BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS | BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE | CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

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File Number: T 321/90 - 3.5.2

Application No.: 83 106 046.2

Publication No.: 0 097 906

Title of invention: Contacts for vacuum switches

Classification: H01H 1/02

D E C I S I O N
of 28 February 1991

Proprietor of the patent: Kabushiki Kaisha Toshiba

Opponent: Doduco GmbH & Co.

EPC Art. 56

Keyword: "Inventive step (no)"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 321/90 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 28 February 1991

Appellant : (Proprietor of the patent)
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Respondent : (Opponent)
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Decision under appeal :
Decision of Opposition Division of the European Patent Office dated 9 February 1990 revoking European patent No. 0 097 906 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : E. Persson
Members : W. Riewald
L. Törnroth

Summary of Facts and Submissions

I. European patent No. 0 097 906 incorporating 3 claims was granted to the Appellant on 17 September 1986 in response to European patent application No. 83 106 046.2, filed on 21 June 1983 and claiming priority of 25 June 1982 of an application in Japan.

II. Claim 1, as maintained throughout the proceedings, reads as follows:

"A vacuum switch comprising a vacuum vessel and a pair of relatively separable electroconductive rods disposed in said vacuum vessel and provided with contact members at the opposing ends of said rods and in which each of said contact members contains boron, a highly electroconductive component and a welding prevention component, characterized in that each of said contact members contains 0.005 - 2% by weight of boron and is provided with a worked contact surface having a disc shape and finished to obtain surface roughness of less than 6μm and the total numbers of surface roughness portions, spallings, and breaks appearing on said worked contact surface are less than ten correspondingly in case the contact material has a diameter of 75mm."

III. A notice of opposition was filed on 15 June 1987 by the Respondent requesting revocation of the patent on the ground of lack of inventive step with regard to the prior art documents, in particular:

D1: GB-A-1 309 197,
D2: DE-A-2 310 317,
D3: DE-C-2 723 749.

The Opponent held that the range of boron content specified in the characterising part of Claim 1 was well within the ranges of boron contents specified in documents D1 and D2 and known as means for reducing the gas content of the contact material. The Opponent held further that the suitability of the finishing of the contact surface in order to achieve a reduced surface roughness was already dealt with in D3, and that it belonged to the general knowledge of the skilled person that a polished contact surface exhibited a higher electric strength ("Spannungsfestigkeit") than an unpolished surface.

The behaviour of the contact members with respect to the arc restriking phenomenon depended on the gas content as well as on the electric strength, and it was therefore obvious to apply the known measures in order to meet the problem of arc restriking which was the object of the invention.

The Patentee relied on the argument that the arc restriking phenomenon was not explicitly dealt with in the cited documents and that the particular details of the invention were not disclosed in the documents.

IV. The Opposition Division revoked the patent by a decision of 9 February 1990.

V. On 17 April 1990, the Patentee lodged an appeal against the decision and paid the appeal fee on the same day. A statement of grounds was received on 18 June 1990.

The Appellant's submissions amount in substance to a completion of his arguments, put forward before the Opposition Division, by a discussion of the difference between "arc restriking phenomenon" and "Spannungs-festigkeit".

The Appellant admits that the increase of "Spannungsfestigkeit" by polishing has been known from D3 but insists that the reduction of arc restriking phenomenon by polishing has not been publicly known at all and concludes that, therefore, the subject-matter of Claim 1 involves an inventive step.

With regard to the claimed boron content (0.005-2%) the Appellant acknowledges that D2 discloses contact members of highly conductive material with 0.5-15% of boron and, in a special embodiment with copper, the boron content of 2%, and that D1 discloses 0.003-0.5% boron content. The Appellant stresses that the claimed range of 0.005-2% is of particular relevance in respect of the prevention of the arc restriking phenomenon due to brittle welding prevention and prevention of gas impurities and pin-holes.

VI. The Respondent (Opponent) opposed the Appellant's submissions by a letter of 21 December 1990.

VII. It follows from the Appellant's submissions that he requests to set aside the decision of the Opposition Division and to reject the opposition.

The Respondent requests that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. **Novelty**

Document D1 (GB-A-1 309 197), cited in the description, page 2, lines 30 to 32, discloses a vacuum switch (10)

comprising a vacuum vessel (evacuated envelope 13) and a pair of relatively separable electroconductive rods (19,20) disposed in said vacuum vessel and provided with contact surfaces (11 and 12) at the opposing ends of said rods. The contact material contains copper as a highly electroconductive component, 0.003 to 0.5% by weight of boron and 0.1% to 1% by weight of bismuth as a welding prevention component (cf. Claims 1 and 2 and page 1, lines 42 to 45). D1 discloses contact rods without the provision of a separate contact member. However, the provision of separate contact members is absolutely common practice in electric switch technology (cf. e.g. D3, Fig. 2 in the context of a vacuum switch).

The vacuum switch of Claim 1 of the patent in suit differs from this prior art by the exclusion of a boron content range from 0.003 to 0.005, the addition of a boron content range from 0.5 to 2% and the provision of a worked contact surface having a disc shape and finished to obtain surface roughness of less than 6μm and the total numbers of surface roughness portions, spallings, and breaks appearing on said worked contact surface are less than ten correspondingly in case the contact material has a diameter of 75mm.

Document D2 (DE-A-2 310 317), which was considered by the Opposition Division as the closest prior art, discloses various alloys for vacuum switches with copper as the highly electroconductive component and the addition of further components in a concentration between 0.5 and 15% in order to obtain a fine grained and hard alloy (cf. Claim 1). In a special embodiment with boron as additional component the document suggests a boron content of 2% (cf. Claim 7).

Considering that the structural details of a vacuum switch not explicitly disclosed in D2 belong to the necessary background knowledge in this technical field (e.g. D1 and D3), the subject-matter of the present Claim 1 is distinguished from this prior art by specific details determining the boron content and the said features concerning the worked contact surface.

3. **Inventive step**

Page 2, lines 35 to 37 of the patent specification defines as an object of the claimed invention the provision of a vacuum switch with contact members exhibiting little or no drawbacks in respect of the arc restriking phenomenon. In the context of the disclosure this must objectively be interpreted as the problem to prevent arc restriking (cf. page 3 of the patent, line 21). The Appellant's comments on the difference between "arc restriking phenomenon" and "Spannungsfestigkeit" in section III.3 of the grounds of appeal are insofar less relevant in respect of the objective problem underlying the present patent as they deal with the consequences when arc restriking occurs i.e. when its prevention has failed.

It is, at any rate, the voltage between the separated electrodes of the vacuum switch which can cause arc restriking and insofar a sufficient voltage strength ("Spannungsfestigkeit") of the space between the electrodes is decisive for the question whether arc restriking can be suppressed.

It is true that the term "Spannungsfestigkeit" in D3, column 4, lines 18 to 25 is defined in a specific context as the result of an arc generation test carried out in a specified test arrangement without regard to the special conditions existing in a vacuum switch. However, this is

no reason to disregard the known teachings in respect of possible improvements of the voltage strength when, as in the case of the arc restriking phenomenon in vacuum switches, the particular voltage strength is modified by the specific electrode forms in the switch and the vacuum condition. In particular, the skilled person will readily take into account any known teaching concerning the dependence of the voltage strength on the form of electrode surfaces in order to improve vacuum switch electrodes in respect of the arc restriking phenomenon. Therefore, there is no objection to the Opposition Division's reasoned finding that the man skilled in the art will make use of his general knowledge that arcing is preferentially released from points and edges of an electrode and that he will therefore aim at obtaining a surface roughness as low as possible, just as this is also realised in the test arrangement referred to in D3, column 4, lines 18 to 25 by polishing the electrodes. The specific dimension of the maximum surface roughness to be less than 6μm and the specification of the total number of surface roughness portions, spallings and breaks to be less than ten for a contact material with a diameter of 75mm can, in this context, only be regarded as arbitrary limiting values for a polished surface.

With regard to the boron content of the contact members, the Appellant acknowledges that the range 0.003-0.5% is disclosed in D1 and that the range 0.5-15% together with a preferred value of 2% is disclosed in D2. As to the effect of the boron content the prior art states:

- smaller copper crystals (D1, page 1, lines 48 to 55; D2, page 6 - hand-written numbering -, lines 8 to 16);
- contact welding prevention (D1, page 1, lines 45 to 48 and page 2, lines 9 to 12);

- smooth contact surface (D1, page 1, lines 56 to 60);
- gas "gettering" function (D1, page 2, lines 12 to 23; D2, page 5 - hand-written numbering -, line 24);
- low gas (e.g. oxygen) content (D1, page 2, lines 24 to 26; D2, page 6 - hand-written numbering -, lines 16 to 19 and 31 to 33);
- less likely induction or support of an arc when the pair of contacts is separated (D1, page 1, lines 21 to 23 and 59 to 60).

Therefore, the prior art already suggests to obtain a reduction of the arc restriking phenomenon on the basis of a boron content of the contact members by making use of a smooth contact surface as well as of the suppression of gas impurities and their detrimental effect on the vacuum of the switch.

The claimed boron content of 0.005 to 2% by weight falls clearly into the ranges covered by D1 and D2. The application of various boron contents within this range and the testing of such alloys in respect of their suitability in vacuum switches belongs to the normal activities of the skilled person when confronted with this prior art. Claim 1 does not specify any specific boron content that might exhibit surprising properties in the sense of a non-obvious selection invention.

It follows from the foregoing considerations that Claim 1 of the opposed patent comprises only subject-matter that results from the obvious application of known technical teachings and lacks, therefore, the necessary inventive step in the sense of Article 56 EPC.

4. Maintenance of the patent on the basis of Claim 1 is, therefore, not possible.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Kiehl E. Persson