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D E C I S I O N
of 13 March 2001

Case Number: T 0143/97 - 3.5.2

Application Number: 87308637.5

Publication Number: 0262937

IPC: H01H 33/66

Language of the proceedings: EN

Title of invention:
Vacuum circuit interrupter

Patentee:
Mitsubishi Denki Kabushiki Kaisha

Opponent:
Siemens AG
ABB Patent GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - denied for main and auxiliary request - bonus effect"

Decisions cited:
T 0204/83

Catchword:
-

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Case Number: T 0143/97 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 13 March 2001

Appellants:
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 19 December 1996 rejecting the oppositions filed against European patent No. 0 262 937 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. Ruggiu
B. J. Schachenmann

Summary of Facts and Submissions

I. Both opponents appealed the decision of the opposition division rejecting the oppositions filed against European patent 0 262 937.

II. During the appeal the appellants referred *inter alia* to the following prior art documents:

D6: DE-B-2 342 257 and the corresponding US patent

D6': US-A-3 777 089.

III. The respondent filed an amended claim 1 as auxiliary request at the oral proceedings held on 13 March 2001.

IV. Claim 1 of the patent in suit as granted reads as follows:

A vacuum circuit interrupter comprising a vacuum vessel (12), a pair of opposed electrodes (7, 10) in the vessel, and a tubular shield (13) in the vessel and surrounding the electrodes, the shield having a larger-diameter portion in the central region of its length, and a smaller-diameter portion in each end region of its length, with tapered transition portions between said larger and smaller-diameter portions, characterised in that the axial length L of the larger-diameter portion is not less than:
(total thickness of the two electrodes + electrode gap length +
$2 \cdot \frac{(\phi_2 - \phi_1)}{2} \cdot \tan 45°$)
where ϕ_2 is the internal diameter of the said larger-diameter portion and ϕ_1 is the electrode diameter, and the transition portions have taper angles in the range 80° to 100°.

Claim 1 of the auxiliary request reads as follows (differences with respect to granted claim 1 underlined by the Board):

A vacuum circuit interrupter comprising a vacuum vessel (12), a pair of opposed electrodes (7, 10) in the vessel, and a tubular shield (13) in the vessel and surrounding the electrodes, the shield having a larger-diameter portion in the central region of its length, and smaller-diameter end portions extending away from the larger-diameter portion, with tapered transition portions between said larger and smaller-diameter portions,
characterised in that the axial length L of the larger-diameter portion is not less than :
(total thickness of the two electrodes + electrode gap length +
$2 \cdot \frac{(\phi_2 - \phi_1)}{2} \cdot \tan 45°$)
where ϕ_2 is the internal diameter of the said larger-diameter portion and ϕ_1 is the electrode diameter, and the transition portions have taper angles in the range 80° to 100°.

V. Both appellants requested that the decision under appeal be set aside and that the patent be revoked.

VI. The arguments of the appellants in connection with documents D6 and D6' are essentially as follows:

Figure 2 of D6 showed a vacuum circuit interrupter with a tubular shield 140 having all the features of claim 1 of the opposed patent as granted, which therefore lacked novelty. In particular, it was clearly apparent from Figure 2 of D6 that the axial length of the larger-diameter portion of the shield met the condition specified in claim 1. The tubular shield had smaller-diameter portions formed by lips 141B, 142B. Figure 2

showed clearly that the portions connecting these lips to the ends of the larger-diameter portion made angles of 90° respectively with the larger-diameter portion.

Figure 1 of D6 showed a vacuum circuit interrupter having all the features of the preamble of claim 1, main or auxiliary request.

Figure 1 showed many constructional details of the interrupter, in particular the evacuation orifice, the solder at the attachment of the stationary rod 23 to the end cap 14, the attachment of the bellows 28 and its shield 37 to the movable rod 24 and the attachment of the bellows 28 to the end cap 16. Only a constructional drawing would show such precise details.

Furthermore the skilled person, who in this case would be an engineer with training in physics or electrical engineering having a long experience in the field of vacuum circuit interrupters, would recognise that Figure 1 of D6 displayed the usual proportions of a vacuum interrupter, in particular that the radial distance (T_2) between the shield and the contact electrodes was about as large as the gap between the contact electrodes in the open position. The skilled person would therefore conclude that Figure 1 had the character of a constructional drawing.

Thus, contrary to the opinion of the Opposition Division, which had misconstrued decision T 204/83 "Venturi/Charbonnages, OJ EPO 1985, 310, it was legitimate to derive dimensional relationships from Figure 1, even if this figure was a patent drawing and did not include a scale or any indication of the absolute dimensions of the interrupter.

By taking measurements from Figure 1, it would be seen that the larger-diameter portion of the shield 40 extended axially beyond the open contact electrodes 21, 22 over distances (l_1) approximately equal to the radial distance (T_2) between the contact electrodes and the larger-diameter portion of the shield. Thus the axial length of the larger-diameter portion met the condition specified in claim 1. Furthermore D6 indicated in column 8, lines 26 to 33 that the larger-diameter portion could be made longer if necessary, so that the embodiment of Figure 1 also encompassed interrupters in which l_1 is greater than T_2.

It was also obvious to the skilled person that the shoulders 46, 54 at the ends of the larger-diameter portion of the shield had to be arranged so as to follow the well-known design rule that the distance between the shield and the contact electrodes must always remain at least as large as the gap between the contact electrodes in the open condition.

The description taught that the base of the smaller-diameter portion served to intercept arc-generated particles and acted as a screen ("Prallplatte") to stop the axial progression of arc-generated particles. Thus the shoulders 46, 54 had the same function as the transition portions specified in claim 1. To fulfill this function, the shoulders had to be arranged transverse to the path of the particles and thus with a taper angle of about 90° with respect to the larger-diameter portion.

It was clear from Figure 1 of D6 that the shoulders 46, 54 made an angle of about 90° to the larger-diameter portion. This was confirmed by the description of D6, which indicated that the parts 41, 42 forming the shield 40 were "napfförmig" or "topfförmig" (pot-shaped), and the description of D6', which indicated

that these parts are cup-shaped. This wording implied that said parts had a wall and a bottom extending about perpendicular to each other.

Thus, taking into account the knowledge of the skilled person, the subject-matter of claim 1 according to either request lacked novelty or in any case did not involve an inventive step in view of Figure 1 of D6.

VII. The respondent requested that the appeal be dismissed and the patent maintained unamended (main request), or with claim 1 as filed during the oral proceedings (auxiliary request).

VIII. The arguments of the respondent regarding documents D6 and D6' can be summarised as follows:

Claim 1 as granted specified a tubular shield having a smaller-diameter portion in each end region of its length and thereby expressed that the smaller-diameter portions were part of the length of the tubular shield. The lips 141B, 142B provided at the end portions of the tubular shield of Figure 2 of D6 were arranged inside the shield and therefore could not be considered as being part of its length, so that claim 1 as granted was novel.

In any case, claim 1 of the auxiliary request specified explicitly that the smaller-diameter portions extended away from the larger-diameter portion of the tubular shield, and therefore clearly avoided any accidental anticipation by said Figure 2.

Decision T 204/83 prohibited the taking of measurements from schematic drawings. Drawings of patent documents were normally schematic because the purpose of patent drawings was simply to illustrate the invention. Thus, in the absence of any clear indication that the drawing

reflected actual dimensions of the illustrated device, it was not legitimate to take measurements from a patent drawing. Such indications were lacking in D6 so that Figure 1 thereof did not disclose relations between the dimensions of the parts of the vacuum interrupter.

The word "shoulder" had a broad meaning and did not imply a particular angle. The same could be said of the words "napfförmig", "topfförmig" and "cup-shaped" which did not imply a wall perpendicular to a flat bottom. Furthermore these words did not describe essential features of the invention of D6. If these words were important D6 would have defined them more precisely.

In a vacuum interrupter, the distance between the contact electrodes and the shield is dictated by the arc in the region around the contacts. This distance can be reduced in the region of the shield at the back of the contact electrodes. Thus the larger-diameter portion of the shield should not necessarily extend beyond the contacts for a distance (l_1) greater than the radial distance (T_2) between the contact electrodes and the shield.

D6 intended to solve the problem of disposing the larger-diameter portion of the shield as far as possible from the contact electrodes. The patent in suit solved a different problem, namely that of avoiding a reduction in the life of the vacuum interrupter due to the scattering of debris originating from erosion of the shield by the arc. None of the prior art documents addressed the problem of the patent in suit and the patentee had found experimentally that both features specified in the characterising portion of claim 1 were needed in combination to solve it. Furthermore, only a taper angle within the specific range defined in claim 1 of patent avoided the build-up

of a spike at the ends of the transition portions. Thus claim 1, main or auxiliary request, defined a selection invention which was novel and involved an inventive step.

Reasons for the Decision

1. The appeals are admissible.

2. *Novelty with respect to Figure 2 of D6*

In this case it can be left undecided whether the subject-matter of granted claim 1 lacks novelty with respect to Figure 2 of D6 because, for the following reasons, it is not considered to involve an inventive step.

3. *Inventive step*

3.1 Figure 1 of D6 illustrates a vacuum interrupter 10 with a vacuum vessel 11 formed by an insulating cylinder 12 closed by a pair of end caps (flanges) 14, 16, a pair of opposed contact electrodes 21, 22 in the vessel and a tubular shield 40 surrounding the contact electrodes, which are represented in the open position. The shield 40 has a larger-diameter portion 61 in the central region of its length and smaller diameter end portions extending away from the larger-diameter portion with transition portions 46, 54 between said larger and smaller-diameter portions. Thus this vacuum circuit interrupter comprises all the features of the preamble of claim 1, main or auxiliary request. It is to be considered as the closest prior art.

3.2 In agreement with decision T 204/83, the Board considers that, in the absence of any clear indication to the contrary, the disclosure provided by a patent drawing does not include precise dimensional relations. On the other hand, the Board considers that a patent drawing may well disclose features by itself, i.e. independently of the corresponding written description. Thus, where the situation so requires, it may be necessary to determine what is disclosed to the skilled person by the drawing itself in order to obtain a complete picture of the state of the art.

In the present case, it is clearly apparent from Figure 1 of D6 that the larger- diameter portion of the tubular shield extends beyond both electrodes for a substantial distance comparable to the gap between the contact electrodes in their open position and the transition portions make marked angles, slightly larger than 90° with the larger-diameter portion.

As explained hereafter, the Board considers that the skilled person, who is assumed to have the technical and scientific knowledge necessary to understand the invention and the prior art, would realise that these details of Figure 1 are not accidental but part of the technical information provided.

3.3 Against this background the problem to the skilled person is to dimension the vacuum interrupter of Figure 1 of D6. This problem is obvious because it can be assumed that the skilled person would consider how to implement this vacuum interrupter.

3.4 At the priority date, it was common general knowledge in the art that a minimum distance must be maintained between the shield and the contact electrodes (or the rods carrying them), this minimum distance being normally as large as the gap between the open

electrodes. This means that, with a shield of the general shape shown in Figure 1 of D6, the axial length of the larger-diameter portion must exceed a certain minimum value, so that the transition and smaller-diameter portions do not come too close to the contact electrodes. Without taking any measurements, it is apparent to the person skilled in the field of vacuum interrupters that Figure 1 of D6 shows that the radial distance between the larger diameter portion 61 and the contact electrodes 21, 22 is, as was to be expected, comparable to the gap between the open contact electrodes, and that the larger-diameter portion 61 of the shield extends beyond both contact electrodes for distances comparable to said gap. In the opinion of the Board, this means that the skilled person would consider a minimum length for the larger-diameter portion of the shield which is comparable to the value specified in claim 1 of the patent in suit. Since this value represents a minimum, it is obvious to the skilled person to consider shields having a larger-diameter portion which is longer than this minimum value. In this respect it can be noted that, as explained in column 8, lines 26 to 33 of D6, there is no difficulty in increasing the axial length of the larger-diameter portion of the shield of Figure 1 if required.

Following these considerations, the skilled person would arrive in an obvious manner at a shield with a larger-diameter portion having an axial length satisfying the condition set out in claim 1 (main or auxiliary request) of the patent in suit, i.e. L not less than the total thickness of the two electrodes + electrode gap length + ϕ_2 - ϕ_1, it being noted that tan 45° = 1.

3.5 Figure 1 of D6 further teaches that the annular shoulders 46, 54 forming the transition portions are arranged so as to intercept particles generated by the arc. For this purpose, it is clearly obvious to dispose the transition portions transverse, in particular about perpendicular, to the path of the particles.

The Board is not convinced that the words "napfförmig" and "topfförmig" used in D6 or the expression "cup-shaped" used in D6' necessarily describe structures having a wall and a bottom substantially perpendicular to the wall. However, since the particles not caught by the longer-diameter portion 61 of the shield are moving with a substantial velocity component in the axial direction of the vacuum interrupter away from the region between the contact electrodes and the shield, it would be obvious to the skilled person to dispose the transition portions at about 90° to the longitudinal axis of the vacuum interrupter and thus to the larger-diameter portion. This is confirmed by Figure 1 of D6 which, without taking any measurement, shows that the angles between the transition portions and the larger-diameter portions are both well marked and only slightly larger than 90°.

Thus it is obvious to the skilled person to provide the transition portion of the tubular shield shown in Figure 1 of D6 with a taper angle falling within the range specified in claim 1 of the patent.

3.6 The patent proprietor has argued that the particular range for the taper angle specified in claim 1 avoids the build-up of a spike while angles outside this range would not provide this effect. The Board considers that, since angles in the claimed range are obvious to

the skilled person for other reasons, this effect only constitutes a bonus and does not make it less obvious to have a taper angle within the range specified in the claim.

The problem of the possible erosion of the shield by the arc is not discussed in D6. However, as explained above, the Board considers that there are other reasons that make it obvious to dimension the tubular shield of Figure 1 of D6 so as to arrive within the scope of claim 1.

For similar reasons, the claimed subject-matter does not qualify as a selection invention because it substantially provides the same effect as the prior art, i.e. intercepting particles moving within the vacuum interrupter with a substantial component in the axial direction of the vacuum interrupter.

4. For these reasons the Board has come to the conclusion that the subject-matter of claim 1, main or auxiliary request, is obvious to a skilled person. Thus the invention does not meet the requirement of Article 52(1) EPC as the subject-matter of the independent claim is not considered to involve an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

M. Hörnell W. J. L. Wheeler