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D E C I S I O N
of 12 December 2000

Case Number: T 0520/96 - 3.4.1

Application Number: 88120326.9

Publication Number: 0372106

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Language of the proceedings: EN

Title of invention:

Surge arrester

Patentee:

ASEA BROWN BOVERI AB

Opponent:

Siemens AG

Headword:

Surge arrester/ASEA BROWN BOVERI AB

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (no)"

Decisions cited:

-

Catchword:



Case Number: T 0520/96 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 12 December 2000

Appellant: Siemens AG
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Representative: -

Respondent: ASEA BROWN BOVERI AB
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Representative: Boecker, Joachim, Dr.-Ing.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 28 March 1996
rejecting the opposition filed against European
patent No. 0 372 106 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: G. Davies
Members: H. K. Wolfrum
U. G. O. Himmler

Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal against the decision of the opposition division, dispatched on 28 March 1996, rejecting the opposition against European patent No. 0 372 106. The notice of appeal was received on 31 May 1996, the prescribed fee being paid on the same day. The statement setting out the grounds of appeal was received on 12 July 1996.
- II. Opposition had been filed against the patent as a whole and based on Article 100(a) together with Articles 52(1) and 56 EPC.
- III. Oral proceedings before the Board of Appeal were held on 12 December 2000.
- IV. The appellant requested that the decision under appeal be set aside and that the patent be revoked. Reference was specifically made to the following documents:
- E1: EP-A-0 230 103,
E2: DE-A-30 02 014, and
E6: EP-A-0 233 022.
- V. The respondent requested that the appeal be dismissed and that the patent be maintained on the basis of claims 1 to 6 filed on 13 November 2000, with the description as granted, subject to the insertion in column 1, between lines 40 and 41, of new page 1 filed on 13 November 2000, and the Figures as granted.
- VI. **Claim 1** on file reads as follows:

"1. A surge arrester comprising a plurality of

cylindrical arrester elements (11) of metal oxide varistor material, which are arranged one after the other in the axial direction of the arrester elements between two end electrodes (13) in an elongated protective housing (10) of Polyäthylen, which is shrunk onto the arrester elements arranged one after the other, thereby making contact with the envelope surface of the arrester elements and being resistant to deformation under the operating conditions for the surge arrester the end surfaces of the arrester elements being perpendicular to the axial direction of the arrester elements and provided with electrodes (11a) secured to said arrester elements,
c h a r a c t e r i z e d i n

that the protective housing consists of cross-linked HD polyethylene,

that heat-absorbing bodies (12) of metallic material are interposed between the arrester elements,

that the protective housing (19) has a wall thickness larger than 2 mm,

that the end electrodes (13) are provided with annular recesses (14) or projections, into which or between which parts of the protective housing (10) project,

and that no additional means are provided which extend from one end to the other end of the stack of arrester elements and interposed heat-absorbing bodies for providing a axial force on said stack."

VII. The opposition division, in the "Facts and Submissions" of its decision, referred to documents D1 to D5, but

held that the subject-matter of patent claim 1 was inventive because it was not rendered obvious by the teaching given by document E1 when combined with that of document SU-A-853 728 (numbered D1 and D5 respectively in the opposition procedure). The opposition division did not comment on the teachings of further documents cited in the statement of opposition (referred to as documents D2, D3 and D4, and including aforementioned document E2) nor did it comment on the prior art according to document E6 which had been cited as D2 during pre-grant examination.

- VIII. The appellant argued that the subject-matter of claim 1 was rendered obvious by the teaching of document E2 in combination with that of documents E1 and E6.

Setting out from a surge arrester known from E2, which constituted the closest prior art, and wishing to improve the mechanical stability thereof, the skilled person had to reconcile the desire for an increased stability of the housing with the requirement for sufficient heat dissipation. The skilled person was aware of the fact that increasing the wall thickness of the housing in order to improve its stability included the risk of an overheating of the surge arrester during operation. In this situation, it would have been obvious for the skilled person to resort to the solution offered by document E6 of interposing heat-absorbing bodies of metallic material between the arrester elements. Moreover, knowing from E2 to use heat-recoverable polyethylene for the housing, it would have been obvious to choose cross-linked HD polyethylene, because this material was known from document E1 as being a suitable material for those parts of the housing of a surge arrester which held the

stack of arrester elements together by providing an axial force on the stack.

IX. The respondent disputed the appellant's view, relying on the following arguments:

Even a combination of the teachings of the three documents E1, E2 and E6 did not result in a surge arrester showing all the features comprised in claim 1 on file. In particular, none of the cited documents showed a housing having a wall thickness of more than 2 mm in direct contact with the envelope surface of the arrester elements. Moreover, the cited prior art did not teach to use cross-linked HD polyethylene for such a housing completely enclosing the stack of arrester elements.

Document E1 taught away from the claimed invention because of its complicated structure. The stack of arrester elements, which did not include heat-absorbing bodies, was held together by means separate from the housing, such as rods, so that the housing did not even come in contact with the envelope surface of the stack. Moreover, E1 did not teach to use cross-linked high density (HD) polyethylene for the housing. The housing was formed from any heat-recoverable polymer and even the material used for the separate means, ultra high molecular weight polyethylene, was not identical to the cross-linked HD polyethylene specified in claim 1 under consideration, as was evident from document US-A-3 929 939, relied on by the Board in the summons to oral proceedings as evidence for the conventional terminology concerning polyethylene materials. Finally, the skilled person would have learned from page 2, first paragraph, of E1 that the housing had to be thin-

walled so as to be heat-recoverable.

Document E2 did not have a housing of a high mechanical stability and did not hint at the use of cross-linked HD polyethylene for the housing, either. Even the largest wall thickness envisaged in E2 for the housing was 33% smaller than the minimum value required according to the patent. Moreover, E2 did not disclose annular recesses or projections with which the shrunk housing would form a sufficiently strong connection so as to generate the required axial forces on the stack. Although the drawings in E2 indicated some undulations at the periphery of the end electrodes, these undulations, for which no corresponding explanation was to be found in the description, could not be compared to annular recesses within the meaning of claim 1 on file. On the contrary, it was apparent from E2 that the required axial forces were generated by parts of the housing extending onto the axial end surfaces of the electrodes. Finally, the incidental reference to conductive interlayers in the stack of arrester elements was not to be considered as a teaching for the provision of heat-absorbing bodies.

Document E6 also taught away from the patent. Although the arrester according to E6 had heat sinks provided between the arrester elements, it required a structure of the housing which was completely different from that of the patent. The polyethylene housing shown in E6 was not in immediate contact with the stack of arrester elements and did not exert axial forces on the stack. The stack was rather held together by a shell of glass-reinforced plastics tightly bonded to the envelope surface of the stack. The shell had to protect the polyethylene housing and to serve as a thermal barrier

between the arrester elements and the housing.

In summary, the recognition that the provision of heat sinks in a surge arrester allowed to increase the wall thickness of the housing was not rendered obvious from the cited prior art. In contrast to the prior art, the surge arrester according to the invention could tolerate temperatures in its interior which even softened the inner regions of the housing as long as the outer regions of the housing remained sufficiently cool and rigid.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.
2. *Amendments*

Claim 1 on file combines the features of patent claims 1 and 4. Moreover, the preamble is modified to take account of the prior art according to document E2. Finally, a statement derived from the embodiments is added to the effect that the protective housing is the sole means for providing an axial force on the stack of arrester elements and interposed heat-absorbing bodies.

Dependent claims 2 to 6 correspond to claims 2, 3 and 5 to 7 as granted, respectively.

The Board is thus satisfied that, for the purpose of this decision, the proposed amendments comply with the requirements of Articles 123(2) and 123(3) EPC.

3. *Inventive step (Articles 52(1) and 56 EPC)*

3.1 Document E2 (cf. in particular claims 1, 2 and 4; Figures 1-3, 5 and 6; page 7, third and fourth paragraph; page 8, third paragraph; page 9, second paragraph; page 10, second and third paragraph; page 11, fifth paragraph; and page 14, first and fourth paragraph) is considered the closest prior art, representing a surge arrester which shows all features comprised in the preamble of claim 1 under consideration.

Moreover, the housing of heat-recoverable polyethylene tightly shrunk onto the stack of arrester elements and end electrodes is the sole means which exerts the required axial force on the stack for holding it together. In this context, Figures 1, 3, 5 and 6 of E2 show undulations in the cross-sectional drawings of the end electrodes indicating annular recesses formed in the envelope surface of these electrodes. The housing is shown to conform with these recesses which consistently appear in the drawings whenever an end electrode is shown. Although the recesses are not explicitly referred to in the description of E2, it is stated on page 11, fifth paragraph that the housing would tightly enclose the envelope surface of the end electrodes. The Board has thus no doubt that a skilled reader of E2 would have taken note of the recesses from the drawings and would have understood their function as a means for supporting a tight anchoring of the housing to the stack of arrester elements. Therefore, the Board cannot detect a relevant difference between annular recesses as defined in claim 1 under consideration and those disclosed by the drawings of document E2.

Furthermore, on page 15, last paragraph, of E2 an indication is given as to the provision of interlayers of electrically conductive material between the individual arrester elements. The interlayers should possess the same shape as the varistor elements and serve for the purpose of adapting the length of the surge arrester to a required value. In this respect, it has to be assumed that interlayers would have to possess a significant thickness in order to be useful for adjusting the length of the arrester. Moreover, given the fact that the interlayers are formed of a conductive material, they would inherently possess a noticeable capability for heat absorption. Therefore, the Board considers the reference in E2 to conductive interlayers more than an accidental coincidence with heat-absorbing bodies within the meaning of claim 1 on file.

3.2 Hence, the subject-matter of claim 1 under consideration differs from the surge arrester according to E2

- (a) by the choice of cross-linked HD polyethylene for the heat-recoverable polyethylene;
- (b) by the choice of a wall thickness larger than 2 mm for the protective housing, whereas E2 contemplates a range of 0.5 to 1.5 mm;
- (c) and by the recognition that conductive interlayers between the arrester elements, when made of metallic material, can serve as efficient heat-absorbing bodies.

3.3 The objective problem associated with this difference

may be seen in the quest for a housing material which is capable of generating the axial compression forces required for holding together the stack of arrester elements and in the desire to improve the mechanical and thermal stability of the housing.

- 3.4 A skilled person entrusted with the development and manufacture of surge arresters would have been routinely faced with the first aspect of the aforementioned problem. In this context, document E1 (cf. claim 3 in combination with page 5, second paragraph and page 6, second paragraph) would have offered cross-linked ultra high molecular weight polyethylene (having a molecular weight greater than about 3 million) as a material of choice for those parts of the arrester housing which have to provide an axial force on the stack of arrester elements. Relying on the generally held view of experts as evidenced by document US-A-3 929 939 (cf. column 1, lines 37-40), that "*high density polyethylene having a weight average molecular weight of above 1.5 million ... is called ultrahigh molecular weight polyethylene*", the Board considers the cross-linked heat-recoverable polyethylene material known from E1 to be identical to cross-linked HD polyethylene within the meaning of claim 1 on file.

The respondent contested this finding by interpreting the above citation from US-A-3 929 939 in combination with the further information in column 1, lines 40-42, "*essentially linear in structure, it has some properties superior to those of linear high density polyethylene of lower molecular weight*" as evidence for the fact that, in distinction to HD polyethylene, an ultra high molecular weight polyethylene was linear and

hence not cross-linked. The Board considers this submission to be based on a misinterpretation of the cited information. This is immediately apparent from the fact that the term "linear" is used in the aforementioned citation also for specifying "high density polyethylene". Thus, if the respondent's argument were correct, HD polyethylene referred to in claim 1 on file could not be cross-linked, either. The Board has thus no doubt that the attributes "linear" and "cross-linked" do not distinguish between HD polyethylene and ultrahigh molecular weight polyethylene but refer to different physical phases of both these materials. In this context, the teaching of E1, stating in the second paragraph of page 6 that "*the polymeric material may be cross-linked at any stage in its production that will enhance the desired dimensional recoverability*", leaves no doubt that the heat-recoverable polyethylene material to be used in surge arresters has to be a cross-linked material.

- 3.5 As regards the aspect of improving the mechanical and thermal stability of the housing, this has to be regarded as a routine task in designing surge arresters. Housings of heat-recoverable polymeric material have been known to inherently possess less mechanical strength than those of ceramic material (cf. E1, page 2, first paragraph). Nevertheless, heat-recoverable polymers such as polyethylene are preferred because of their low weight and the fact that the shrunk housing eliminates the risk of air gaps at the surface of the arrester elements which could reduce the reliability of operation (cf. E1, page 4, second paragraph; and E2, page 5, last paragraph to page 6, first paragraph).

A straightforward option for increasing the strength of a polyethylene housing would have been to increase the wall thickness (cf. E2, page 7, last paragraph). An increase of the wall thickness, however, impairs heat dissipation through the wall. Hence, in designing a polyethylene housing, the skilled person would have had to find a compromise between these conflicting requirements.

In this context, the skilled person would have been aware of document E6 (cf. Figure 1 and column 8, lines 17-29) which shows a surge arrester with a heat shrink polymer housing having metallic discs or blocks arranged between the arrester elements, which blocks serve the dual purpose of forming heat sinks and of adjusting the required length of the arrester. Between the heat shrink housing and the stack of blocks and arrester elements, a glass reinforced plastics shell is provided for the purpose of holding the stack together and of forming a thermal barrier between the stack and the polymer housing. In particular from the latter function of the plastics shell it is apparent that, due to the presence of the heat sinks, heat can be stored within the stack and need not be dissipated through the wall of the heat shrink housing.

Given the fact that the conductive interlayers in the stack of arrester elements according to E2 and the heat sink blocks according to E6 have in common the function of adjusting the length of the surge arrester, the skilled person would have readily recognized that the interlayers in the arrester of E2, in particular when formed of metal, would be capable of absorbing heat to such an extent that the requirement for heat dissipation through the wall of the housing becomes

relaxed. Having gained such insight from E6, it would have been obvious for the skilled person that for a surge arrester of the structure shown by E2 the compromise between wall thickness and heat dissipation can be shifted towards an increase of the former. In this context, the mere fact that in the specific embodiment according to E2 another compromise in favour of a lower wall thickness was found does not prove a prejudice against wall thicknesses above 2 mm.

- 3.6 For these reasons, no exercise of inventive step would have been required for the skilled person to devise a surge arrester according to claim 1 under consideration.

The respondent's request thus does not comply with the requirements of Articles 52(1) and 56 EPC having regard to inventive step.

Order

For these reasons it is decided that:

The decision of the opposition division is set aside.

The patent is revoked.

The Registrar:

The Chairman:

R. Schumacher

G. Davies