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**Datasheet for the decision
of 16 March 2023**

Case Number: T 0665/19 - 3.5.02

Application Number: 12156390.2

Publication Number: 2631104

IPC: B60L15/00, B60L15/20, B60L3/00

Language of the proceedings: EN

Title of invention:
DC-link decoupling circuit for parallel inverters

Patent Proprietor:
ALSTOM Transport Technologies

Opponent:
Siemens Aktiengesellschaft

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
Novelty - (yes)
Inventive step - (yes)



Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0665/19 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 16 March 2023

Appellant: Siemens Aktiengesellschaft
(Opponent) Werner-von-Siemens-Straße 1
80333 München (DE)

Representative: Siemens Patent Attorneys
Postfach 22 16 34
80506 München (DE)

Respondent: ALSTOM Transport Technologies
(Patent Proprietor) 48, rue Albert Dhalenne
93400 Saint-Ouen (FR)

Representative: Karaghiosoff, Giorgio Alessandro
c/o Praxi Intellectual Property S.p.A. - Savona
Via F. Baracca 1R, 4° piano
"Il Gabbiano"
17100 Savona (IT)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
4 January 2019 concerning maintenance of the
European Patent No. 2631104 in amended form.**

Composition of the Board:

Chairman R. Lord
Members: G. Flyng
R. Cramer

Summary of Facts and Submissions

- I. The opponent appealed against the interlocutory decision of the opposition division with respect to European patent no. 2 631 104, with which it was found that the patent in the form of the sole request, referred to as auxiliary request 1, fulfilled the requirements of the EPC.
- II. In the contested decision, the opposition division found that the subject-matter of claim 1 of auxiliary request 1 (referred to hereinafter as "claim 1") was not known from, or rendered obvious by, the prior art document E1 (DE 10 2007 006 840 B3).
- III. Claim 1 reads as follows:
- "1. DC-link decoupling circuit (12) in combination with two inverters (9) which are connected in parallel to a common DC power supply line (11) each inverter driving one different traction motor (2), switch means (16) being provided for each of said two inverters, for separating the corresponding inverter from said power supply line in case of failure,
- the said DC-link decoupling circuit is *[sic]* provided with resonance oscillation attenuating/damping means in the form of a resistor-inductor filter (13,17)
- and in that *[sic]* it includes an inductor (13) for each branch of the power supply line connecting one of the inverters, which inductor is connected in series between said common power supply line and said inverter and

characterized in that a resistor (17) is connected in parallel to said inductors and in parallel to the inputs of said two inverters, and connects the two branches connecting the two inverters with each other."

- IV. Oral proceedings before the Board were held on 16 March 2023.
- V. The appellant (opponent) requested that the decision under appeal be set aside and that the patent be revoked in its entirety.
- VI. The respondent (patent proprietor) requested that the appeal be rejected (i.e. dismissed).
- VII. The appellant's submissions may be summarised as follows:

The appellant made reference to, and upheld, the arguments made in the first-instance opposition proceedings.

Addressing the contested decision, the appellant maintained that the subject-matter of claim 1 was not novel over document E1, or at least did not involve an inventive step in view of document E1 and the common general knowledge of the skilled person.

The appellant argued that document E1 disclosed all of the features of claim 1, including its characterising feature.

According to the appellant, E1 showed a damping element used to decouple two intermediate circuits in order to differentiate between desired low-frequency currents

and undesired high-frequency currents. The high-frequency currents were also damped. For this purpose, E1 provided a path with high inductance (figure 6, 62) and a path with low inductance and high damping resistance (figure 6, 64), giving exemplary values for inductance and resistance. From this, the skilled person would read that there was a path characterised by inductive behaviour and a path characterised by resistive behaviour (cf. E1, [0010] and [0023]).

According to the appellant, it was irrelevant whether the equivalent circuit diagram of figure 6 of E1 disclosed two attenuating elements, each arranged between one of the converters and the absorption circuit ("Saugkreis"). An absorption circuit, frequently present in a traction converter, was not provided for in the patent in suit. Thus, it was obvious for the person skilled in the art to use only one damping element, as this already ensured a symmetrical arrangement with respect to the two converters.

Even if the person skilled in the art would not come up with the idea of replacing the two damping elements of E1 with a single damping element, these two inductances and the two resistors had no special effect. In an intermediate circuit such as that of the patent in suit, i.e. without an absorption circuit and auxiliary converter as disclosed in E1 (cf. E1, figure 1, 26 and 20), there were none of the vertical current paths shown in figures 1 and 6 of E1, which could be traversed by the current i_{CS} or i_{CH} . The two damping elements then had the same current flowing through them and they could be easily combined into one element. In other words, the two resistances and the two

inductances of E1 were equivalent to the one resistance and inductance of the patent in suit.

Even if the skilled person would not think of replacing the two resistors and the two inductors by one resistor and one inductor, the embodiment of E1 was still within the scope of protection of claim 1. Claim 1 recited "a resistor". This wording was not restricted to "exactly one resistor" and thus also included a plurality of resistors. Therefore, for this reason alone, claim 1 could not be regarded as new.

Even if the damping circuits through which the same current flowed were not assumed to be equivalent to one damping circuit, it is obvious to the person skilled in the art to simplify a series circuit of two resistors or two inductors to one resistor or one inductor respectively.

In the oral proceedings, the appellant argued that figure 6 of E1 showed the schematic circuit of an arrangement with two converters 2, 4, that were connected by the damping element depicted in figure 5. The damping element of figure 5 consisted of two opposed high-resistance/low-inductance stainless steel busbars 46, 48 and two low-resistance/high-inductance copper coils 50, 52. Each copper coil was connected in parallel to a respective stainless steel busbar. According to the appellant, the skilled person would realise that in some implementations the absorption circuit 26 and auxiliary inverter 18 disclosed in figure 6 could be dispensed with, and that in the absence of any connections between the series-connected parts of the damping element, they could be simplified to a single part comprising two series-connected low-resistance/high-inductance copper coils 50, 52

mounted on and connected in parallel to a single high-resistance/low-inductance stainless steel busbar.

For these reasons, the subject-matter of claim 1 was not based on an inventive step, within the meaning of Article 56 EPC, over E1 in combination with the common general knowledge of the person skilled in the art.

VIII. The respondent's submissions may be summarised as follows:

The respondent maintained the arguments in favour of patentability of the opposed patent which were made in the opposition proceedings.

In their detailed written submissions, the respondent submitted that the appellant's arguments were based on an *ex post facto* analysis, which transformed the technical content disclosed in E1 to an interpretation which seemed equivalent to the matter claimed.

As regards the appellant's argument that the claimed feature "a resistor" could be interpreted as a plurality of resistors, the respondent submitted that the application only referred to the resistor as a single element and concurred with the opposition division's finding that this feature had to be interpreted as "one resistor".

Making reference to the reasoning of the opposition division in paragraphs 9.2 and 9.3 of the contested decision, the respondent also submitted that document E1 could not lead to a circuit configured according to claim 1 and that trying to modify the configuration of the circuits according to figures 1, 5 and 6 of E1 the circuit obtained was not the same as that defined in

claim 1. The respondent used a graphical comparison in an attempt to demonstrate that the substitution of the resistive components of E1 by only one resistive component, integrating in an equivalent manner the resistive components in E1, would lead to a profound modification of the configuration of the circuit. The respondent submitted that E1 disclosed in figure 5 a construction that consisted of two stainless steel busbars representing one resistance each. These busbars were arranged in parallel to a copper inductance each arranged in particular manner and it was difficult to see how the two busbars could be combined into one resistive element without completely changing the composition.

Furthermore, the respondent argued that the circuit diagrams of figures 1 and 5 of document E1 showed a common point between the two damping elements. This common point was connected to both resistive and both inductive branches of the damping elements. In this configuration exchanging the two resistors by one would remove the common point and substantially alter the circuit.

In the oral proceedings the respondent argued that figure 6 appeared to show two of the filter elements as depicted in figure 5, one on each side of the connection point 14 and submitted that it was not evident that the skilled person would adapt such a complex arrangement to react the claimed subject-matter.

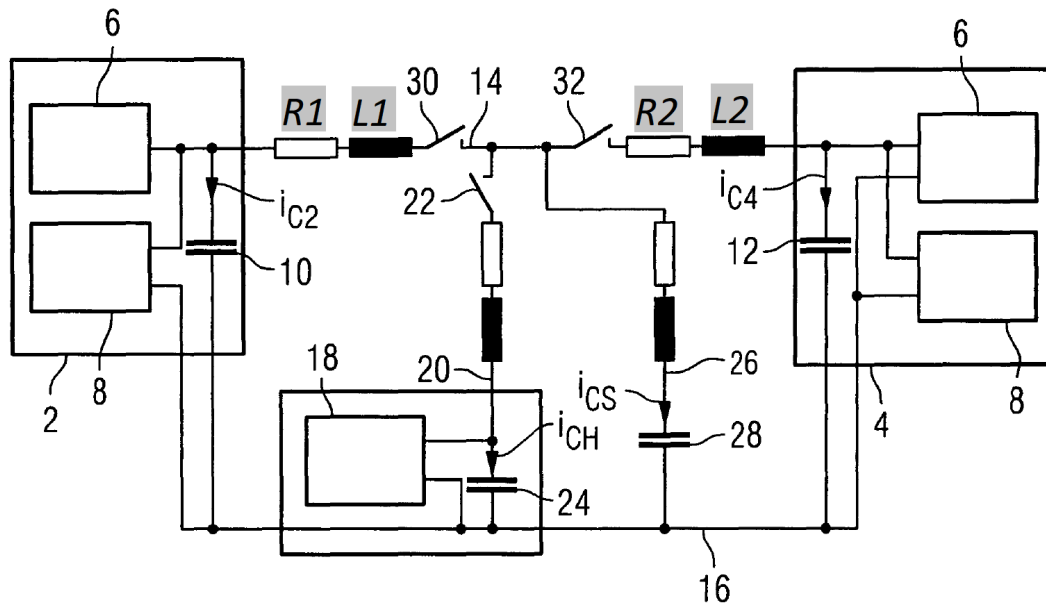
Reasons for the Decision

References to first-instance submissions

1. Both parties referred to their submissions in the first-instance proceedings. As such references do not fulfil the requirements in Article 12(2) RPBA 2007 and Article 12(3) RPBA 2020, they were disregarded by the Board.

Novelty, Article 54 EPC

2. According to claim 1, the two inverters (9) are connected in parallel to a common DC power supply line (11). Furthermore, the DC-link decoupling circuit includes an inductor (13) for each branch of the power supply line connecting one of the inverters, which inductor is connected in series between said common power supply line and said inverter.
3. For the disclosure of document E1 to be read onto claim 1, it has to be established which of the elements disclosed in document E1 are considered to represent these claimed features.
4. Figure 1 of document E1 is reproduced below, with references R1, L1, R2, L2 added by the Board for ease of identification.



5. Figure 1 of document E1 shows a resistance R1 and an inductance L1 connected in series between an inverter 2 and a switch 30. The switch 30 is connected in series to a connection 14. Figure 1 of E1 also shows a resistance R2 and an inductance L2 connected in series between an inverter 4 and a switch 32. The switch 32 is connected in series to the connection 14.
6. The appellant on the one hand seems to regard the inductances L1 and L2 of figure 1 as each representing an "inductor (13) for each branch of the power supply line" as set out in claim 1. For that to hold, the connection 14 has to be taken as representing the claimed "common DC power supply line (11)".
7. According to the characterising feature of claim 1, "a resistor (17) is connected in parallel to said inductors...". Document E1 does not disclose a resistor that by any stretch of the imagination can be considered to be connected in parallel to the inductances L1 and L2. For that to be the case, there would have to be a resistor connected in parallel with

the series arrangement comprising resistance R1, inductance L1, switch 30, switch 32, resistance R2 and inductance L2, which there is not.

8. The same reasoning holds true for figure 3 of document E1, which shows the same arrangement of inductances and resistances as figure 1.
9. The same reasoning holds true for figure 6 of document E1, in which the resistances R1, L1, R2, L2 are replaced by a more detailed network of resistances and inductances representing the damping elements shown in figure 5, but again there is no resistor in parallel with the overall network.
10. The appellant's argument regarding the interpretation of the feature "a resistor" of claim 1 is not convincing because this feature is defined not just in abstraction, but also in terms of its parallel connection with the inductors. Document E1 does not disclose any resistors connected in this manner.
11. The appellant also argued that the resistances R1 and R2 could be replaced by an electrically equivalent circuit comprising a resistor in parallel with the inductances L1, L2. Even if that were the case, that would be a matter for inventive step, not novelty.
12. At least for these reasons, the subject-matter of claim 1 is considered to be novel over the disclosure of document E1.

Inventive step, Article 56 EPC

13. The appellant's arguments, that it would be obvious to use only one damping element, or only one high-resistance/low-inductance stainless steel busbar, if the arrangement of document E1, like the patent, did not have an absorption circuit 26 and an auxiliary inverter 18, are not convincing for the following reasons.
14. Firstly, document E1 specifically discloses to use an absorption circuit and an auxiliary inverter 18 connected to the connection point 14 in figure 6, and the appellant has not demonstrated why it would be obvious for the skilled person to do away with these integral aspects of E1's disclosure.
15. Secondly, even if the skilled person were to come to the idea of abandoning the absorption circuit and the auxiliary inverter, the Board is not convinced that the skilled person would adapt the damping arrangement disclosed in E1 in such a way as to come to the claimed arrangement of a resistor that is connected in parallel to the inductors that are in series between a common power supply line and the inverters. The reasons are as follows.
16. It seems clear from paragraphs [0020] and [0024] of E1 that figure 6 shows a schematic circuit diagram of a power converter with one single damping element as shown in figure 5. This can be confirmed by comparing the details in the figures. The two current paths 62 in figure 6 (one on each side of the connection point 14) have relatively low resistance and high inductance, corresponding to the two copper coils 50, 52 shown in figure 5. Similarly, the two current paths 64 in

figure 6 (one on each side of the connection point 14) have relatively high resistance and low inductance, corresponding to the opposed stainless steel busbars 46, 48 in figure 5. Furthermore, in figure 6 each inductive current path 62 is connected in parallel with a corresponding resistive current path 64, just as in figure 5 each copper coil is connected in parallel with a corresponding stainless steel busbar. It is evident from this comparison that the current paths 62 and 64 on one side of the connection 14 in figure 6 correspond to the upper busbar and coil in figure 5, and the current paths 62 and 64 on the other side of the connection 14 in figure 6 correspond to the lower busbar and coil in figure 5. That having been established, it has to be noted that according to paragraph [0022] of document E1, the distance between the two busbars 46 and 48 determines the inductance value of the current path through them. Given the importance of the inductance value, it would be clear to the skilled person that it is important to have two busbars separated by the appropriate distance. Thus, it would not be obvious to the skilled person to abandon this two-busbar arrangement in favour of a single common stainless steel busbar (i.e. resistor), as put forward by the appellant.

17. At least for these reasons, the subject-matter of claim 1 is not obvious in view of document E1 and the common general knowledge of the person skilled in the art, and is thus considered to meet the requirement for inventive step, Article 56 EPC.

Conclusion

18. For these reasons the Board acceded to the respondent's request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

R. Lord

Decision electronically authenticated