

Publication in the Official Journal ~~Yes~~ / No

File Number: T 278/91 - 3.3.1

Application No.: 84 111 965.4

Publication No.: 0 136 725

Title of invention: Ferroelectric chiral smectic liquid crystal composition
and light switching element

Classification: C09K 19/02

D E C I S I O N
of 28 July 1992

Proprietor of the patent: Chisso Corporation
Hitachi Ltd

Opponent: 01 N.V. Philips' Gloeilampenfabrieken
02 BSG Technische Beratungs- Gesellschaft mbH
03 The Secretary of State for Defence in
Her Britannic Majesty's Government of the United
Kingdom of Great Britain and Northern Ireland

Headword:

EPC Article 54

Keyword: "Novelty (denied) - construction of prior art document, identical
technical teaching"



Case Number : T 278/91 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 28 July 1992

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Decision under appeal :

Decision of Opposition Division of the European
Patent Office of 14 January 1991, with written
reasons posted on 4 February 1991, revoking
European patent No. 0 136 725 pursuant to
Article 102(1) EPC.

Composition of the Board :

Chairman : R.W. Andrews
Members : R.K. Spangenberg
 W. Moser

Summary of Facts and Submissions

- I. European patent No. 0 136 725 in respect of European patent application No. 84 111 965.4, which was filed on 5 October 1984, was granted on 19 October 1988 (cf. Bulletin 88/42).

- II. Notices of oppositions, which were filed on 3 July 1989, 14 July 1989 and 17 July 1989 (by a duly confirmed telefax), requested the revocation of the patent on the grounds that its subject-matter lacked novelty and did not involve an inventive step. The oppositions were supported, inter alia, by the following document

(5) Ferroelectrics, Volume 49, pages 275 to 284, 1983.

- III. By a decision delivered orally on 14 January 1991, with written reasons being issued on 4 February 1991, the Opposition Division revoked the patent. The Opposition Division held that the subject-matter claimed in accordance with the main and auxiliary requests was novel but that it did not involve an inventive step. The Opposition Division considered that the alleged invention was obvious since it was known that, in order to use the chiral smectic C phase in a light switching means, the helical pitch has to be of the same magnitude as the cell gap and that the helical pitch length of the phase may be controlled by mixing materials of opposite twist directions.

- IV. An appeal was lodged against this decision on 4 April 1991 with payment of the prescribed fee. In their statement of grounds of appeal filed on 12 June 1991 and during oral proceedings held on 28 July 1992, the Appellants (Proprietors of the patent) contended that the claimed ferroelectric liquid crystal composition not only has to

have a long helical pitch but also a large spontaneous electric polarisation, smectic phases which are stable not only within a large temperature range but also at low temperatures and good chemical stability and physical stability against light. With respect to this latter aspect, the Appellants referred to Table 9 on page 52 of EP-A-0 110 299 which demonstrated that a compound in accordance with the present formula 1 was more optically stable than the known 2-methylbutyl p-decyloxybenzylidene-p'-aminocinnamate (cf. documents (1) and (2)). The Appellants argued that the solution of providing liquid crystal compositions having this combination of properties could not be deduced from the cited prior art since, according to "Chemie in Unserer Zeit", 1984, pages 168 to 176, it was very difficult to predict the liquid crystal phase character and the usefulness of compounds as liquid crystal phases even for compounds which differ very little structurally.

With respect to document (5), the Appellants admitted that the liquid crystals of the general formulae on page 282 fell within the scope of the present general formula I. However, the Appellants maintained that the disclosure in the paragraph bridging pages 281 and 283 would not lead the skilled person to the specific compositions now claimed or allow the skilled person to make any deductions with respect to the stability of the Sc (chiral smectic C phase) over a wide temperature range. Moreover, in the Appellants' opinion, the first complete paragraph on page 281 had to be construed as referring not only to the compounds disclosed in these documents but compounds of different structures such as those disclosed in the other cited documents. The Appellants also argued that document (5) made no mention of the fact that compounds having helices of the opposite twist must not form a racemate.

V. Respondent 2 (Opponent 2) maintained that the subject-matter of the present Claim 1 lacked novelty with respect to document (5). He also argued that the first complete paragraph on page 281 of this document implicitly disclosed that the compounds mixed to provide a ferroelectric phase of infinite pitch were not racemates and that the Appellants' construction of the paragraph bridging pages 281 and 283 was incorrect.

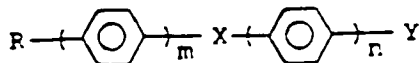
Respondent 3 (Opponent 3) considered that document (5) disclosed a teaching which the skilled person was invited to follow, and, if he did follow it he would arrive at the subject-matter of Claim 1.

In accordance with his letter filed on 5 May 1992, Respondent 1 (Opponent 1) was not represented at the oral proceedings.

VI. The Appellants requested that the decision under appeal be set aside and that the patent be maintained on the basis of Claims 1 to 5 and on amended description submitted during oral proceedings in accordance with either their main or auxiliary request.

Claim 1 of the main request reads as follows:

"1. A ferroelectric chiral smectic liquid crystal composition consisting of at least one chiral smectic liquid crystal compound having a twist sense of helix right-handed, not forming a racemate and expressed by the general formula



wherein m and n each independently are an integer of 1 or 2;

X is $\overset{\text{O}}{\parallel}\text{-C-O-}$, -CH=N- , $\text{-CH}_2\text{O-}$, $\text{-O-}\overset{\text{O}}{\parallel}\text{C-}$, -N=CH- , $\text{-OCH}_2\text{-}$, or a single bond; R is an alkyl or alkoxy group of 1-18 carbon atoms; and Y is an alkyl, alkoxy, alkoxy-carbonyl, alkanoyl or alkanoyloxy group, each having an asymmetric carbon atom, and at least one chiral smectic liquid crystal compound having a twist sense of helix left-handed, not forming a racemate and expressed by the general formula (I).

Claims 1 to 4 of the auxiliary request are identical with Claims 1 to 4 of the main request. Claim 5 of the main request relates to a light switching element comprising at least one chiral smectic liquid crystal compound having a twist sense of helix right-handed and at least one chiral smectic liquid crystal compound having a twist sense of helix left-handed; and not forming a racemate. Claim 5 of the auxiliary request differs from that of the main request in that the ferroelectric chiral smectic liquid crystal composition is defined as being in accordance with Claims 1 to 4.

The Respondents requested that the appeal be dismissed.

VII. At the conclusion of the oral proceedings, the Board's decision to dismiss the appeal was announced.

Reasons for the Decision

1. The appeal is admissible.
2. There are no objections under Article 123 EPC to either versions of the claims. In particular, Claim 1 of both requests represents a combination of Claims 1 and 2 as

filed and granted apart from the replacement of the term "comprising" by the expression "consisting of". This amendment was necessary to restrict the scope of the claim to ferroelectric chiral smectic liquid crystal compositions containing only compounds of the general formula (I).

Claims 2 to 4 of both requests correspond to Claims 3 to 5 as filed and granted. Claim 5 of both requests is based on Claim 6 as filed and granted in combination with page 3, line 12 to page 4, line 17 of the patent application as filed (cf. also page 2, lines 33 to 49 of the printed patent specification).

3. Claim 1 in accordance with the main and auxiliary requests is directed to a ferroelectric chiral smectic liquid crystal composition consisting of compounds of the general formula (I) wherein at least one of said compounds has a right-handed helical pitch sense and at least one of them has a left-handed helical pitch sense, with the proviso that the two compounds of opposite twist sense do not form a racemate.

3.1 In the Board's opinion the essential issue to be decided in this appeal is whether the subject-matter of Claim 1 in accordance with both requests is novel having regard to the disclosure of document (5).

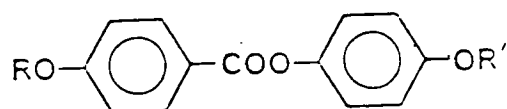
In accordance with the established jurisprudence of the Boards of Appeal (cf. Decisions T 124/87 "Copolymers/DUPONT", OJ EPO 1989, 491, paragraph 3.2; T 12/81 "Diastereomers", OJ EPO 1982, 296, paragraph 5; T 198/84 "Thiochloroformates", OJ EPO 1985, 209, paragraph 4; T 666/89 "Washing Composition/UNILEVER", Headnote published OJ EPO 6/1992; and T 12/90, [1991] EPOR 312, paragraphs 2.6 and 2.7), in order to decide this

question it is necessary to consider whether the disclosure of document (5) is such as to make the compositions claimed in accordance with both requests available as a technical teaching to the skilled person.

3.2 Therefore, it is necessary to determine the nature and the extent of the information actually imparted to the skilled person by this document as distinct from its literal disclosure.

3.3 According to this article smectic systems are characterised by tilted arrangement of the molecules and by the material being optically active (cf. second paragraph of the introduction on page 275). In order to satisfy the fundamental definition of ferroelectricity, it is necessary for the polar chiral molecule to have a spontaneous polarisation parallel to the two-fold axis of rotation and for the molecules to be able to reorientate themselves in response to an applied field (cf. page 276, lines 17 to 22).

3.4 After discussing the various smectic phase types, the author indicates that tilted smectic phases are generally exhibited by compounds having a mixed aromatic-aliphatic structure of the general formula



in which the functional groups give rise to a lateral dipole moment across the molecular long axis and in which the alkyl chains need to be of at least 7 carbon atoms long in order to obtain tilted phases (cf. first paragraph under the heading "Material Design" on page 280). To obtain an optically active phase it is usual to position a chiral centre in one of the terminal chains. 4-Decyloxy-

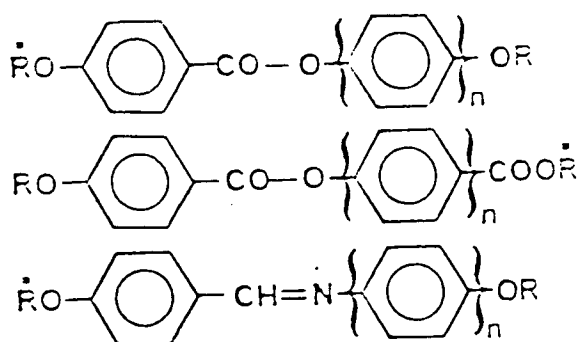
phenyl 4-(4-methylhexyloxy)benzoate is given as an example of such a compound (cf. second paragraph under the above-mentioned heading).

3.5 In the paragraph bridging pages 280 and 281, it is disclosed that the closer the branch is to the core the greater the coupling is to the delocalised electrons of the core and, due to the reduced rotational freedom of the branch with respect to the rest of the molecule, the greater is the polarisation. On the other hand, the pitch of the helix is increased as the chiral centre is moved away from the core.

3.6 The first complete paragraph on page 281, which is highly relevant, reads as follows:

"As the branch is moved along the terminal chain there is an odd-even effect producing an alternation of the helical sense of the phase. A ferroelectric phase of infinite pitch can be obtained by mixing a left hand helix material against a right hand one."

3.7 According to the paragraph headed "Material Synthesis" on page 281, ferroelectric smectic liquid crystals are usually prepared from S-(-)-2-methyl-1-butanol. Syntheses, using this compound as starting material, are illustrated in Figure 3 on page 282. This figure also discloses several methods by which the position of the chiral centre in the side chain may be varied (cf. also lines 5 to 9 of the above-mentioned paragraph on page 281). According to Figure 3, liquid crystals of the following general formula may be prepared



wherein R is an alkyl radical having at least 7 carbon atoms and R* is an alkyl radical containing a chiral centre.

3.8 Finally, the paragraph bridging pages 281 and 283 discloses that, if a material is not in its ferroelectric phase at room temperature, materials may be blended together to produce a low melting eutectic mixture. Since the liquid crystal transitions are relatively unaffected by this, a wider temperature range for the phase is obtained.

3.9 During the oral proceedings the Appellants conceded that there is no mention in document (5) of ferroelectric smectic liquid crystals other than those referred to on pages 280 and 282 and that the above-mentioned general formulae on page 282 fell entirely within the scope of the general formula (I) of the disputed patent. In the absence of any reference to ferroelectric smectic liquid crystals of any other type, the above-quoted paragraph on page 281 has to be construed as relating only to those compounds specifically referred to in the article and not to compounds of other structures such as DOBAMBC and HOBACDC (cf. JETP Letters, Volume 33 (10) pages 536 to 539, 1981; document (1)). Furthermore, since all the compounds generally disclosed in this document fall within the scope of the present general formula (I) any possibility of a selection from the disclosure of this document must be ruled out.

- 3.10 Therefore, in the Board's judgment, document (5) makes available to the public in the form of a clear technical teaching a ferroelectric chiral smectic liquid crystal composition consisting of compounds falling within the scope of the present general formula (I) wherein at least one of said compounds has a right-handed helical pitch sense and at least one of them has a left-handed helical pitch sense.
- 3.11 The only feature referred to in Claim 1 in accordance with the main and auxiliary requests not specifically mentioned in document (5) is the requirement that the two compounds having right-handed and left-handed helical pitch senses do not form a racemate. However, since the above-quoted paragraph on page 281 discloses mixtures consisting of compounds having opposite helical pitch sense in which the chiral centre is separated from the core by an odd and even number of carbon atoms, there can be no question of the compounds forming a racemate.
- 3.12 From the above it is clear that the technical teaching of Claim 1 in accordance with both the main and auxiliary requests is not distinguished from that of document (5). Therefore the skilled person reducing the technical teaching of document (5) to practice would automatically obtain a ferroelectric chiral smectic liquid crystal composition falling within the terms of Claim 1 of the main and auxiliary requests. Therefore, the subject-matter of these claims lacks novelty and both the requests must be refused.
4. In the light of the above finding, it is not necessary to consider the Appellants' arguments with respect to inventive step.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R.W. Andrews