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Case Number: T 1814/06 - 3.5.02

Application Number: 01127316.6

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Title of invention:
Vacuum valve

Patentee:
MITSUBISHI DENKI KABUSHIKI KAISHA

Opponent:
SIEMENS AKTIENGESELLSCHAFT

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step (yes)"

Decisions cited:
T 0400/98, T 0308/99

Catchword:
-

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Case Number: T 1814/06 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 23 November 2009

Appellant: (Opponent)
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Representative:
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 27 July 2006 concerning maintenance of European patent No. 1251539 in amended form.

Composition of the Board:

Chairman: M. Ruggiu
Members: R. Lord
E. Lachacinski

Summary of Facts and Submissions

I. This is an appeal of the opponent against the interlocutory decision of the opposition division concerning the European patent No. 1 251 539 that, account being taken of the amendments made by the patent proprietor, the patent and the invention to which it related met the requirements of the EPC.

II. The following documents of the state of the art cited in the notice of opposition played a role in the appeal proceedings:

D3: DE-U-93 09 824
D4: DE-A-36 13 450
D5: DE-A-199 02 500
D7: DE-OS-2 036 099
D8: DE-OS-2 007 655
D13: WO-A-91/19308
D14: FR-A-1 257 305
D15: EP-A-0 747 917
D16: US-A-3 283 100
D17: US-A-3 591 742
D19: JP-A-09 320 412 (with computer-generated translation from the JPO website)

III. Oral proceedings before the board took place on 23 November 2009.

The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed.

IV. The claims of the patent as maintained by the opposition division read as follows:

"1. A vacuum valve comprising:

a vacuum vessel having an interior portion sealed by a fixed-end end plate (2) and a moving-end end plate (3) disposed at first and second end portions, respectively, of a cylindrical electrically-insulating tube (1);

a fixed electrode rod (4) secured to said fixed-end end plate (2), a fixed electrode (7) being disposed on an end portion of said fixed electrode rod (4);

a movable electrode rod (5), a movable electrode (8) capable of contacting and separating from said fixed electrode (7) being disposed on an end portion of said movable electrode rod (5); and

an electrode shield (9) secured to said electrically-insulating tube (1) and enveloping said fixed electrode (7) and said movable electrode (8), said electrode shield (9) preventing an inner wall surface of said electrically-insulating tube (1) from being polluted by a metallic vapor generated by said fixed electrode (7) and said movable electrode (8) during electric-current interruption,

characterized in that

a recess portion (8a) [sic] is formed in a central portion of a contact surface of said fixed electrode (7) only.

2. A vacuum valve comprising:

a vacuum vessel having an interior portion sealed

by a fixed-end end plate (2) and a moving-end end plate (3) disposed at first and second end portions, respectively, of a cylindrical electrically-insulating tube (1);

a fixed electrode rod (4) secured to said fixed-end end plate (2), a fixed electrode (7) being disposed on an end portion of said fixed electrode rod (4);

a movable electrode rod (5), a movable electrode (8) capable of contacting and separating from said fixed electrode (7) being disposed on an end portion of said movable electrode rod (5);

characterized in that

a fixed-end shield (9a) is secured to said fixed-end end plate (2) and envelops said fixed electrode (7) and said movable electrode (8), said fixed-end shield (9a) preventing an inner wall surface of said electrically-insulating tube (1) from being polluted by a metallic vapor generated by said fixed electrode (7) and said movable electrode (8) during electric-current interruption, and in that

a recess portion (7a) is formed in a central portion of a contact surface of said fixed electrode (7) only.

3. A vacuum valve comprising:

a vacuum vessel having an interior portion sealed by a fixed-end end plate (2) and a moving-end end plate (3) disposed at first and second end portions, respectively, of a cylindrical electrically-insulating tube (1);

a fixed electrode rod (4) secured to said fixed-end end plate (2), a fixed electrode (7) being disposed on an end portion of said fixed electrode rod (4);

a movable electrode rod (5), a movable electrode

(8) capable of contacting and separating from said fixed electrode (7) being disposed on an end portion of said movable electrode rod (5);

characterized in that

a moving-end shield (9b) is secured to said moving-end end plate (3) and envelops said fixed electrode (7) and said movable electrode (8), said moving-end shield (9b) preventing an inner wall surface of said electrically-insulating tube (1) from being polluted by a metallic vapor generated by said fixed electrode (7) and said movable electrode (8) during electric-current interruption, and in that

a recess portion (8a) is formed in a central portion of a contact surface of said movable electrode (8) only."

V. The appellant essentially argued as follows:

The document D19 disclosed a vacuum valve according to the preamble of claim 1 of the patent as maintained by the opposition division. D3 taught how to improve the current interruption performance of such a device by providing a central recess on at least one of the electrodes. The particular arrangement defined in the characterising portion of the present claim 1 represented an obvious selection of one of the three alternatives taught by D3, so that the subject-matter of the claim did not involve an inventive step. That such a selection was obvious was in line with the case law of T 400/98 (not published in OJ), as cited in OJ EPO Special Edition No. 3 of 2003, section II, I, D, 7.1. Even if this case law had not been considered to be applicable, the subject-matter of the claim would have been obvious in the light of the case law of

T 308/99 (not published in OJ), as cited in the OJ EPO Special Edition of 2004, II, I, C, 4.5, in particular since D3 disclosed the technical problems of tilting of the movable electrode and arcing to the shield. Moreover the same conclusion could have been reached by taking D3 as the starting point, and combining that document with D19. This objection could also have been based on the document D4 in place of D3, or by starting from any of the documents D13 to D17 instead of D19.

Based on similar reasoning, the subject-matter of claim 2 of the patent as maintained by the opposition division was obvious in the light of the combination of the document D5 with either D3 or D4, and the subject-matter of claim 3 was obvious in the light of the combination of either of the documents D7 and D8 with either D3 or D4.

VI. The arguments of the respondent can be summarised as follows:

The fact that D3 or D4 suggested the three options of providing a central recess on either of the two electrodes or on both of them did not render obvious the particular selections from those three options defined in the claims as maintained by the opposition division, because the selections defined in those claims led to a technical effect, namely suppressing arcing from an electrode to the shield, which was not suggested in D3, D4 or any of the other cited prior art. Thus the technical problem addressed by the claims was more specific than that indicated by the appellant. Also, although D3 disclosed both the recesses and the technical problem of arcing to the shield, it did not

disclose any link between them. In particular, the disclosure in D3 relating to the recesses was concerned only with the technical problem of preventing arcing on the central axis of the electrodes, whereas the disclosure in that document concerning arcing to the shield was in the context of the main development described in that document, namely suppressing the arcing to the shield by providing chamfered portions on the periphery of the electrodes. The argumentation of the appellant combining these different aspects of the teaching of D3 was thus based on an *ex post facto* analysis.

Reasons for the Decision

1. The appeal is admissible.

2. The novelty of the subject-matter of the claims of the patent as maintained by the opposition division is not in dispute.

3. *Inventive step (Article 56 EPC) - Claim 1*

3.1 The document D19 represents the closest prior art for the present claim 1, and describes a vacuum valve including all of the technical features of the preamble of this claim, so that the claimed vacuum valve is distinguished from the known device solely in that a recess portion is formed in a central portion of the contact surface of the fixed electrode only, whereas that of D19 does not have a recess on either electrode. This conclusion is not disputed by either party.

3.2 In order to identify the objective technical problem, it is necessary firstly to establish the technical effect arising from this difference. From the description of the patent (as granted and as maintained by the opposition division) it is apparent that the difference comprises two aspects, associated with two different effects. Firstly, provision of a recess on one of the electrodes results in displacement from the central axis of the initial arc and thus of any welding imprint (see in particular paragraph [0046], column 9, lines 6 to 14). Secondly, the selection that this one electrode should be the fixed electrode results in suppression of arcing from the edge of the recess to the shield, which would be more likely to occur if the recess were on the movable electrode, because of the combined effects of the distortion of the electric field by the edge of the recess and the inevitable sideways movement of the movable electrode (see paragraph [0047] and also paragraph [0036], sub-paragraph 2)). Thus the first aspect of the difference can be seen as addressing the technical problem of reducing welding effects, whereas the second addresses the technical problem of preventing damage to the shield.

3.3 The document D3 is at least partially concerned with both of these problems, so the skilled person would consider its teaching to be relevant. Thus it can be seen that the description of D3 on page 7, lines 18 to 27, referring to Fig. 2, addresses the technical problem of reducing welding effects due to arcing on the central axis, and does so by providing a recess in the central portion of one of the electrodes, which causes the arc generated on electrode separation to

form away from the central axis, so that magnetic effects then cause it to move, as a result of which welding would be less likely to occur. From this description it is not clear whether the electrode illustrated is the fixed or the movable one, or whether a similar recess should also be provided on the other electrode, and the corresponding claim of D3 (dependent claim 5) merely states that a recess is formed on at least one of the electrodes. Thus the document suggests three alternative implementations, namely a recess provided on the fixed electrode, or on the movable electrode, or on both.

3.4 The document D3 also discusses the issue of the sideways movement of the movable electrode (see page 2, lines 21 to 26) and the problem of arcing from an electrode to the shield (see page 3, lines 11 to 29). However, the solution to this problem described in D3 (the main invention of that document) is to provide the electrodes with a chamfered edge (see page 4, lines 1 to 6), which keeps the arc away from the electrode periphery, so that it is less likely to transfer to the shield (see page 4, lines 22 to 25). Moreover, the description of the embodiment with the central recess says nothing about any possible influence of the recess on arcing to the shield.

3.5 Thus D3 provides clear teaching concerning the first aspect of the difference identified in section 3.2 above and the corresponding technical problem, and suggests the solution of providing a central recess on at least one of the electrodes. However, as regards the second aspect of the difference, D3 merely provides various elements of relevant teaching without

suggesting the link between them, and in particular it does not suggest any link between the provision of the recess (or recesses) and the problem of arcing to the shield. Moreover it provides no teaching that the provision of a recess results in changes to the electrical field which need to be taken into account when choosing whether to use one or two recesses, and if only one, where to place that recess. Thus the board concludes that the skilled person, without hindsight, would not be able to derive from the teaching of D3 that he should select, from the three alternatives available, the one which is defined in the present claim 1.

3.6 The similar objections of lack of inventive step raised by the appellant, in which the document D17 was used as the starting point instead of D19, and in which the document D4 was used in place of D3, also do not render the subject-matter of the present claim 1 obvious, since the document D17 contains only similar teaching to D19, and since D4 contains only part of the relevant teaching of D3. The same applies also to the appellant's objections using any of the documents D13 to D16 as the basis for the preamble of the claim, because each of those documents discloses that central recesses are formed on both electrodes, whereas the appellant has provided no arguments as to why the skilled person would go against the teaching of those documents by removing one of those recesses.

3.7 The above conclusions do not diverge from the case law referred to by the appellant.

3.7.1 The appellant argued that the selection of one of the three options for the recesses (as identified in paragraph 3.3 above) would be obvious if decision T 400/98 were followed. The board is of the opinion that this decision is not applicable to the present case, since it was based on the premise that the available alternatives "*were equally promising candidates*" for solving the technical problem (see Reasons 4.4.6). In the present case, the three alternatives are only equally promising to the extent that the technical problem concerns the prevention of on-axis arcing, which is the problem addressed by providing central recesses as such, whereas the technical problem addressed by the specific selection of which electrode should be provided with the recess is that of preventing arcing to the shield, and as discussed in paragraph 3.2 above, the specific selection defined in claim 1 is superior to the other two options in this respect.

3.7.2 The appellant argued further that, even if the decision T 400/98 could not be applied, the selection as claimed would nonetheless be obvious to the skilled person, because it would result from carrying out obvious tests, in line with the decision T 308/99. The board does not find this argument convincing, since decision T 308/99 concluded that the selection was obvious because the prior art already directed the skilled person towards the claimed use, and because all that was then necessary was to carry out routine tests to confirm the expected result (see Reasons 8.3 and 8.4), whereas in the present case the prior art provides no suggestion to the skilled person that there is a link between the electrode recesses and the problem of arcing to the

shield, so does not direct him towards any tests which might lead him to make the claimed selection. For the same reason, the skilled person starting from the teaching of D3 concerning the electrodes, and combining that teaching with that of D19 concerning the shield and the other components of the vacuum valve would not arrive in an obvious manner at a device according to the present claim 1.

3.8 In summary, the board considers the objections of lack of inventive step raised by the appellant with respect to the present claim 1 to be based on an *ex post facto* analysis. Thus, having regard to the cited state of the art, the device defined by claim 1 of the patent as maintained by the opposition division is not obvious to a person skilled in the art. The board concludes therefore that the subject-matter of this claim involves an inventive step in the sense of Article 56 EPC.

4. *Inventive step (Article 56 EPC) - Claims 2 and 3*

4.1 It is not disputed that the document D5 describes a vacuum valve having all of the technical features of the present claim 2 with the exception of the feature that a recess portion is formed in a central portion of the contact surface of the fixed electrode only. The technical effects of this feature and the technical problems solved correspond almost exactly to those discussed above concerning claim 1. The only difference in this respect is that in the vacuum valve of claim 2 the shield is at the same potential as the fixed electrode, whereas in that of claim 1 the shield is at a floating potential, which would thus lie between the

potentials of the fixed and movable electrodes. Therefore in the vacuum valve of claim 2 there is no voltage difference between the shield and the fixed electrode, but a larger voltage difference between the shield and the movable electrode than in the device of claim 1, so that the considerations of the risk of arcing between the movable electrode and the shield apply even more strongly to the device of this claim. Hence the above conclusion that the subject-matter of claim 1 involves an inventive step applies also to the subject-matter of this claim.

4.2 The documents D7 and D8, which have very similar disclosure, have been cited by the appellant as representing the closest prior art for the present claim 3. Under the appellant's interpretation of those documents that the elements labelled 16 and 40 in Figs. 2 to 5 of D7 and the elements labelled 12 in Fig. 1 of D8 can be considered as shields within the meaning of this claim, the vacuum valves of each of those documents include all the technical features of the present claim 3 with the exception of the feature that a recess portion is formed in a central portion of the contact surface of the movable electrode only. Thus the arguments of the previous paragraph apply correspondingly, i.e. noting that in this case the shield is at the same potential as the movable electrode, so that the larger voltage difference is between the shield and the fixed electrode. Moreover, the elements of D7 and D8 identified by the appellant as corresponding to the shield of the claim are described in the relevant passages of those documents as having a function different from that of the shield defined in the present claim 3, since both documents

identify these elements as outer electrodes (see e.g. D7, page 7, line 21) and describe that the transfer of the arc from the central electrodes contacts to these outer electrodes is desired. Thus these documents also do not disclose a shield secured to the moving-end end plate and having the function defined in the penultimate paragraph of the present claim 3, so that this represents a further distinguishing feature of the claimed device with respect to the documents D7 and D8. The appellant has not provided any other arguments as to why the introduction of this technical feature would be obvious to the skilled person.

4.3 Therefore the board also concludes that the subject-matter of the present claims 2 and 3 involves an inventive step in the sense of Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu