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**Datasheet for the decision  
of 12 September 2017**

**Case Number:** T 2305/13 - 3.4.02

**Application Number:** 02769744.0

**Publication Number:** 1393122

**IPC:** G02F1/167, C09B67/00

**Language of the proceedings:** EN

**Title of invention:**  
ELECTROPHORETIC PARTICLES

**Applicant:**  
E Ink Corporation

**Relevant legal provisions:**  
EPC 1973 Art. 56

**Keyword:**  
Inventive step: yes (amended claims)



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Case Number: T 2305/13 - 3.4.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.02**  
**of 12 September 2017**

**Appellant:** E Ink Corporation  
(Applicant) 733 Concord Avenue  
Cambridge, MA 02138-1002 (US)

**Representative:** Hoffmann Eitle  
Patent- und Rechtsanwälte PartmbB  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted on 27 May 2013  
refusing European patent application No.  
02769744.0 pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chairman** R. Bekkering  
**Members:** F. J. Narganes-Quijano  
B. Müller

## Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 02769744.0.

In its decision the examining division held in respect of the set of claims then on file that

- independent claims 1, 7, 12 and 17 did not involve an inventive step (Article 56 EPC) in view of the disclosure of documents

D8 : JP-A-3 258 866 A, together with a full English language translation of the document, labelled document D8\*,

D9 : JP-A-3 249 738 A, together with a partial English language translation of the document, labelled document D9\*,

D10: US-A-5 914 806 A, and

D11: US-A-6 113 810 A,

and

- independent claims 1 and 7 were contrary to the requirements of conciseness set forth in Article 84 in combination with Rule 43(2) EPC.

II. With the statement setting out the grounds of appeal the appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the then pending claims.

III. In a communication annexed to a summons to oral proceedings the board introduced the following document into the procedure:

A1 : WO-A-00 67327 A.

IV. Oral proceedings were held on 12 September 2017.

During the oral proceedings the appellant filed a set of claims 1 to 11 as main and sole request, and amended pages 1 to 9 and 12 to 68 of the description.

The appellant requested that the decision under appeal be set aside and that a patent be granted in the following version:

- claims 1 to 11 of the main request filed during the oral proceedings,
- description pages 1 to 9 and 12 to 68 (with pages 10 and 11 deleted) filed during the oral proceedings, and
- drawing sheets 1/8 to 8/8 of the application as published.

At the end of the oral proceedings the chairman announced the decision of the board.

V. Independent claims 1 and 11 of the appellant's request read as follows:

"1. An electrophoretic medium (102; 202; 302) comprising a plurality of pigment particles (108; 218; 320) suspended in a suspending fluid (106; 206), the pigment particles having a polymer chemically bonded to the pigment particles (108; 218; 320), the electrophoretic medium (102; 202; 302) being characterized by two types of pigment particles (108; 218; 320) differing in at least one optical characteristic and having differing electrophoretic mobilities and bearing charges of opposite polarity, both types of the pigment particles (108; 218; 320)

having from about 1 to about 15 per cent by weight of the pigment, of the polymer chemically bonded to the pigment particles (108; 218; 320), wherein the polymer comprises a main chain and a plurality of side chains extending from the main chain, each of the side chains comprising at least four carbon atoms, and wherein the suspending fluid comprises an aliphatic hydrocarbon fluid."

"11. An electrophoretic display (100; 200; 300) comprising an electrophoretic medium (102; 202; 302) and at least one electrode (110; 112) arranged adjacent the medium and capable of applying an electric field to the medium, the display being characterized in that the electrophoretic medium (102; 202; 302) is a medium according to any one of the preceding claims."

The set of claims of the appellant's request also includes dependent claims 2 to 10 all referring back to claim 1.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *Amendments*

The board is satisfied that the application documents amended according to the present request of the appellant comply with the requirements of Article 123(2) EPC. In particular,

- claim 1 is based on claims 1, 2, 8 and 9 as originally filed, together with page 11, lines 20 to

24, and page 34, lines 6 to 12 of the description as originally filed,

- independent claim 11 is based on independent claim 14 as originally filed, together with the combination of features of present claim 1, and

- dependent claims 2 to 10 are based on dependent claims 3 to 7 and 10 to 13 as originally filed, respectively.

In addition, the description has been brought into conformity with the invention as defined in the claims (Article 84, second sentence, together with Rule 27 (1) (c) EPC 1973).

3. *Conciseness - Article 84 EPC 1973*

In its decision the examining division held that independent claims 1 and 7 then on file, both directed to an electrophoretic medium, did not satisfy the requirements of conciseness of Article 84, together with Rule 43 (2) EPC - corresponding to Article 84, together with Rule 29 (2) EPC 1973 applicable in the present case. The present set of claims, however, contains one single independent claim directed to an electrophoretic medium, namely claim 1, the remaining independent claim 11 being directed to an electrophoretic display comprising the electrophoretic medium of claim 1. Therefore, the objection of lack of conciseness raised by the examining division is no longer applicable to the present set of claims.

4. *Novelty and inventive step*

4.1 Novelty was not disputed by the examining division, and the board sees no reason to conclude otherwise in respect of the present set of claims.

4.2 Document A1 is considered to represent the closest state of the art. The document discloses an electrophoretic medium comprising a plurality of particles suspended in a suspending medium (Fig. 11b, and page 39, line 20 to page 40, line 13). The medium comprises two types of particles differing in optical characteristics (page 40, lines 2 to 4), having differing electrophoretic mobilities (page 40, lines 1 and 2), and bearing charges of opposite polarity (page 40, lines 7 to 9). In addition, in its section "Particles" on pages 20 to 25, document A1 discloses a variety of particles that can be used as electrophoretic particles. Among the variety of particles, the document discloses pigment particles in general and, in particular, specific pigment particles as being preferred or especially useful (page 20, lines 5 to 11 and line 15, page 20, line 21 to page 22, line 9, and page 22, lines 15 to 17).

Document A1 also mentions examples of aliphatic hydrocarbons to be used as the suspending fluid (page 27, lines 10 to 13), but only as examples among a wide variety of possibilities (page 26, line 1 to page 27, line 22).

In addition, document A1 addresses the problem of the stability of the electrophoretic medium and, in particular, the problem of the agglomeration of particles (page 29, lines 6 to 8), and in this context the document proposes the use of charge control agents and stabilizers, the chemical modification of the surface of the particles, etc. (page 29, line 4 to page 32, line 15). However, particular aspects of the problem of the stability associated with the presence of different types of particles, such as the formation

of aggregates induced by the electrostatic attraction between particles of opposite polarity, are not addressed in the document.

- 4.2.1 Claim 1 defines an electrophoretic medium of the type disclosed in document A1 and the claim specifically requires that the suspending fluid is an aliphatic hydrocarbon medium. Claim 1 requires, in addition, that the pigment particles have a polymer chemically bonded to the pigment particles, the polymer comprising a main chain and a plurality of side chains, each of the side chains comprising at least four carbon atoms, and the amount of polymer being from about 1 to about 15 per cent by weight of the pigment.

According to the description of the application and the submissions of the appellant, the claimed combination of features improves the stability of the electrophoretic medium. In particular, the structure of the aliphatic hydrocarbon constituting the suspending fluid and the branched structure determined by the claimed main and side chains of the polymer chemically bonded to the pigment particles improve the affinity of the particles for the suspending fluid (page 33, line 28 to page 34, line 20, of the description of the application) and hinder the formation of aggregates induced by the electrostatic attraction between particles of opposite polarity (page 5, line 18 to page 6, line 2, and page 40, lines 4 to 12 of the description), thus improving the stability of the particle dispersion (page 26, lines 14 to 16, and page 33, lines 21 to 27).

- 4.2.2 None of the documents on file discloses or suggests modifying the electrophoretic medium disclosed in



document A1 as claimed, nor the technical effects achieved therewith and mentioned above. In particular:

Document D8 discloses an electrophoretic medium with pigment particles of the same type suspended in a fluid (document D8\*, page 10, lines 11 to 18, and page 15, lines 6 to 8). Furthermore, the document teaches the improvement of the stability of the dispersion by the provision of a polymer chemically bonded to the pigment particles (document D8\*, page 3, lines 6 to 8, page 9, line 16 to page 10, line 10, and page 15, lines 2 to 5), the amount of polymer not being smaller than 1 % or, preferably, 2 % by weight of the pigment particles (document D8\*, page 9, lines 6 to 15). The polymer, however, is a polydimethylsiloxane (see document D8\*, page 6, line 15 to page 7, line 1), and there is no indication in the document that the resulting bonded polymer would comprise side chains with at least four carbon atoms as required by the claimed invention. In addition, the document specifies polydimethylsiloxane as being particularly advantageous as suspending fluid over other non-aqueous solvents such as n-hexane (document D8\*, page 9, lines 16 to 20).

Document D9 discloses an electrophoresis medium having pigment particles of two types suspended in a fluid, the surfaces of the particles having been treated with a coupling agent having a vinyl group and having been subsequently treated with a compound having a vinyl group at the end thereof (document D9\*, page 3, lines 2 to 24). Among the compounds having a vinyl group, the document mentions those that can be dissolved in an organic solvent and, among a wide variety of these compounds, the document mentions styrene derivatives having side chains comprising the six carbon atoms of the phenyl group of the styrene (document D9\*, page 4,

lines 3 to 15). However, the document does not disclose the use of a dispersing fluid of the aliphatic hydrocarbon type, let alone the specific use of the styrene derivative, together with such a fluid.

Document D10 discloses an electrophoretic medium comprising a plurality of pigment particles suspended in a suspending fluid (Fig. 1 and 2, and column 5, lines 8 to 37), the pigment particles having a polymeric stabilizer covalently bonded thereon (abstract, column 1, lines 50 to 60, column 2, lines 5 to 12, column 3, lines 12 to 45, and column 5, lines 1 to 7). Among the preferred polymers for use as polymeric stabilizer, the document mentions polystyrene (column 3, lines 46 to 67, and "Example 1" in column 5, line 45 to column 6, line 12), i.e. a polymer comprising side chains with a phenyl group. However, polystyrene is disclosed together with toluene as suspending fluid (sentence bridging columns 5 and 6), i.e. a non-aliphatic hydrocarbon. The document also lists other suitable combinations of polymeric stabilizers and suspending fluids (column 4, lines 39 to 57), but none of the combinations involving the use of an aliphatic hydrocarbon suspending fluid also involves the use of a polymer having side chains as claimed.

Document D11 discloses an electrophoretic medium comprising two types of particles dispersed in a fluid (column 3, lines 13 to 38, and column 6, lines 10 to 20). The particles of the first type are white particles constituted by polymeric particles of poly(styrene-co-divinylbenzene) having grafted thereon polyacrylamide or polymethacrylic acid (column 5, lines 9 to 19), and the particles of the second type are dark or black particles obtained from the white particles of

the first type by staining the polymeric particles (column 5, lines 20 to 32). In addition, the document lists, among the preferred suspending fluids, examples of aliphatic hydrocarbon fluids (column 6, lines 21 to 25). However, there is no disclosure in document D11 pointing towards the selection, among the examples of suspending fluids, of aliphatic hydrocarbon fluids, and the use of a polymer grafted on the polymeric particles in the claimed amount and having the claimed branched structure. In view of these considerations, there is no need for the board to decide whether the polymeric particles of document D11 constitute - as held by the examining division but contested by the appellant during the proceedings - "pigment particles" as claimed.

The remaining documents on file are less relevant for the issues under consideration.

- 4.2.3 It follows from the above considerations that the subject-matter of claim 1 is not obvious when starting with document A1 as the closest state of the art. It is also clear from the above analysis that the same conclusion would also be drawn when starting with any of documents D8 to D11 as closest state of the art.
- 4.3 The board concludes that the subject-matter of claim 1 is new and involves an inventive step over the documents on file (Articles 54(1) EPC and 56 EPC 1973). The same conclusion applies to dependent claims 2 to 10 by virtue of their dependence on claim 1, and also to independent claim 11 directed to an electrophoretic display incorporating the electrophoretic medium of claim 1.

5. In view of the above considerations, the board concludes that the present request of the appellant is allowable.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to grant a patent in the following version:
  - claims: No. 1 to 11 of the main request filed during the oral proceedings of 12 September 2017;
  - description: pages 1 to 9 and 12 to 68 (with pages 10 and 11 deleted) filed during the oral proceedings of 12 September 2017; and
  - drawings: sheets 1/8 to 8/8 of the application as published.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated