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D E C I S I O N
of 21 March 2002

Case Number: T 0380/99 - 3.2.2

Application Number: 92101915.4

Publication Number: 0508055

IPC: H01H 1/02

Language of the proceedings: EN

Title of invention:

Silver-base metal oxide material for electrical contacts

Patentee:

MITSUBISHI MATERIALS CORPORATION

Opponent:

AMI DODUCO GmbH

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

"Late filed auxiliary requests (not admitted)"

Decisions cited:

T 0095/83; T 0029/85; T 0297/91; T 0252/92; T 0270/90

Catchword:

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Case Number: T 0380/99 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 21 March 2002

Appellant: MITSUBISHI MATERIALS CORPORATION
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Representative: May, Hans Ulrich, Dr.
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Respondent: AMI DODUCO GmbH
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Representative: Twelmeier, Ulrich, Dipl. Phys.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 22 February 1999
revoking European patent No. 0 508 055 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: W. D. Weiß
Members: R. Ries
U. J. Tronser

Summary of Facts and Submissions

- I. European patent No. 0 508 055 was granted on 2 May 1997 on the basis of European patent application No. 92 101 915.4.
- II. The granted patent was opposed by the present respondents (opponent: AMI DODUCO GmbH) on the ground that its subject matter did not involve an inventive step with respect to the state of the art (Article 100(a) EPC).
- III. With its decision posted on 22 February 1999, the opposition division held that the claimed subject matter according to the main request and the auxiliary request lacked an inventive step and revoked the patent.
- IV. An appeal against this decision was filed by the patentee (the appellant) on 6 April 1999 and the appeal fee was paid on the same date. The written statement setting out the grounds of appeal was filed within the time limit given in Article 108 EPC.

The following documents have been relied upon on appeal:

D1: DE-C-2 482 147

D4: Proceedings International Conference Electr.
Contact Phenomena, 10th, 1980, volume 2, pages 905
to 914

D5: US-A-4 462 841

- D6: Keil, A., Elektrische Kontakte und ihre Werkstoffe, Springer Verlag, 1984, pages 42, 43; 68 to 71; 203, 204
- D7: Metals Handbook, pages 689 and 690 and Table 10.7
- D8: Annual Book of ASTM Standards, part 44, American Society for Testing and Materials, 1980, pages 261 to 268

- V. In response to the official communication by the Board the appellant submitted a report relating to comparative tests on the claimed silver base metal oxide material and on the prior art materials.
- VI. Oral proceedings before the Board were held on 21 March 2002.
- The appellant (patentee) requested that the decision under appeal be set aside and the patent be maintained in amended form
 - with claims 1 to 8 submitted with letter of 24 June 1999 and the description pages 2 to 6 enclosed with the same letter (main request) or
 - with further amendments to claim 1 as requested with letter of 21 February 2002 (first auxiliary request) or
 - with claims 1 to 8 submitted at the oral proceedings (second auxiliary request) or
 - with claims 1 to 6 submitted at the oral proceedings (third auxiliary request).

- The respondent (opponent) requested that the appeal be dismissed.

Claim 1 of the main request reads as follows:

"1. A silver-base metal oxide material for electric contacts, having excellent deposition resistance and consumption resistance, said material being formed by subjecting to an internal oxidation treatment an Ag-base alloy consisting of, by weight:

Sn	4 to 11%
In	1 to 5%
Te	0.1 to 1%

at least one element selected from the group of Fe, Ni, and Co 0.01 to 1%

Ag and impurities the balance."

Claim 1 of the first auxiliary request further includes the wording (in bold letters):

"1. A silver-base metal oxide material ...and consumption resistance **and showing sublimation of tellurium oxides in use as electric contacts**, said material... "

Claim 1 of the second auxiliary request reads (amendments in bold letters):

"1. A silver-base metal oxide material for electric contacts, having excellent deposition resistance and consumption resistance, said material being formed by subjecting to an internal oxidation treatment an

Ag-base alloy consisting of, by weight:

Sn	4 to 11%
In	1 to 5%
Te	0.1 to 1%

at least one element selected
from the group of Fe, Ni, and Co 0.01 to 1%

Ag and impurities the balance,

wherein strips of said silver- base metal oxide material are formed and subjected to the internal oxidation treatment and said internally oxidized strips are put together and compacted into a billet, the billet being extruded."

Claim 1 of the third auxiliary request reads:

"1. A silver-base metal oxide material for electric contacts, having excellent deposition resistance and consumption resistance, said material being formed by subjecting to an internal oxidation treatment an Ag-base alloy consisting of, by weight:

Sn	4 to 11%
In	1 to 5%
Te	0.1 to 1%

at least on element selected
from the group of Fe, Ni, and Co 0.01 to 1%

Ag and impurities the balance,

wherein the material is prepared by the following

steps:

- (1) ingots of the silver-base alloy prepared by smelting and casting, are hot extruded into a plate having a thickness of 5 mm;
- (2) said plate is then hot-rolled, followed by being cold rolled into a sheet of 0.6 mm thickness;
- (3) said sheet is cut or sliced in its longitudinal direction into strips having a width of 2 mm;
- (4) said strips are subjected to an internal oxidation treatment under an oxidizing atmosphere at a temperature of 650° to 750°C during 8 to 26 hours;
- (5) said internally oxidized strips are put together and compacted into a billet having a diameter of 70 mm, the billet being extruded into a diameter of 7 mm, followed, if desired, by a wire-drawing into a wire having a diameter of 2 mm."

VII. The appellant argued as follows:

Document D4 which represents the closest prior art, deals with the effect of small additions of Sb, Mn, Te, Cu, Zn and Bi upon the internal oxidation and the switching behaviour of AgSnIn-alloys. Compared to all other additives tested in D4, tellurium is, however, not the first choice for the expert when looking for an AgSnInX- alloy composition which after internal oxidation is expected to exhibit a high deposition resistance (resistance to sticking and light welding) and a high consumption resistance (= low erosion rate or high wear resistance). In spite of the very low

erosion rate effected by the addition of 1% tellurium, unwanted side effects are associated therewith including a low conductivity, the softening of the material and, more importantly, an inhomogeneous distribution of needle- or platelike oxides which adversely affects the properties of the contact material. As stipulated in document D4, page 906, second paragraph, a homogeneous and fine dispersion of the precipitates generated by the alloying additions is beneficial to the characteristics strived at. Consequently, the skilled worker would prefer Sb or Bi which do not form needle- or platelike oxides as does Te, and which exhibit - amongst all other components - very low welding forces in combination with acceptable low erosion rates.

Moreover, document D4 remains silent about the addition of at least one of the iron group elements Fe, Co or Ni which is compulsory in the claimed alloy. Although documents D1 and D5 referred to by the opponent advocate the optional addition of one or more of the iron group metals (D1) or of nickel (D5) for promoting a fine and homogeneous dispersion of the oxides, they are concerned with AgSnIn-alloy compositions which are different to those claimed in the patent. The metallurgist is, however, aware of the fact that by slight additions of a new constituent, a known alloy can be significantly changed in its properties. The precise effect of a particular amount of Fe, Co or Ni on the properties of the final AgSnInTe alloy, therefore, cannot be exactly anticipated, as alleged by the opponent. Hence, the addition of Fe, Co or Ni to the claimed AgSnInTe alloy was not a straightforward or obvious measure which could simply be read across from the AlSnIn alloys or AlSnInCdCu disclosed in documents

D1 or D5, respectively, to the claimed AgSnInTe material. The subject matter according to the main request, therefore, involves an inventive step.

The amendment to claim 1 of the first auxiliary request renders even more precise that the resistance to deposition and consumption of the internally oxidised AgSnInTe alloy is essentially improved by the sublimation of the Te-oxides during switching.

Claim 1 of the second and third auxiliary requests further includes specific process steps for producing the claimed Ag-based metal oxide material. It strongly depends upon these process steps, in particular by compacting the internally oxidised strips into billets and extruding them, that the favourable homogeneous dispersion of the oxides and the excellent switching properties of the claimed material are achieved. No information is given in the prior art disclosing these process steps or characterising them as conventional or typical practice, as alleged by the opponent. The subject matter according to claim 1 of the second and third auxiliary request is, therefore, novel and involves an inventive step vis-à-vis the known prior art.

As to the second and third auxiliary requests, the last paragraph on page 5 of the appellant's letter submitted on 21 February 2002 reflects the high impact that is exerted by the claimed process steps on the Ag-metal oxide material. The claimed processing is, therefore, essential to achieve the fineness of the microstructure, the homogeneous dispersion of the oxides and the desired switching properties of the claimed material. The second and third auxiliary

requests are, therefore, not late filed.

VIII. The respondent argued as follows:

Document D4 makes clear that it is not possible to get an optimum contact material in every respect. However, as regards the "consumption resistance" this document advocates the addition of tellurium since the AgInSn base material containing 1% Te having coarse needlelike precipitates exhibits a very low (the lowest) erosion rate. Moreover, the welding forces are significantly reduced by additions of Sb, Te and Bi and are much lower than those achieved by Mn, Cu or Zn. Tellurium is, therefore, the most promising additive. According to document D1 the specific additive should afford either an increase of the content of oxides or should generate a homogeneous and fine dispersion of the precipitates. Dispersion in a metallurgical sense describes the state of homogeneity and fineness of the multi-phase material. The expert, therefore, would look for technical information showing how the needlelike oxides and their inhomogeneous dispersion could be improved. Such information is found in documents D1 or D5 both documents teaching that adding small amounts of iron or nickel effectively improves the homogeneity and fineness of the microstructure. Consequently, the subject matter of claim 1 of the main request does not involve an inventive step.

As to the second and third auxiliary request, the patentee's arguments that the key feature of the claimed subject matter is to be seen in the process steps of compacting and extruding the internally oxidised AgSnInTe(Fe,Co,Ni) strips to bring about the desired fine microstructure were presented for the

first time at the oral proceedings. This is quite surprising, the more so since the opponent's position in the opposition proceedings that the process claimed in claim 10 as granted does not involve an inventive step has never been contradicted by the patentee ever since. The second and third auxiliary requests should, therefore, not be admitted to the proceedings.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request*
- 2.1 Amendments (Article 123(2) EPC).

Claim 1 of the main request originates from claim 2 as granted which has been further restricted by limiting the tellurium content to 0.1 to 1%. This range is disclosed as being preferred on page 3, lines 49/50 of the patent specification. Hence, the requirements pursuant to Article 123(2) EPC are satisfied.

- 2.2 The closest prior art

Since their introduction as a possible replacement for Ag-CdO-based materials, Ag-SnO₂- and more particularly Ag-SnO₂-In₂O₃-based contact materials have been continuously improved with respect to their applicability and their performance. Like the patent at issue, document D4 is concerned with the switching behaviour of AgSnIn alloys and the effect of small amounts of Sb, Mn, T, Cu, Zn and Bi upon the internal oxidation process, the erosion rate and the welding

forces. Specifically, a basis alloy consisting (by weight) of 90%Ag-5%Sn-4%In further comprising 1% of either Sb, Mn, Te, Cu, Zn, or 0.3% Bi was investigated (cf. D4, page 907, third paragraph). As agreed by all parties, none of the remaining documents comes closer to the silver-base metal oxide material claimed in the disputed patent. Also in the Board's view, the closest prior art is reflected by document D4.

2.3 Problem and solution

Starting from this prior art, the problem underlying the patent at issue thus resides in providing a AgSnIn alloy which exhibits a high resistance to consumption and deposition (corresponding to the technical terms "low erosion rate" and "low welding forces" frequently used in the art), and hence a prolonged service life.

The solution to this problem consists in providing an internally oxidised AgSnIn alloy which further comprises Te and at least one of Fe, Co or Ni within the elemental ranges defined in claim 1 of the opposed patent. However, this solution would have been obvious to the expert as is shown in the following.

2.4 Inventive step

The internally oxidised 90%Ag-5%Sn-4%In-1%Te alloy composition disclosed in document D4 falls within the elemental ranges specified in claim 1 of the patent at issue. Among all alternative additives listed in Table II of document D4, the addition of tellurium results in the lowest erosion rate at 1300A and 350A (cf. D4, Table II and page 910, lines 5 to 8). Moreover, tellurium belongs to those additives (Sb, Te,

Bi) which effect lower welding forces than additions of Mn, Cu or Zn.

The addition of 1% tellurium entails the drawback of a lowered electrical conductivity and the softening of the metal-oxide AgSnIn material as well as an inhomogeneous distribution of the platelike or needlelike oxides (cf. D4, page 907, third full paragraph, and second line from the bottom; page 908, end of the first full paragraph). This fact needs, however, to be considered before the background that the conductivities of all the AgSnIn-X alloys (X = Sb, Mn, Te, Cu, Zn, Bi) are reported to be lower than those of Ag/CdO materials and are, nevertheless, tolerable (cf. D4, page 908, lines 3/4). Besides, additives other than Te are not devoid of unwanted side effects: although Zn additions form fine particles, the internal oxidation is insufficient; Mn additions promote the finest metal oxides, but the welding forces and wear resistance are unsatisfactory (cf. D4, page 908, last paragraph; page 909, lines 5 and 6), and CuO shows the worst contact resistance of all components (cf. page 911, lines 3/4). Compromising all these considerations, the most promising starting point for a skilled person when looking for a silver base metal oxide material which exhibits a high reliability against wear and welding is a AgSnIn alloy comprising 1% Te.

The claimed silver base metal oxide material differs from the AgSnInTe alloy disclosed in document D4 by further including at least one or more of Fe, Co or Ni. As set out on page 3, lines 50 to 55 of the patent specification, the iron group elements dissolve in the matrix to finely divide the oxides and the silver

grains and thereby improve the deposition resistance (resistance to light welding). As a general teaching given in document D4, page 906, first full paragraph, lines 5 to 10, the components added to AgSnIn alloys should promote a fine and homogeneous dispersion of the precipitates. A finely dispersed microstructure results in very low welding forces, as has been specifically demonstrated in connection with internally oxidised AgSnIn-Mn alloys (cf. D4, page 910, last paragraph, lines 7 to 12). Thus, faced with the problem of a inhomogeneous distribution of the needlelike or platelike oxides that is associated with the addition of tellurium, the expert will look for a solution to overcome this drawback.

Such technical incentive is found in documents D1 and D5 which represent an advancement in the development of internally oxidised AgSnIn alloys. Claim 2, in combination with column 3, lines 10 to 12 and Table 1 of document D1 states that by the addition of up to 0.5% of the iron group metals, very homogeneous and uniform microcrystals are formed during the internal oxidation of AgInSn alloys. A similar effect upon the microstructure is reported in document D5, column 3, lines 39 to 45, according to which adding up to 1% nickel is effective in making a fine dispersion of the oxide particles in the AgSnInCdCu material and to thereby increase the hardness and the arc-wear resistance. This all goes to show that the influence of small additions of the iron group metals does not depend, for their physical effect, upon a specific AgSnIn or AgSnInCdCu alloy, as alleged by the patentee. On the contrary, the Board is convinced that no prejudice existed against applying (or at least trying to apply) the teaching given in either document D1 or

D5 to the AgSnInTe alloy known from document D4. Adding small amounts of Fe, Ni or Co to this alloy in order to promote a more homogeneous and fine dispersion of the oxides consequently amounts, in the light of the documents mentioned, to no more than an obvious choice to a skilled person. The subject matter of claim 1 of the main request, therefore, does not involve an inventive step.

3. *First auxiliary request*

The same is true for claim 1 of the first auxiliary request which has been amended for the sake of improved clarity and, therefore, does not differ in substance from claim 1 of the main request.

4. *Second and third auxiliary request*

4.1 Referring to the comparative experiments appended to its letter of 21 February 2002, the appellant has argued **for the first time** at the oral proceedings that the fine dispersion of the oxides in the AgSnInTe-Fe,Co,Ni material is strongly influenced by the process steps of compacting the internally oxidised strips into a billet and extruding this billet which is then optionally drawn into a wire. These process steps are stipulated by the product-by-process claim 1 according to the second and third auxiliary requests.

It is true that claim 6 according to the patentee's request of 24 June 1999 (corresponding to claim 10 as granted) relates to a process for preparing the Ag-based metal oxide material defined in claim 1. However, no technical information is discernable anywhere in the patent specification reflecting how these process steps

actually do act upon the fineness of the oxide dispersed matrix and thus upon the switching properties of the claimed Ag-based metal oxide material. On the contrary, the formation of finely divided oxides in the fine grained Ag-matrix is reported in the disputed patent on page 3, lines 50 to 55 to be a consequence of the addition of Fe, Co or Ni in amounts ranging from 0.01 to 1%. It is, therefore, not possible for the Board to ascribe any physical effect to these process steps on the basis of the opposed patent.

- 4.2 It is further important to note in this context that the opponents' negative assessment as regards the patentability of the process claim 10 (cf. Notice of Opposition of 2 February 1998, page 5) has not been challenged by the patentee at the opposition proceedings. No experimental evidence or counter-arguments were presented in order to confirm that the process steps stipulated by claim 10 (as granted) strongly influence the physical properties of the product. The patentee has not argued in its written submissions in the appeal proceedings either that the invention ought to be seen in particularly adhering to this specific process.

At the oral proceedings, the appellant referred in this context to page 5, last paragraph of its letter dated 21 February 2002. There it was found that the claimed contact material free of Fe, Ni or Co (and also the AgSnInTe material disclosed in D4) did not form coarse needlelike precipitates when prepared and tested under the conditions set out in the disputed patent. The appellant's interpretation that the cited paragraph underlines the importance of the processing of the Ag-metal oxide material is, however, not intelligible to

the reader without further explanations. Based on these rather vague and veiled allusions, it has, therefore, been impossible for the Board and for the opposing party to anticipate the patentee's revised and surprising assessment of the core of the claimed invention. Given this situation, the Board as well as the opponent had no reason to expect that such a new claim directed to a product-by-process would be presented during the oral proceedings and put forward for decision.

- 4.3 These remarks also make clear that (i) revised claims 1 submitted as second and third auxiliary request are late filed and (ii) that in these claims the essence of the invention is shifted from the chemical composition of a internally oxidized Ag-base metal oxide material to the principle that the process steps for preparing this material are of prime importance. In particular the steps of compacting the internally oxidised sheets to a billet followed by extruding are now depicted in these claims to constitute the key feature of the invention. However, such late filed claims when submitted unexpectedly at the oral proceeding and changing radically the core of the invention, may delay the proceedings, because the question of inventive step is raised in new terms and cannot be answered by the mere reference to the documents on file. It is, therefore, indispensable to an applicant or patentee party to appeal proceedings to file new claims significantly in advance to the oral proceedings so as not to delay the proceedings. This should be done also in fairness to the other parties and to the Board of Appeal. In the present case, a proper examination of whether or not the newly claimed subject matter involves an inventive step would necessitate either a

continuation in writing of the appeal procedure or a remittal of the case to the first instance. In any case, it would be impossible to give a final decision at the end of the oral proceedings. Such a situation, if created deliberately by a party, would have to be regarded as an abuse of the procedure. Reference is made in this respect to the established jurisprudence represented in particular by the following decisions: T 0297/91, point 12.1.6; T 0252/92, point 3.1; T 0029/85, point 4.1; T 0095/83, points 7 and 8; T 0270/90, point 5, second paragraph and point 7, second paragraph).

- 4.4 In view of the above considerations, the Board decides not to consider either of the late filed alternative set of claims submitted as second and third auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

V. Commare

W. D. Weiß