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D E C I S I O N
of 25 March 1998

Case Number: T 0491/96 - 3.5.2

Application Number: 85306848.4

Publication Number: 0177276

IPC: H01F 1/24

Language of the proceedings: EN

Title of invention:
Compressed magnetic powder core

Patentee:
Kabushiki Kaisha Toshiba

Opponent:
Hoeganaes AB

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (yes)"
"Inventive step (yes)"
"Distinction between disclaiming and deleting a member from a list of alternative substances in a claim"

Decisions cited:
T 0597/92

Catchword:
-

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Case Number: T 0491/96 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 25 March 1998

Appellant: (Opponent)
Hoeganaes AB
26383 Hoeganaes (SE)

Representative:
-

Respondent: (Proprietor of the patent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 2 April 1996 concerning maintenance of European patent No. 0 177 276 in amended form.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. R. J. Villemin
A. C. G. Lindqvist

Summary of Facts and Submissions

I. The Appellant filed an opposition against European patent No. 0 177 276 and now contests the interlocutory decision of the Opposition Division dated 2 April 1996 that, account being taken of the amendments made during the opposition proceedings, the patent and the invention to which it relates were found to meet the requirements of the EPC.

II. In the grounds of appeal the Appellant (Opponent) referred to the following prior art documents:

D1: US-A-4 385 944,

D2: Journal of Material Science, 20 (1985), D. Raybould et al., "Factors affecting the magnetic properties of consolidated amorphous powder cores", pages 2776 to 2786,

D3: Patent Abstract of Japan , Vol. 5. No. 7 (E 41), [679], 17 January 1981; JP-A- 55 138 205,

D4: GB-A-736 844,

D5: Institute of Static Electricity, Vol. 7, No. 5 (1983) pages 292 to 299 (in Japanese).

III. In reply to observations of the Board in the annex to the summons to attend oral proceedings, the Appellant submitted with the letter dated 25 February 1998 a translation of the text relating to Figure 5 of document D5.

IV. Oral proceedings were held on 25 March 1998 without the participation of the Appellant, who had informed the Board by letter dated 18 March 1998 that he would not attend.

V. In the oral proceedings, the Respondent (patent proprietor) submitted a single request comprising an amended claim 1 and an amended description. Claim 1 reads as follows:

"A compressed magnetic powder core comprising a compressed body of a magnetic powder and electrically insulating material separating the magnetic powder particles, characterized in that the magnetic powder has an average particle size of 10 to 300 µm, and the insulating material covers each of the particles of said magnetic powder with an insulating layer consisting essentially of small particles of an insulating inorganic compound having a particle size of 5 µm or less, said insulating inorganic compound having either an electronegativity of 12.5 or more and being selected from the group consisting of thallium oxide, bismuth oxide, manganese dioxide, boron trioxide, arsenic oxide, germanium oxide, tin oxide, tantalum oxide, niobium oxide, vanadium oxide, titanium dioxide, zirconium dioxide, silicon nitride, titanium nitride, silicon carbide, titanium carbide and a mixture thereof; or an electronegativity of less than 8.5 and being of a material selected from the group consisting of yttrium oxide, europium oxide, neodymium oxide, thulium oxide, dysprosium oxide, lanthanum oxide, and a mixture thereof."

Claims 2 to 5 are dependent on claim 1.

VI. The Appellant's written arguments may be summarised as follows:

It was clear from the electronegativity calculations according to Pauling (see the patent in suit, page 3, lines 27 to 31), that each and every inorganic compound containing metal ions had a specific electronegativity value, so the recital in the present claims of values of electronegativity above 12.5 or below 8.5 did not involve a **limitation** but was an **inherent** feature of each compound listed in the two groups. During the examination and opposition proceedings, specific compounds had been excluded from the claimed subject-matter by way of disclaimers. According to the case law of the EPO Boards of Appeal, a disclaimer may render an invention novel but not inventive (see decisions T 170/87, T 188/83, T 597/92 and T 710/92). In order to be inventive, the claimed subject-matter must show an unexpected effect when compared with the closest prior art, which was D1, taking MgO as the insulating inorganic compound. The disputed patent did not provide a new, improved, or different solution when compared with compressed magnetic powder cores of the kind known from D1.

In view of the disclosures of D1 to D4, it was obvious to a skilled person to select the types of compound listed in claim 1 of the patent in suit for insulating purposes, with a view to improving the magnetic properties of the core. To select other inorganic compounds including metal ions, which were known to be strongly attracted by an electrostatic force to the surface of magnetic metal powder particles, was obvious not only in view of the teaching of D5 but also from common sense, since considerable production difficulties would arise if the compounds were not strongly attracted.

The blow off method mentioned in the translation of the part of D5 concerning its Figure 5 indicated the ease with which particles could be separated from each other. As it was known that attraction and electronegativity were correlated, an inventive step could not consist in defining the compounds having sufficient attraction by their electronegativity values. To select metal oxides having sufficiently smaller or larger electronegative values than that of iron in order to obtain a sufficient attraction and to prepare a compressed magnetic powder core as disclosed in D1 must be considered as a routine measure which did not require inventive skill in view of what was known from D5. If the Board did not agree with the Appellant's views, the Board's decision should include the reason for considering that it was the electronegativity value rather than the attraction between the particles that was the primary reason for the selection of the insulating inorganic compounds listed in claim 1.

VII. The Respondent disagreed with the Appellant's interpretation of a disclaimer. A disclaimer was a proviso disclaiming a specific example from a genus. Cancelling materials from a list of materials in a claim was not a disclaimer, but rather a normal amendment narrowing the extent of protection. This followed from the decision T 597/92 (OJ EPO, 1996, 135) cited by the Appellant, where the main request was rejected because claim 1 included a disclaimer: "in the presence of a Lewis acid, excluding Ag^+." but the auxiliary request, in which those words were replaced by "in the presence of a Lewis acid acting as a catalyst and selected from ... " (list), was accepted.

The Appellant's arguments were based on hindsight. There was no suggestion in any of the cited documents D1 to D5 that the magnetic properties of a core made of magnetic powder particles and inorganic compound particles could be improved by selecting specific inorganic compounds, e.g. MgO, with an electronegativity of less than 8.5 or greater than 12.5. It was not necessary to explain why an effect occurred: it was enough to disclose how to obtain it.

VIII. The Appellant requested that the decision under appeal be set aside and the European patent No. 0 177 276 be revoked.

IX. The Respondent requested that the patent be maintained in amended form in the following version:

Claims: claim 1 as filed in the oral proceedings on 25 March 1998, claims 2 to 5 of the patent specification;

Description: page 2, insert to page 2, and pages 3 and 3a as filed in the oral proceedings on 25 March 1998, pages 4 to 8, line 46, of the patent specification;

Drawings: figures 1 to 3 of the patent specification.

Reasons for the Decision

1. The appeal is admissible.

2. Document D2, which was published after the priority date of the contested patent and, therefore, does not belong to the state of the art according to Article 54(2) EPC, will be disregarded by the Board.

3. *Admissibility of amendments*

3.1 Claim 1 differs from the granted version only in that magnesium oxide, cobalt oxide and nickel oxide have been deleted from the group of insulating inorganic compounds having an electronegativity of less than 8.5. Thus the claim now specifies a more restricted group of insulating inorganic compounds.

3.2 Amendments have been made in the description to acknowledge the prior art known from D1 and to bring the lists of compounds on page 3 as granted (now on pages 3 and 3a) into agreement with the lists in claim 1. The reference to Figure 4 (which does not exist) has been deleted and the references on page 3 to the average particle size of the magnetic powder being "preferably" 300 µm or less and "preferably" 10 µm or more have been deleted as these average particle size limits are mandatory according to claim 1.

3.3 The above-mentioned amendments quite clearly do not infringe Article 123(2) or Article 123(3) EPC. In particular, in view of the Appellant's "disclaimer" argument, it is noted that the deletion from claim 1 of three members from the list of specifically named insulating inorganic compounds having an electronegativity of less than 8.5 is not a "disclaimer" in the sense of the word as used in the

decisions of the Boards of Appeal cited by the Appellant. Indeed, it follows from the allowance of the auxiliary request in decision T 597/92 (OJ EPO, 1996, 135) that the deletion of one or more members from such a list is not to be treated in the same way as the disclaimer of a particular point (not disclosed in the originally filed application) in a range, or the disclaimer of a particular member of a class of substances which was only generically specified in the originally filed application. In the present case, all the remaining members of the list were specifically named in the originally filed application. There is thus no added subject-matter giving rise to an inventive selection not disclosed in the originally filed application.

4. *Prior art and novelty*

4.1 The compressed magnetic powder core according to claim 1 comprises:

(a) a compressed magnetic powder having an average particle size of 10 to 300 µm, and

(b) an electrically insulating inorganic compound separating the magnetic powder particles and having

(b1) a particle size of 5 µm or less, and

(b2.1) an electronegativity of 12.5 or more and selected from the first group of compound listed in claim 1, or

(b2.2) an electronegativity of less than 8.5 and selected from the second group of components defined in claim 1.

4.2 The closest prior art is disclosed in D1 (see example 1). It is a compressed magnetic powder core of the type defined in the prior art portion of claim 1 of the patent in suit, and comprises:

- a magnetic powder in the form of particles having a size falling within the range defined by feature (a) mentioned above, although the range of average particle size of 10 to 300 µm is not disclosed in D1,

- insulating material (submicron magnesium oxide) separating the magnetic powder particles, as defined by feature (b) mentioned above, and, being submicron (D1, column 4, line 7), having a particle size falling within the range specified in feature (b1) mentioned above, although the range of particle size of 5 µm or less is not disclosed in D1.

4.3 However, none of the electrically insulating inorganic compounds specified in the first and second groups recited in claim 1 (features (b2.1) and (b2.2) mentioned above) is disclosed in D1. Therefore, the claimed magnetic powder core is new over the cores disclosed in D1.

5. *Inventive step*

5.1 Starting from the prior art disclosed in D1, the problem solved by the claimed subject-matter is, as stated in the patent in suit (page 2, lines 43 to 45 of EP-B1-0 177 276), to provide a compressed magnetic powder core having a high magnetic flux density, good frequency characteristics of magnetic permeability, and a low hysteresis loss due to annealing.

5.2 D1 discloses the use of various glassy ferromagnetic alloys in powder form for manufacturing magnetic cores having excellent strength and magnetic response. These cores are obtained by consolidation of the powders, effected using mechanical pressure and/or a binder (see D1, column 1, lines 7 to 9 and 35 to 57). According to example 1 of D1, magnetic particles with a size of less than 30 µm are blended uniformly with 2% submicron magnesium oxide particles. In D1, magnesium oxide is not described as being used to improve the magnetic properties of the core but as a "fine ceramic powder" to provide a uniformly distributed air gap in the core with the aim to increase its resistivity.

5.2 Although magnesium oxide has an electronegativity much less than 8.5, and consequently a strong electrostatic attraction to the ferromagnetic particles (see D5, Figure 5, MgO), D1 does not suggest that this property of MgO is in any way important for the magnetic properties of the core: the person skilled in the art would simply assume that the strong attraction is useful in providing excellent mechanical strength.

5.3 Thus D1 cannot be regarded as suggesting, in a general way, the addition of an insulator having an electronegativity of less than 8.5 to a ferromagnetic alloy for improving its magnetic properties, and certainly not the addition of one or more rare earth oxides selected from the group consisting of yttrium oxide, europium oxide, neodymium oxide, thulium oxide, dysprosium oxide, and lanthanum oxide specified in claim 1 of the patent in suit. Nor does D1 in any way suggest the addition of an insulator having an electronegativity of 12.5 or more to a ferromagnetic alloy for improving its magnetic properties.

5.4 Thus, it remains to be considered whether or not, starting from D1, and in the light of the prior art according to document D3, D4 and/or D5 cited by the Appellant, it would have been obvious to the skilled person to arrive at the combination of features recited in claim 1.

5.5 According to D3, the addition of an insulating powder such as mica, montmorillonite graphite, molybdenum dioxide, or boron nitride and a bonding agent to ferromagnetic powder results in an increase of the magnetic flux density and reduction in the weight of magnetic dust cores made of these materials. D3 does not suggest the use of any of the insulating inorganic compounds recited in claim 1. Although D3 discloses that the insulating powder and bonding agent fill the gaps of iron powder, it does not suggest that the insulating powder covers each of the particles of magnetic powder, as required by claim 1 of the patent in suit.

5.6 D4 discloses magnetic dust cores consisting solely of a powder of a nickel-iron based magnetic alloy insulated and bonded with colloidal silica, and a process for manufacturing such a magnetic dust core in which colloidal silica is deposited between the particles of the magnetic alloy and the resulting powder is annealed. D4 does not remotely suggest the use of any of the insulating inorganic compounds recited in claim 1 of the patent in suit.

5.7 It is true that, as pointed out by the Appellant, it can be seen from Figure 5 of D5 that some inorganic compounds have electronegativity values of 12.5 or more, whereas others have electronegativity values of less than 8.5. However, D5 does not disclose the particle sizes of the ferromagnetic powder or of the insulating inorganic compounds, and D5 does not suggest

choosing insulating inorganic compounds whose electronegativity values are less than 8.5 or 12.5 or more in order to obtain a compressed magnetic powder core with high magnetic flux density, good frequency characteristics of magnetic permeability, and low hysteresis loss due to annealing. Indeed, the fact that D5 shows MgO to have a stronger attachment to ferromagnetic particles than the rare earth oxides have, would tend to dissuade the skilled person from choosing a rare earth oxide instead of the magnesium oxide used in example 1 of D1.

5.8 In answer to the Appellant's question as to why it has been considered that it was the electronegativity values and not the attraction between the particles that was the primary reason for the selection of the insulating inorganic compounds listed in claim 1, it is pointed out that this is not of any real consequence because the claimed invention does not merely select substances on the basis of their electronegativities rather that on the basis of the attraction between particles, but is based on the discovery that the combination of magnetic powder particles within a certain range of sizes and certain electrically insulating inorganic particles, listed as members of the groups specified in claim 1 of the patent in suit, whose particle size is 5 µm or less, makes it possible to produce magnetic cores with outstanding magnetic properties.

5.9 In the judgement of the Board, the subject-matter of claim 1 cannot be deduced in an obvious way from the prior art documents cited by the Appellant. Consequently, this subject-matter involves an inventive step within the meaning of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form in the following version:

Claims: claim 1 as filed in the oral proceedings on 25 March 1998, claims 2 to 5 of the patent specification;

Description: page 2, insert to page 2, and pages 3 and 3a as filed in the oral proceedings on 25 March 1998, pages 4 to 8, line 46, of the patent specification;

Drawings: figures 1 to 3 of the patent specification.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler