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D E C I S I O N
of 21 December 1999

Case Number: T 0205/98 - 3.5.2

Application Number: 92100381.0

Publication Number: 0495415

IPC: H02M 7/10

Language of the proceedings: EN

Title of invention:
Valve stack for high voltages

Patentee:
Asea Brown Boveri AB

Opponent:
Siemens AG

Headword:
-

Relevant legal provisions:
EPC Art. 56, 123(2), (3)

Keyword:
"Inventive step - yes, after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0205/98 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 21 December 1999

Appellant: (Opponent)
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Postfach 22 16 34
80506 München (DE)

Representative:
-

Respondent: (Proprietor of the patent)
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Representative:
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Decision under appeal:
Interlocutory decision of the Opposition Division of the European Patent Office posted 30 December 1997 concerning maintenance of European patent No. 0 495 415 in amended form.

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: A. G. Hagenbucher
B. J. Schachenmann

Summary of Facts and Submissions

I. The appellant filed an opposition against European patent No. 495 415 and now contests the interlocutory decision of the opposition division to maintain the patent in amended form on the basis of the claims filed in oral proceedings on 9 December 1997.

II. The following documents cited in support of the opposition have been discussed during the present appeal proceedings:

Da: DE-C-2 211 268,

Db: DE-C-865 490,

Dc: "Siemens Power Engineering", vol. II, No. 12, December 1980, pages 348 to 351,

Dd: Publication No. DSI 1286 83E, Konsortium Gleichstromkupplung Österreich "HVDC Back-to-Back Tie Duernrohr", pages 1 to 7,

De: Siemens publication "Thyristor Converters for Static Compensators, Order No. A19100-E124-A960-X-7600, 112494 SD 12861.

No publication date has been given for documents Dd and De, but their prior publication has not been disputed by the respondent.

III. Oral proceedings were held before the Board on 21 December 1999, during which the respondent filed an amended claim 1.

Claim 1 now reads as follows:

"Valve stack for high voltage converter valves, wherein the valve stack (2) is divided into a number of floors (4) located one above the other, each floor (4) comprising a number of electrically interconnected valve modules (5) including valves with associated auxiliary equipment, wherein the valve stack (2) is divided along a substantially vertical section into two stack portions separated by a vertically extending centre shaft (6), c h a r a c t e r i z e d in that at least between two adjacent floors (4) between the vertically adjacent valve modules (5) individual substantially horizontal fire screens (8) are arranged which do not contact each other."

Claims 2 to 8 are dependent on claim 1.

IV. The appellant argued as follows:

The subject-matter of claim 1 was not inventive because fire screens for blocking the spread of fire were generally known and easily applicable in any given situation. The problem of preventing fire spread in the valve stack defined in the preamble of claim 1 was just a routine consideration. Document Da disclosed a plate between two vertically stacked electric modules, which plate acted mainly as a duct for cooling air, but also as a fire screen. This document underlined the generally known use of fire walls in electric installations in order to inhibit the spread of fire from one space to another one, independently of the actual stack design. Fire could result from incorrect functioning of a component leading to excessive heat,

regardless of the voltage rating. Fire protection was therefore mainly a cooling problem. Da referred to Db which described a stack of dry rectifier plates. Several rectifier elements were arranged together to form a valve group. There was a chimney-like space between two vertical columns of valve groups. As an integral part of each valve group an L-shaped air guide sheet was attached to the lower part of the respective valve group. The air guide shield had no sharp edges and was made from heat insulating material or metal plates with interspace. Falling parts or liquids could be collected by these sheets and led to the outside. Hence, the prior art encouraged the use of such screens in a valve stack as defined in the preamble of claim 1. The high voltages used in a valve stack would not create a prejudice against the use of fire screens because a later installation of screens in existing stacks was not possible anyway. Screens could always be provided in connection with a new stack design. It had to be considered in this context, that in view of the sub-division of a stack into several floors and valve modules, adjacent valve modules were subjected only to a fraction of the total high voltage. A person skilled in the art recognizing the danger of fire was in a position to include fire screens in the planning process. The water cooled stack solutions in documents Dc, Dd and De had leakage water troughs below valve modules, as shown in the drawings (see Dc, Figure 6; Dd, Figure 4; De, Figure 6) and served also as fire screens even though this was not expressly mentioned. Dd showed on its front page centre shafts.

V. The respondent's arguments may be summarized as follows:

Only documents Dc, Dd and De concerned valve stacks which were in any way similar to the valve stack defined in the preamble of claim 1. They did not have a centre shaft, however. Dc depicted in Figure 5 a horizontal construction with a maximum of three floors. The construction shown in Figure 5 of Dd was closer to the stack described in the preamble of claim 1 but the construction was not self-supporting. The valve structure illustrated in Figure 7 of De had only two floors. Hence, none of documents Dc, Dd and De disclosed all the features in the preamble of claim 1. The patent proprietor conceded, however, that apart from the fire screens, a valve stack as shown in Figure 1 of the patent in suit and defined in the preamble of claim 1 had been state of the art since the 70's. Regarding document Dd the appellant had not shown that there was a closed trough below the module depicted in Figure 4. On the contrary, the parts referred to were open assembly frames. Moreover, metal walls such as known from Da were not fire screens because they could become glowing hot. Fire screens should be heat conducting and not burnable.

Da and Db concerned a field which was different from that of the claimed subject-matter. The patent in suit concerned an arrangement which prevented the spread of an existing fire. In contrast thereto, Da concerned a cooling system for electric equipment with sliding racks. It was only mentioned that a sliding rack with partitions and variably inclined metal walls had the obvious effect that it prevented the intrusion of flames or burning particles from one sliding rack with components to the next one. Such a by-product of a sliding rack for guiding the cooling air in a cooling

system with forced convection for small hand-held low-voltage sliding racks did not suggest the idea of providing a valve stack as described in the preamble of claim 1 with individual substantially horizontal fire screens between vertically adjacent floors between the vertically adjacent valve modules, which fire screens did not contact each other. Document Da did not show a solution of a general technical problem in a neighboring field because it did not describe how the spread of fire could be prevented in general. Document Da mainly concerned a specific cooling system for small electric equipment with closed walls. The described solution tried to avoid too high a temperature in order to ensure the correct functioning of the electric equipment. The invention, however, concerned a huge relatively open valve stack for very high voltages and currents. The high voltage converter valve stack of the present invention could not operate with hermetically closed walls as in Da because the necessary capacitors required air cooling without distorting the electrical field. Document Db concerned only air cooling and did not suggest the use of fire protection material. Only dry rectifier plates were cooled which could not burn. There was nothing inflammable, so the problem underlying the present invention did not arise.

VI. The appellant (opponent) requested that the decision under appeal be set aside and that the European patent No. 495 415 be revoked.

VII. The respondent (patentee) requested that the patent be maintained as amended in the following version:

- claim 1 filed during the oral proceedings;

- claims 2 to 8, description and drawings as maintained by the opposition division.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

Claim 1 has been restricted with respect to claim 1 as granted and claim 1 as amended during the opposition proceedings by specifying that "at least between two adjacent floors between the vertically adjacent valve modules individual substantially horizontal fire screens are arranged which do not contact each other". This arrangement is disclosed in column 2, line 46 to column 3, line 3 of the patent specification (corresponding to page 4, lines 12 to 26 of the description as originally filed) in connection with Figure 1. The amendments better specify the arrangement of the fire screens, in line with the respondent's arguments. The present amended version of the patent complies with the requirements of Article 123(2), (3) EPC.

3. *Novelty*

The novelty of the claimed subject-matter is not in dispute.

4. *Inventive step*

4.1 Closest prior art and problem to be solved.

The respondent declared that valve stacks for high voltages according to the preamble of claim 1 have been state of the art since the beginning of the 70's, and that if the fire screens were taken away, Figure 1 of the patent specification would represent such prior art. In view of this, it need not be decided whether documents Dc, Dd and De show all the features in the preamble of claim 1 or not. It is observed, however, that a valve stack with a vertically extending centre shaft can only be found in document Dd (Figure 5 and cover picture) but not in documents Dc and De. It is also noted that the resistor module shown in Figure 4 of Dd is not mounted on a trough-like plate but on a relatively open frame base plate which could heat up and ignite oil on the upper side of the plate. Nothing is said there about a leakage water trough or a fire screen.

Starting from the prior art acknowledged by the patentee in the preamble of claim 1, the problem addressed by the present invention is to develop a valve stack for high voltages in which the spread of fire from one valve module towards another valve module is largely prevented.

It is noted that the respondent's argument that the solution in document Dd lacks an independent self-supporting structure in contrast to the patent in suit does not appear to have much relevance in view of the explanation in column 2, lines 42 to 44 of the present

patent specification that stand 1 for valve stack 2 is intended to be suspended by means of insulators 3 from the roof of the valve hall.

4.2 This problem is solved by the features in claim 1.

According to claim 1, the individual substantially horizontal fire screens are arranged between vertically adjacent valve modules between two adjacent floors and thus can protect the lower module from falling burning matter and protect the higher valve module from rising flames. Since the fire screens do not contact each other, they leave space between horizontally adjacent screens to allow air cooling of the necessary capacitors. In view of the limited extension of the fire screens, a large distortion of the prevailing electric field is avoided. The fact that the screens are "substantially horizontal" limits the risk of voltage breakdown due to their introduction into the electrical field between two modules.

4.3 Document Da is the only document which mentions the effect of blocking the spread of fire by means of screens. However, whereas the invention is concerned with a valve stack for high voltage converter valves which requires sufficient distance between vertically and horizontally adjacent valve modules in view of the very high field strength and space for the water cooling of the valve modules and for air cooling of the capacitors, document Da concerns a closed desktop rack with cubicles for housing electronic equipment such as printed circuit cards, which are arranged on sliding racks or drawers. Da discloses a cooling system which is hermetically closed. Between two vertically adjacent

sliding racks with electronic equipment there is an additional type of sliding rack smaller in vertical extension and comprising only a sloped partition, which serves to direct cooling air to an associated sliding rack from one closed air channel 24a and then to another closed channel 24b on the other side of the rack. Neither this specific solution of document Da for racks with closed walls for small voltage components nor the general knowledge that a spread of fire is normally prevented by fire screens, hint at the claimed solution of the problem "developing a valve stack for high voltages in which the spread of fire from one valve module towards another valve module is largely prevented" because in the case of high voltage converter valve stacks, nothing must be done which would interfere with the cooling of the necessary capacitors or provoke discharges by distorting the high electrical fields prevailing there. The claimed solution allows for the necessary free space which is not required for the solution in document Da.

4.4 Document Da refers to document Db. Db, however, is only concerned with a cooling system for valve groups built-up of dry rectifier plates. Groups of valves are arranged on top of each other in two vertical columns. Between the two columns there is a chimney-like space. An S-shaped inclined air guide sheet is attached to the bottom part of each valve group and extends over the whole cross-sectional area of the column. The valves do not have individual air guide sheets. Since document Db does not mention means for preventing the spread of fire and does not mention individual air guide sheets, the person skilled in the art would not find any incentive there for the solution of the problem

underlying the present invention.

4.5 Since documents Dc, Dd and De describe only valve stacks without fire screens, document Db does not concern a valve stack for high voltage converter valves and does not mention fire screens, and document Da concerns only small desktop racks with closed cubicles for low voltage equipment unrelated to the field of HV converter stacks, the cited prior art cannot render the claimed solution obvious. Therefore, the subject-matter of claim 1 involves an inventive step within the meaning of Article 56 EPC.

5. In the judgement of the Board, independent claim 1 together with dependent claims 2 to 8 are allowable. The patent can be maintained in the amended form requested by the respondent.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in the following version:

   - claim 1 filed during the oral proceedings.

   - claims 2 to 8, description and drawings as maintained by the Opposition Division.

The Registrar: The Chairman:

M. Kiehl W. J. L. Wheeler