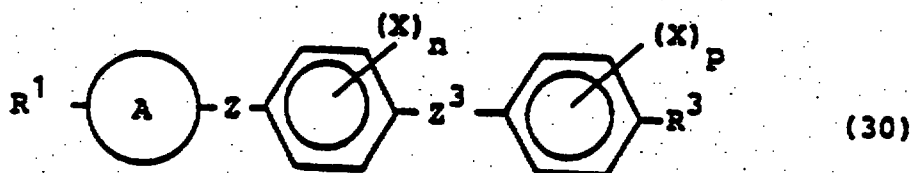
in which R^2 , R^5 , Z , Z^5 , A , X , n and r have the meaning specified in Claim 1.

9. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (29)



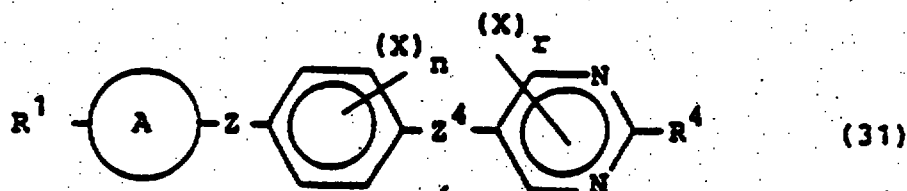
in which R^2 , R^6 , Z , Z^6 , A , X and n have the meaning specified in Claim 1.

10. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (30)



in which R^1 , R^3 , Z , Z^3 , A , X , n and p have the meaning specified in Claim 1.

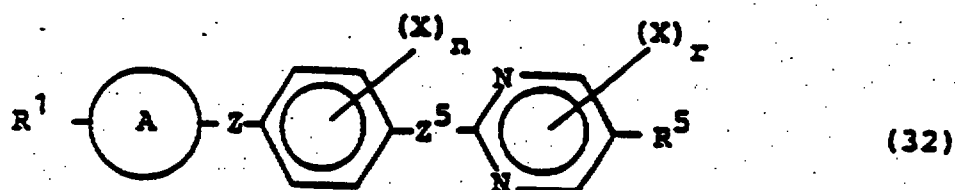
11. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (31)



in which R^1 , R^4 , Z , Z^4 , A , X , n and r have the meaning specified in Claim 1.

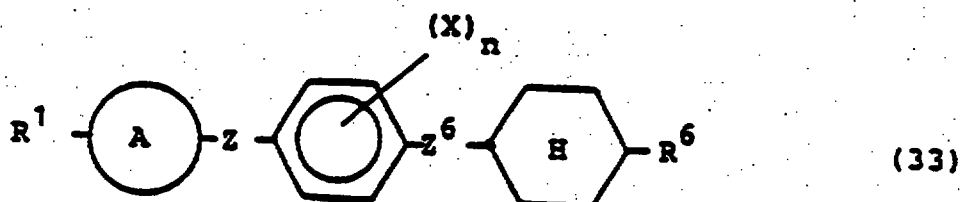


12. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (32)



in which R^1 , R^5 , Z , Z^5 , A , X , n and r have the meaning specified in Claim 1.

13. Liquid-crystal mixture according to Claim 1, characterized in that it contains a compound of the formula (33)



in which R^1 , R^6 , Z , Z^6 , A , X and n have the meaning specified in Claim 1.

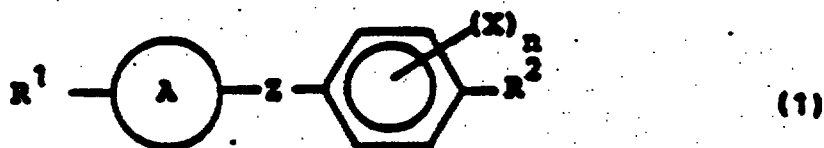
14. Liquid-crystal mixture according to any one of Claims 1 - 13, characterized in that X is the methyl group.

15. Liquid-crystal mixture according to any one of Claims 1 - 13, characterized in that X is fluorine, chlorine, bromine or iodine.

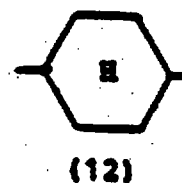
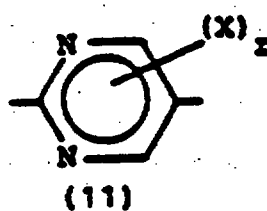
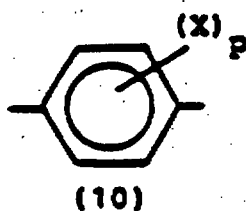


**Claims** (as printed)

1. A liquid crystal mixture containing at least one anisotropic compound having a nematic phase having the formula (1)



wherein A is a cyclic radical according to one of the formulae (10) to (12)



Z is a single bond or a -CH₂CH₂-group,

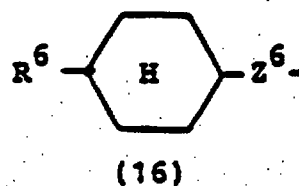
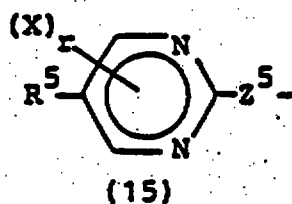
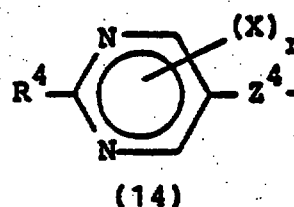
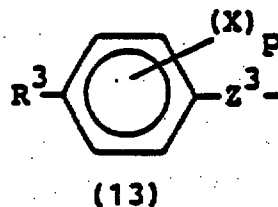
n is 1 or 2,

p is 0, 1, or 2,

r is 0 or 1,

X is fluorine, chlorine, bromine, iodine, nitrile or methyl,

R¹ and R² are alkyl, alkoxy or alkanoyloxy each having 1 to 12 carbon atoms in the alkyl moiety the alkyl moiety being straight chain or branched and optionally chiral, or are cyclic groups of the formulae (13) to (16)



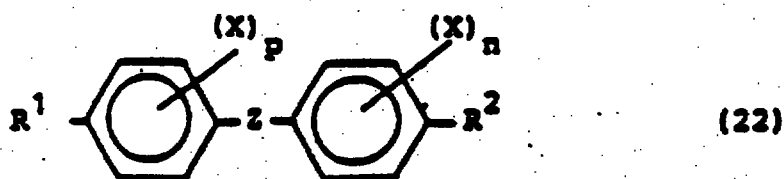
wherein R³ through R⁶ are alkyl, alkoxy or alkanoyloxy each having 1 to 12 carbon atoms in the alkyl moiety, the alkyl moiety being straight chain or branched and optionally chiral Z² to Z⁶ have one of the meanings given for Z, and X, p and r have the meanings given above, with the proviso that at least one X in the molecule of formula (1) is methyl when

(A) one or none of the groups R¹ and R² is a cyclic radical of the formula (16) A has the formula (10) and the bridging groups Z and Z⁶ are a single bond and/or

(B) only one or none of the groups R¹ and R² is a cyclic radical of the formula (13) or (16), whereby A has the formula (12) and the bridging group Z and the optionally existing bridging group Z³ or Z⁶ are a single bond

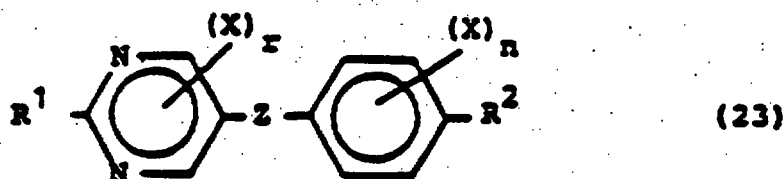
2. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (22)





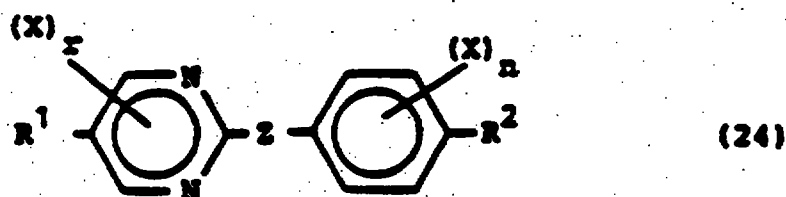
wherein R¹, R², X, Z, p and n have the meanings given in Claim 1.

3. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (23)



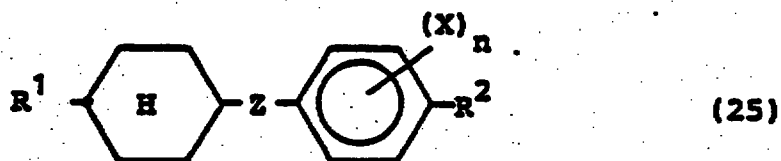
wherein R¹, R², X, Z, n and r have the meanings given in Claim 1.

4. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (24)



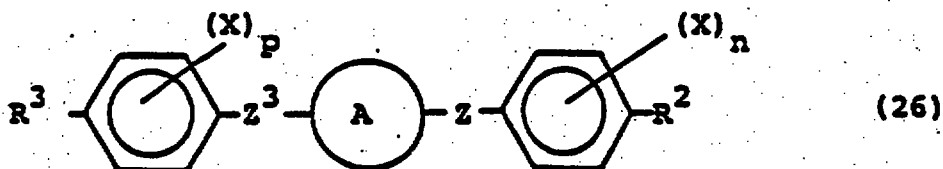
wherein R¹, R², X, Z, r and n have the meanings given in Claim 1.

5. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (25)



wherein R¹, R², Z, X and n have the meanings given in Claim 1.

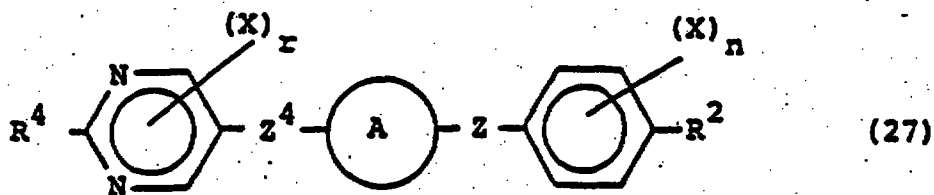
6. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (26)



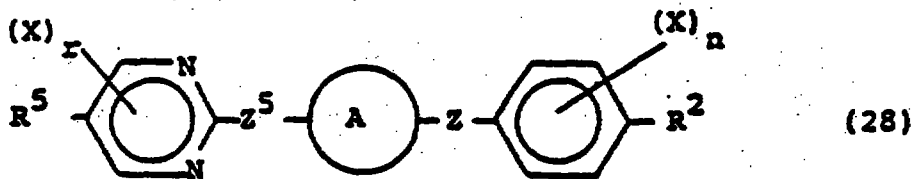
wherein R², R³, Z, Z³, A, X, p and n have the meanings given in Claim 1.

7. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (27)

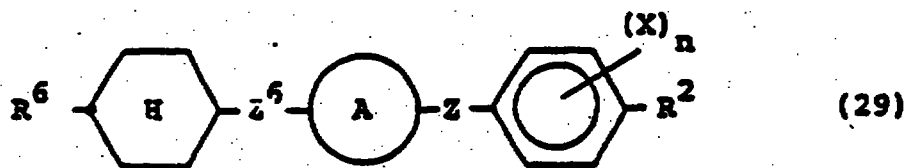




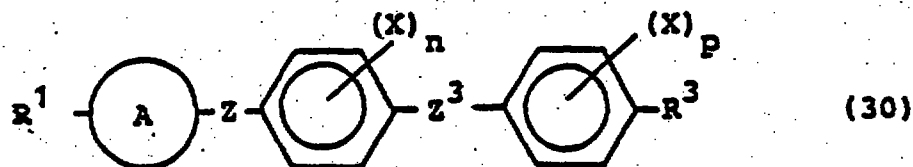
wherein R^1 , R^4 , Z , Z^4 , A , X , n and r have the meanings given in Claim 1.
 8. A liquid crystal mixture according to Claim 1 characterised in that it contains a compounds having the formula (28)



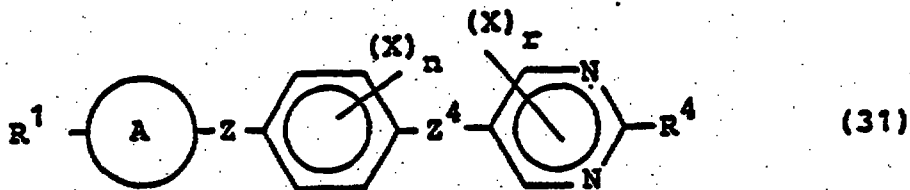
wherein R^2 , R^5 , Z , Z^5 , A , X , n and r have the meanings given in Claim 1.
 9. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (29)



wherein R^2 , R^6 , Z , Z^6 , A , X and n have the meanings given in Claim 1.
 10. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (30)

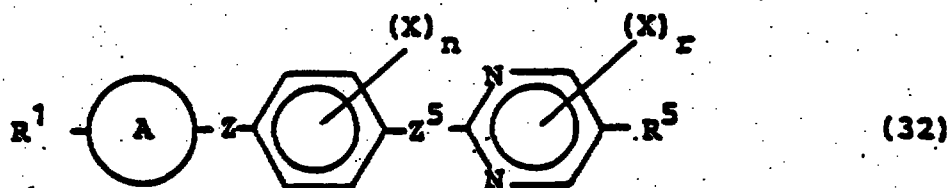


wherein R^1 , R^3 , Z , Z^3 , A , X , n and p have the meanings given in Claim 1.
 11. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (31)



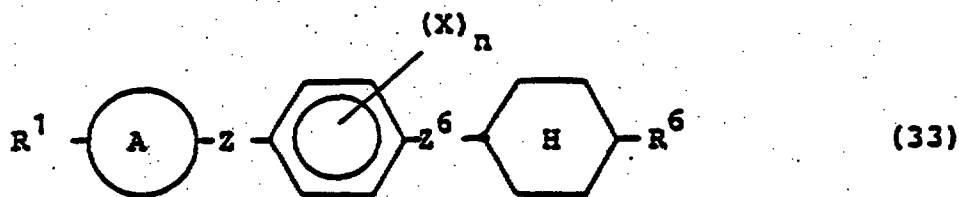
wherein R^1 , R^4 , Z , Z^4 , A , X , n and r have the menings given in Claim 1.
 12. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (32)





wherein R^1 , R^5 , Z , Z^5 , A , X , n and r have the meanings given in Claim 1.

13. A liquid crystal mixture according to Claim 1 characterised in that it contains a compound having the formula (33)



wherein R^1 , R^6 , Z , Z^6 , A , X and n have the meanings given in Claim 1.

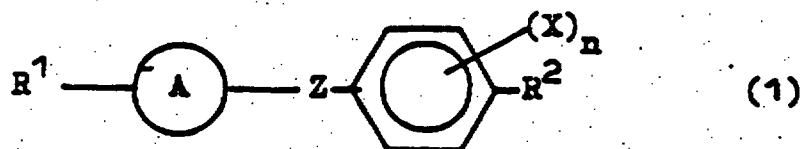
14. A liquid crystal mixture according to one of the Claims 1 - 13, characterised in that X is a methyl group.

15. A liquid crystal mixture according to one of the Claims 1 - 13, characterised in that X is fluorine, chlorine, bromine or iodine.

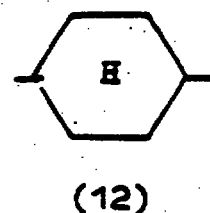
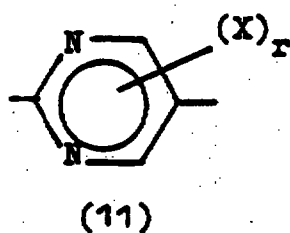
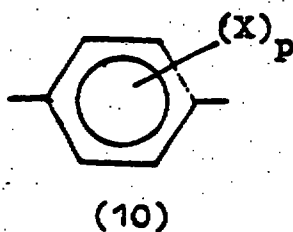


Revendications (as printed)

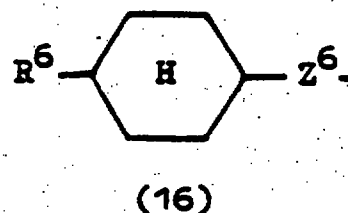
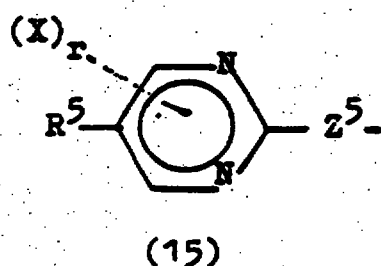
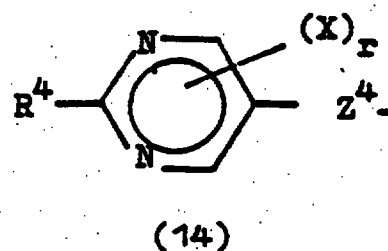
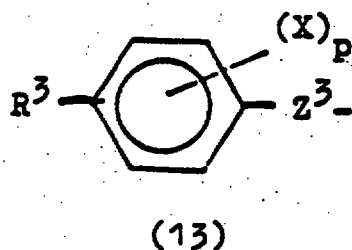
1 - Mélange à cristaux liquides, contenant au moins un composé anisotrope à phase nématique de formule 1



dans laquelle A représente un reste cyclique répondant à l'une des formules 10 à 12



Z représente une liaison simple ou le groupe $-\text{CH}_2\text{CH}_2-$, n est égal à 1 ou 2, p est égal à 0, 1 ou 2, r est égal à 0 ou 1, X représente un atome de fluor, de chlore, de brome ou d'iode ou un groupe nitrilo ou méthyle, R¹ et R² représentent des groupes alkyle, alcoxy ou alcanoyloxy contenant chacun 1 à 12 atomes de carbone dans la partie alkyle qui est à chaîne droite ou ramifiée et éventuellement chirale, ou des groupes cycliques de formules 13 à 16



dans lesquelles R³ à R⁶ représentent des groupes alkyle alcoxy ou alcanoyloxy contenant chacun 1 à 12 atomes de carbone dans la partie alkyle qui est à chaîne droite ou ramifiée et éventuellement chirale, Z³ à Z⁶ ont l'une des



significations indiquées pour Z et X, p et r ont les significations indiquées ci-dessus, avec la condition supplémentaire qu'au moins un symbole X de la molécule de formule 1 représenté un groupe méthyle lorsque (A) l'un des groupes R¹, R² ou les deux représentent un reste cyclique de formule 16, A ayant alors la formule 10 et les ponts Z et Z⁶ consistant en liaisons simples,

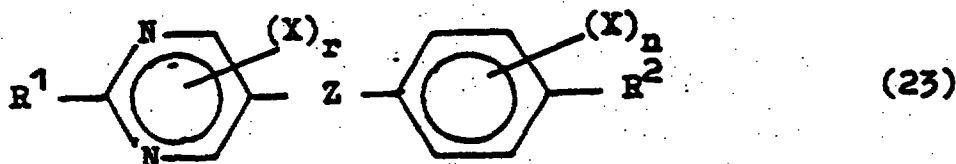
et/ou (B) un seul des symboles R¹, R² ou aucun de ces symboles ne représente un reste cyclique de formule 13 ou 16, A ayant alors la formule 12 et le pont Z ainsi que le pont Z³ ou Z⁶ éventuellement présent consistant en une liaison simple.

2 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule 22



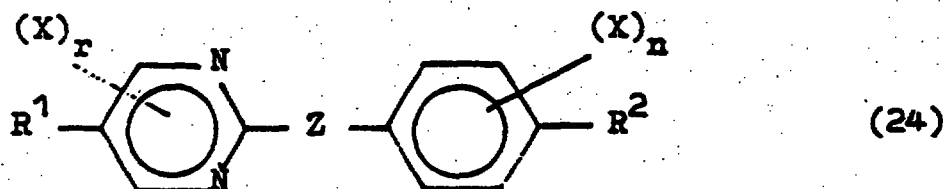
dans laquelle R¹, R², X, Z, p et n ont les significations indiquées dans la revendication 1.

3 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



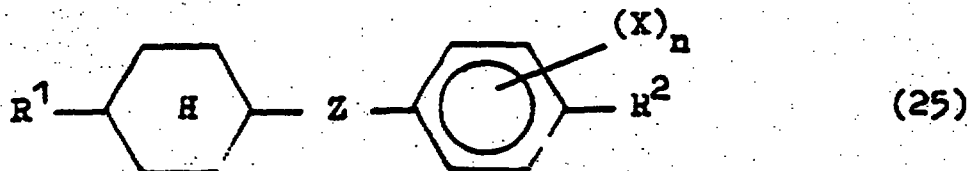
dans laquelle R¹, R², X, Z, n et r ont les significations indiquées dans la revendication 1.

4 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



dans laquelle R¹, R², X, Z, r et n ont les significations indiquées dans la revendication 1.

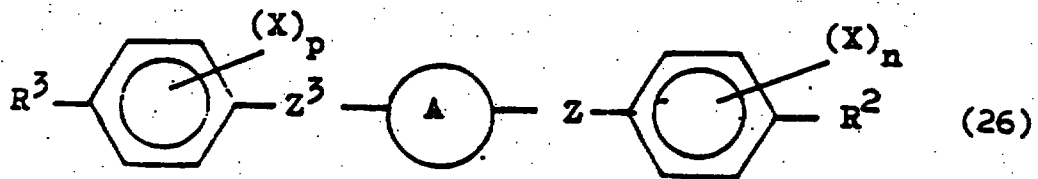
5 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



dans laquelle R¹, R², Z, X et n ont les significations indiquées dans la revendication 1.

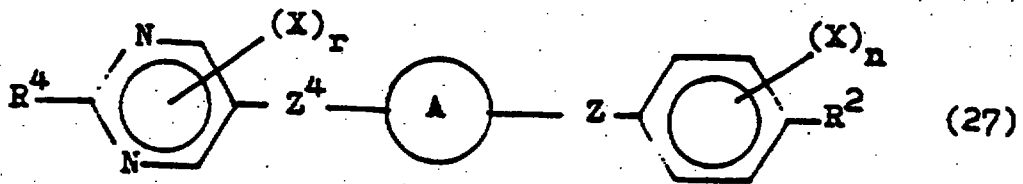
6 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule





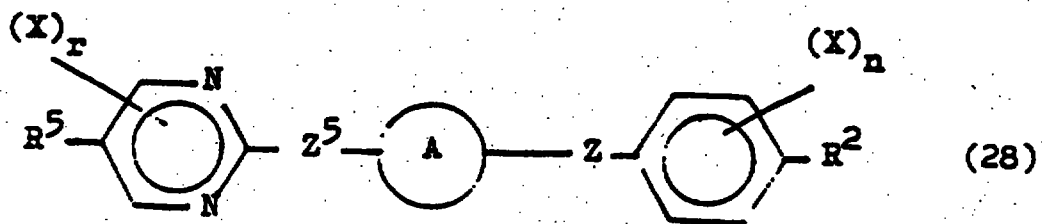
dans laquelle R², R³, Z, Z³, A, X, p et n ont les significations indiquées dans la revendication 1.

7 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



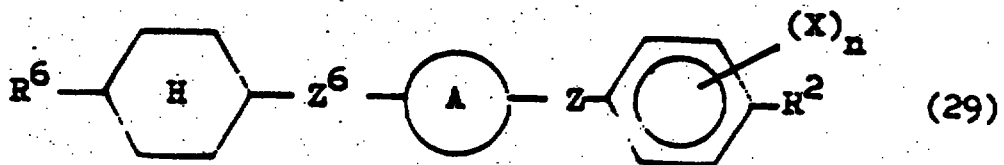
dans laquelle R², R⁴, Z, Z⁴, A, X, n et r ont les significations indiquées dans la revendication 1.

8 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



dans laquelle R², R⁵, Z, Z⁵, A, X, n et r ont les significations indiquées dans la revendication 1.

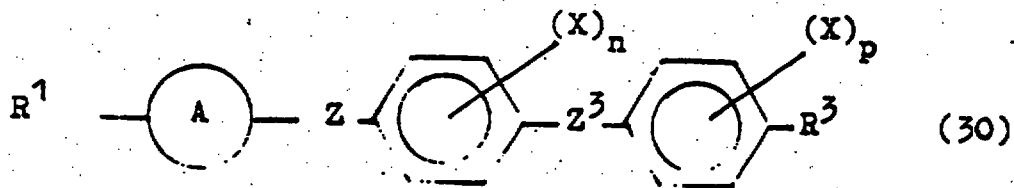
9 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule



dans laquelle R², R⁶, Z, Z⁶, A, X et n ont les significations indiquées dans la revendication 1.

10 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule

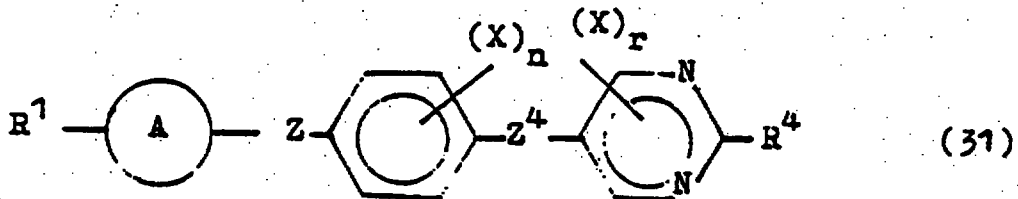




dans laquelle R^1 , R^3 , Z , Z^3 , A , X , n et p ont les significations indiquées dans la revendication 1.

11 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule

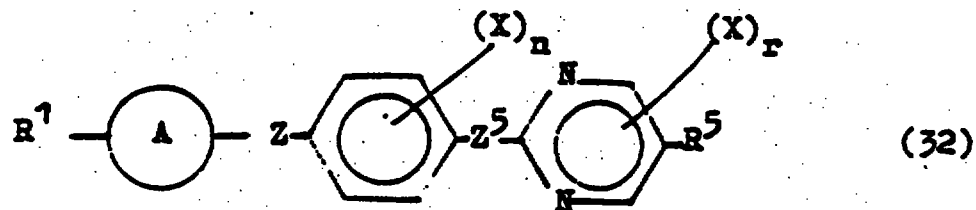
31



dans laquelle R^1 , R^4 , Z , Z^4 , A , X , n et r ont les significations indiquées dans la revendication 1.

12 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule

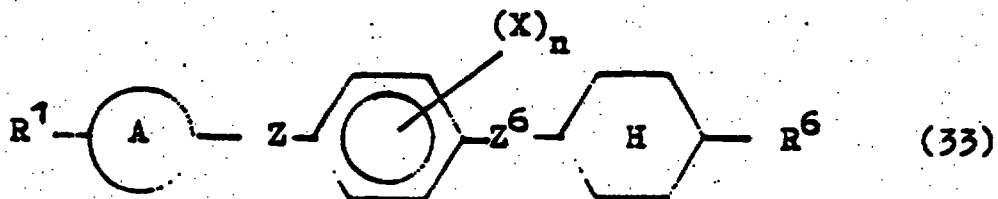
32



dans laquelle R^1 , R^5 , Z , Z^5 , A , X , n et r ont les significations indiquées dans la revendication 1.

13 - Mélange à cristaux liquides selon la revendication 1, caractérisé en ce qu'il contient un composé de formule

33



dans laquelle R^1 , R^6 , Z , Z^6 , A , X et n ont les significations indiquées dans la revendication 1.

14 - Mélange à cristaux liquides selon l'une des revendications 1 à 13, caractérisé en ce que X représente le groupe méthyle.

15 - Mélange à cristaux liquides selon l'une des revendications 1 à 13, caractérisé en ce que X représente le fluor, le chlore, le brome ou l'iode.

