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**Datasheet for the decision
of 5 February 2021**

Case Number: T 1897/16 - 3.4.03

Application Number: 09405031.7

Publication Number: 2219205

IPC: H01J37/32, H01J37/34

Language of the proceedings: EN

Title of invention:

A power supply device for plasma processing

Patent Proprietor:

Solvix GmbH

Opponent:

TRUMPF Huettinger Sp. z o.o.

Headword:

Relevant legal provisions:

EPC R. 99(2)

EPC Art. 84, 56, 101(3) (b), 111(1)

RPBA 2020 Art. 13(2)

Keyword:

Admissibility of appeal - notice of appeal - reasons for
setting aside the decision
Claims - clarity (yes)
Inventive step - (no)
Amendment after summons - exceptional circumstances (no) -
taken into account (no)

Decisions cited:

Catchword:



Beschwerdekammern

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Case Number: T 1897/16 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 5 February 2021

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
16 June 2016 concerning maintenance of the
European Patent No. 2219205 in amended form.**

Composition of the Board:

Chairman T. Häusser
Members: M. Stenger
W. Van der Eijk

Summary of Facts and Submissions

- I. The appeals of both the proprietor and the opponent concern the interlocutory decision of the Opposition Division to maintain European patent EP-B-2 219 205 in amended form according to auxiliary request 2 as then on file. In the contested decision, the grounds of opposition under Articles 100 a) (in connection with Articles 54 and 56 EPC), 100 b), 100 c) and the requirements of Article 84 EPC are discussed.
- II. The following documents are referred to:
- D5: WO 2008/138573 A1
- D16: Extracts from Band 33 Kontakt & Studium, Elektronik: J. Wüsthube et al., "Schaltnetzteile: Grundlagen, Entwurf, Schaltungsbeispiele", pages 24 to 27, 50 to 53 and 138 to 141, expert-verlag, Grafenau, Germany, 1979, ISBN 3-88508-601-8
- D17: Extracts from P. Horowitz, W. Hill: "The Art of Electronics", pages 324 to 331 and 360 to 365, 2nd edition 1989, reprinted 1995, Cambridge University Press, ISBN 0-521-37095-7
- D18: Extract from U. Tietze, Ch. Schenk: "Halbleiter-Schaltungstechnik", pages 534 to 543, 9th edition, 2nd reprint 1991, Springer-Verlag, ISBN 3-540-19475-4
- III. At the end of the oral proceedings before the Board, the appellant-proprietor (henceforth: proprietor) requested that the decision under appeal be set aside and the patent be maintained according to a main

request or, auxiliarily, according to one of auxiliary requests 1 to 3, all requests as filed with the statement of grounds of appeal dated 25 October 2016, or according to auxiliary request 4 as filed during the oral proceedings before the Board. Moreover, with letter dated 4 January 2021 the appellant conditionally filed revised versions of the main request and auxiliary requests 1 to 3, the condition relating to a negative finding of the Board concerning sufficiency of disclosure of claim 12 of the main request, and the corresponding claims of auxiliary requests 1 to 3.

IV. At the end of the oral proceedings before the Board, the appellant-opponent (henceforth: opponent) requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

V. The oral proceedings before the Board were held by videoconference using Zoom. Both parties had consented thereto previously (proprietor: see letter dated 5 January 2021; opponent: see letter dated 21 December 2020; see also the Board's communication dated 21 December 2020).

VI. Claim 1 of the main request has the following wording (labelling (1a), (1b), ... added by the Board):

(1a) *A power supply device for plasma processing, wherein electric arcs may occur, comprising*

(1b) *a power supply circuit (10) designed to generate a DC voltage across a negative and a positive output terminal (1, 2) ,*

(1c) *the output terminals being for connection to a plasma processing chamber (7) by means of conductors*

(3, 4),

(1d) a first switch (25) connected between the power supply circuit and one (1) of the output terminals for interrupting the power supply to the plasma processing chamber in case of the occurrence of an arc, and

(1e) a recovery energy circuit (40) connected to the output terminals (1, 2) and to the power supply circuit (10),

(1f) the recovery energy circuit serving for feeding at least partially the energy which is stored in the conductors (3, 4) when the first switch (25) is actuated to interrupt the power supply to the plasma processing chamber (7) back to the power supply circuit (10),

(1g) which is configured to reuse the energy fed back by the recovery energy circuit (40) for the power supplied to the plasma processing chamber (7),

(1h) wherein the power supply circuit (10) comprises a capacitor (9) for storing at least partially the energy fed back and wherein, in use, closing the first switch (25) has the effect that the power of the power supply circuit (10) is supplied again to the plasma processing chamber,

(1i) the capacitor (9) being connected to a first input terminal (18) of the power supply circuit (10) and a second input terminal (19) of the power supply circuit (10),

(1j i) the recovery energy circuit (40) being connected by a first line (41) to the negative output

terminal (1), by a second line (42) to the positive output terminal (2),

(1j ii) by a third line (43) to the first input terminal (18) and by a fourth line (44) to the second input terminal (19).

This claim corresponds, with the exception of the added term "first" in feature (1h), to claim 1 of auxiliary request 1 as filed during oral proceedings before the Opposition Division.

- VII. Claim 1 of auxiliary request 1 differs from claim 1 of the main request in that features (1j i) and (1j ii) are replaced, respectively, by features (1j i') and (1j ii') as follows (labelling (1j i'), (1j ii') added by the Board):

(1j i') the recovery energy circuit (40) being connected by a first line (41) with a diode (45) to the negative output terminal (1), by a second line (42) to the positive output terminal (2),

(1j ii') by a third line (43) with a diode (47) to the first input terminal (18) and by a fourth line (44) to the second input terminal (19).

- VIII. Claim 1 of auxiliary request 2 differs from claim 1 of the main request in that features (1j i) and (1j ii) are replaced by features (1j 0), (1j i'') and (1j ii'') as follows (labelling (1j 0), (1j i'') ... added by the Board):

(1j 0) the recovery energy circuit (40) comprising a transformer (46), wherein

(1j i'') a first line (41) connects the negative output terminal (1) via a diode (45) to the primary winding (46a) of the transformer (46), a second line (42) connects the positive output terminal (2) to the primary winding (46a) of the transformer (46),

(1j ii'') a third line (43) connects the secondary winding (46b) of the transformer (46) via a diode (47) to the first input terminal (18), and a fourth line (44) connects the secondary winding of the transformer (46) to the second input terminal (19).

Claim 1 of auxiliary request 2 corresponds in substance to claim 1 of the request according to which the Opposition Division maintained the patent (2nd auxiliary request in the first instance opposition proceedings).

Auxiliary request 2 comprises a further independent claim 2 which differs from claim 1 in substance in that it comprises a DC-DC converter with an input and an output instead of the transformer with its primary and secondary windings.

IX. Auxiliary request 3 differs from auxiliary request 2 essentially in that claim 2 is deleted. Claim 1 of auxiliary request 3 is identical to claim 1 of auxiliary request 2.

X. The revised versions of the main request and auxiliary requests 1 to 3 filed with the letter of 4 January 2021 differ from the main request and auxiliary requests 1 to 3 only in the deletion of a dependent claim (claim 12 of the main request and auxiliary requests 1 and 2;

claim 11 of auxiliary request 3), the independent claims being identical.

XI. Claim 1 of auxiliary request 4 as filed during oral proceedings differs from claim 1 of auxiliary request 2 in that it comprises, at the end, the additional features as follows (labelling (1k), (1l), ... added by the Board):

(1k) *wherein the power supply circuit (10) comprises*

(1l) *a AC input (11),*

(1m) *a first rectifier (12) connected [sic] to the AC input and to the first input terminal (18) and to the second input terminal (19),*

(1n) *a switching circuit (13) connected [sic] to the AC input and to the first input terminal (18) and to the second input terminal (19),*

(1o) *another transformer (14) connected to the switching circuit (13) and*

(1p) *a second rectifier (15) connected to the transformer (14).*

XII. The relevant arguments of the opponent may be summarized as follows:

(a) Admissibility of the appeal:

In the grounds of appeal, the proprietor had interpreted the disclosure of the embodiment shown in figure 6 of D5 as being limited to what was actually depicted in

that figure. They had then used embodiments shown in other figures of D5 as closest prior art.

In contrast to that, the Opposition Division had used the embodiment of figure 6 in the context of the whole document as closest prior art. The proprietor had not given any reason for their different choice of the closest prior art, whereby their appeal was not admissible under Rule 99(2) EPC.

(b) Article 84 EPC

The skilled person would interpret the term "input terminal" used in claim 1 as defining the terminals where the mains supply 11 was connected to the power supply circuit. In contrast thereto, the terminals 18, 19 and the capacitor 9 were always arranged between the rectifier 12 and the switching circuit 13. Another capacitor 27 connected to terminals 16, 17 was arranged after a second rectifier 15. It was thus not clear for which positions of the capacitor within the power supply circuit defined in claim 1 of the main request protection was sought.

Moreover, the expression "in use" in feature (1h) rendered claim 1 unclear, as the reader was left in doubt what led to the closing of the first switch.

(c) Closest prior art

Recycling the energy stored in the capacitor C to the power supply unit was presented in D5 not only in relation to Figure 6, but on a more general level as an alternative to dissipating it by means of a resistor. Discharging the energy stored in capacitor C, by recycling or dissipating it, was independent from transferring the energy from leads 3.1 and 3.2 to

capacitor C. Thus, even if figure 6 did not disclose the transfer of energy to the capacitor in an enabling manner, this would have no influence on the disclosure related to that figure that this energy was to be recycled into the power supply unit 5.

In any case, the skilled person would not consider what was shown in figure 6 of D5 in a manner isolated from the rest of the document. The skilled person would thus have connected the diode D2 in Figure 6 with its anode instead of with its cathode to the switch SS if need be, to bring it in line with the other embodiments of D5.

In the context of D5 as a whole, figure 6 thus represented an enabling embodiment and was suitable as closest prior art.

(d) Distinguishing features

A capacitor was implicitly present in any power supply, and thereby also in the power supply unit 5 of D5. Each capacitor was necessarily connected to at least two terminals. Thereby, claim 1 of the main request differed from the embodiment of figure 6 of D5 only in feature (1j ii).

(e) Obviousness

Starting from figure 6 of D5 and trying to solve the problem of efficiently treating arc events, the skilled person would learn from the part of the description corresponding to figure 6 that the energy from the leads should be fed into the power supply unit to be recycled. To choose a capacitor for storing this energy would be the most straightforward option for the

skilled person. By connecting such a capacitor, the skilled person would then arrive inevitably at two lines connecting the discharging circuit 7.2 to the capacitor.

(f) Auxiliary request 1

D5 disclosed diode D2 which corresponded to the diode 45 in the first line 41 to the negative output terminal 1.

Claim 1 of auxiliary request 1 thus had, in comparison to claim 1 of the main request and compared to D5, the only additional distinguishing feature that the third line 43 was connected with a diode 47 to the first input terminal, that is to the capacitor. The technical effect of this additional distinguishing feature was that the current to the capacitor could flow only in one direction.

D5 mentions a "converter" in the text on page 21, lines 7 to 11 and shows a transformer symbol in figure 6. In such a context, it was necessary to convert alternating current to directed current before using a capacitor as storage device. For this purpose, at least one diode was needed, as evidenced by D17, figure 6.46, upper left corner and D18, page 535.

Further, it would have been an obvious choice to use the reservoir capacitor of the power supply unit 5 as target because using this capacitor as energy storage was generally known as evidenced by D16, section 2.4.1.

D5 did not require that the power supply was interrupted by opening switch SI (see figure 5), as this switch was not mentioned in the general description of the operation of the power supply device in the second paragraph on page 13 with respect to figure 1. Features mentioned in the description of D5

could be used in accordance with the invention either individually or in conjunction according to page 9, lines 12 to 18, whereby the skilled person would know that in the embodiment of figure 6, switch SI was not mandatory either.

(g) Auxiliary requests 2 and 3

The wording of claim 1 did not require a direct connection between the diodes and the transformer. Therefore, the only additional feature of claim 1 of auxiliary request 2 as compared to claim 1 of auxiliary request 1 was that the recovery circuit comprised a transformer. This additional feature was, however, also explicitly disclosed in figure 6 of D5.

In addition, power converters as mentioned in the text of D5 also usually comprised a transformer and diodes as evidenced by D17 and D18.

(h) Auxiliary request 4

Auxiliary request 4 was submitted extremely late. It could have been submitted by the proprietor already with the grounds of appeal.

Auxiliary request 4 was therefore not to be admitted.

XIII. The relevant arguments of the proprietor may be summarized as follows:

(a) Admissibility of the appeal

The grounds of appeal contained on page 5 in section 2.5 arguments why the embodiment of figure 6 of D5 did not work. This constituted a reasoning why the

arguments of the Opposition Division with respect to lack of inventive step were wrong.

(b) Article 84 EPC

The combined term "input terminal" was not restricted to designating terminals to which the mains supply was connected. Instead, the term "terminal" only defined an electrical connection while the term "input" only specified that this connection was used to input something, in the present case the energy to be stored in the capacitor.

Which capacitor of the power supply circuit was used for that purpose or its position within the power supply circuit was not important. The only relevant characteristic of the capacitor was that it was used to store the energy fed back from the cables.

The expression "in use" in feature (1h) made it clear that re-closing of the switch only happened when the device was in use.

(c) Closest prior art

As long as switch SS in the embodiment shown in figure 6 of D5 was open, the capacitor C could be pre-charged. During plasma operation, however, the switch SS would be closed. Thereby, the current from the current source would not pre-charge the capacitor C, but would rather flow through the switch SS to the power supply unit 5. The capacitor C would then be charged the wrong way round by the current exiting the plasma chamber through diode D2, unless the current provided by the power supply was much higher than the current provided by the power supply unit 5.

Figure 6 of D5 thus did not show an enabling embodiment and could not be taken as closest prior art. Instead, any of the embodiments shown in figures 1 to 5 of D5 would have to be taken as closest prior art.

(d) Distinguishing features

Figure 6 of D5 only very roughly showed an arrow pointing from the discharging circuit 7.2 to the power supply unit 5. However, D5 did not contain any details as to how this arrow was implemented.

Further, in D5, the energy fed back was first stored in a capacitor C of a pre-charging circuit 7.1 outside of the power supply unit 5 and only subsequently transferred thereto.

In contrast thereto, according to the patent, the energy fed back was stored within the power supply circuit. That is, D5 did not disclose that the power supply unit 5 included a particular capacitor connected to its output terminals for feeding energy back when the switch was opened.

(e) Obviousness

The arrow shown in figure 6 of D5 could be implemented by having an energy storage outside the power supply unit or by a direct connection to the output terminals of the power supply unit. If the energy was to be stored, this could also be done using an inductance. Thus, the skilled person would arrive at the subject-matter of claim 1 of the main request only by hindsight.

Further, the storage of the energy fed back within the power supply circuit had the technical effect that the

energy fed back was immediately discharged to the plasma chamber when switch 25 was opened. This effect was not achieved by the discharging circuit of D5.

Thereby, the subject-matter of claim 1 of the main request was inventive.

(f) Auxiliary request 1

If the skilled person changed the position of diode D2 in figure 6, this diode would then not necessarily be used for feeding back energy. Thus, the diode in the first line according to claim 1 was not disclosed in figure 6 of D5. The diode in the third line was not disclosed in D5, either.

According to D5, a switch DS had to be closed for discharging the energy fed to capacitor C. In this approach, no diodes were needed, contrary to the invention.

The technical effect of the distinguishing features including the diodes in the first and the third lines, was that the system could be designed in a simple manner such that when switch 25 was opened, the diodes guaranteed that the power was fed back immediately without shutting down the power supply circuit. According to page 6, lines 13 to 15 of D5, the power supply had to be interrupted. The energy from the cables could not be fed back as long as the power supply was still powered on.

D5 followed a different approach according to which a switch 7.2 had to be closed for discharging the energy fed to capacitor C, whereby no diodes were needed.

(g) Auxiliary requests 2 and 3

The disclosure of D5 was not clear, since the description mentioned a converter while figure 6 showed a transformer symbol.

Further, no elements other than the transformer were shown in circuit 7.2 of figure 6 and the description did not mention any further elements, either. In particular, D5 did not disclose any diodes for connecting the transformer. Instead, switches were provided whose timing needed to be controlled. The replacement of switches by diodes was inventive.

There were many differences between the invention of the patent and D5 which were all claimed. These differences were not part of the common general knowledge of the skilled person. Instead, they enabled the concept of immediate automatic feedback of the energy stored in the cables in the case of an arc without shutting down the power supply, contrary to D5.

(h) Auxiliary request 4

This request, although late filed, should be admitted in the appeal proceedings for the following reasons. There were so many differences between claim 1 of auxiliary requests 2 and 3 and D5 combined with the common general knowledge that the finding of the Board that the subject-matter of that claim was not inventive did come as a surprise for a physicist.

In any case, the conduct of the oral proceedings by videoconference was flawed in particular at the beginning due to technical problems.

Further, having to use a headset during the videoconference due to the presence of interpreters was

a disadvantage that became apparent only at a test shortly before the oral proceedings.

If the opponent needed more time for considering auxiliary request 4, the oral proceedings could be postponed or the case could be remitted to the Opposition Division.

Reasons for the Decision

1. The patent

The invention of the patent concerns a power supply device for plasma processing. In plasma processing, arcs may occur. Arc events may lead to damages in the target or to a poor quality of the processed surfaces. Thus, when an arc event occurs, the supply of power to the plasma processing chamber is interrupted. In this case, the energy which is stored e. g. in the cables to the plasma processing chamber when the supply of power is interrupted is supplied to the plasma, prolonging the quenching of the arc. The patent proposes to handle arc events in a more efficient way by providing a recovery energy circuit for feeding at least a part of the energy stored in the cables back to the power supply circuit.

2. Prior art

Document D5 also concerns a power supply for plasma applications and the fast extinction of arcs. When an arc is detected in the plasma, a large amount of the energy stored in the cables (lead inductance) is transferred into a capacitor C, arranged, according to

the figures, outside the power supply unit 5. The capacitor is discharged by means of a discharging circuit which can either dissipate the energy in a resistor or feed it back to the power supply unit.

3. Admissibility of the appeals

3.1 Admissibility of the opponent's appeal

The appeal of the opponent is admissible; this was not challenged by the proprietor.

3.2 Admissibility of the proprietor's appeal (see sections XII. (a) and XIII. (a) above)

The reasoning of the Opposition Division with respect to lack of inventive step concerning the former auxiliary request 1, which corresponds essentially to the present main request, is based on the embodiment of figure 6 of D5 (see point 18 of the Reasons).

The proprietor argues that the circuit shown in figure 6 was not an enabling configuration and thus did not form part of the prior art and could not be considered as closest prior art (grounds of appeal of the proprietor, point 2.5, second paragraph).

Thereby, contrary to the opponent's submissions, the proprietor does provide a reason why the Opposition Division's choice of the closest prior art was wrong and why they use a different prior art.

The proprietor's grounds of appeal thus relate to the reasoning of the Opposition Division with respect to lack of inventive step and indicate reasons for setting aside the impugned decision according to Rule 99(2)

EPC. Consequently, the appeal of the proprietor is admissible.

4. Article 84 EPC (see sections XII. (b) and XIII. (b) above)

4.1 If - hypothetically - feature (1i) referred to "the" input terminals, the skilled person might be led to consider that the first and second input terminals mentioned should indeed be the input terminals by means of which the power supply circuit is connected to the mains supply (AC input 11, see figure 1), as submitted by the opponent.

However, feature (1i) defines in fact that the capacitor is connected to "a" first and "a" second input terminal of the power supply circuit. Since the indefinite article "a" is used, the skilled person would understand that the input terminals referred to could be any electrical terminals used by the power supply circuit as any input. In the present case, the input provided to the first and second terminals of the power supply circuit is the energy fed back by the recovery circuit and not necessarily the AC input provided by the mains supply, in line with the submissions of the proprietor.

It follows therefrom that feature (1i) is broad in that it does not specify the position of the capacitor in the power supply circuit or its role during standard operation of the power supply circuit, as acknowledged by the proprietor. It is, however, clear because it does not create any doubt whether a given power supply device would fall under the subject-matter for which protection is sought.

- 4.2 Moreover, the Board agrees with the proprietor in that the expression "in use" in feature (1h) meant that the effect defined in that feature (the closing of the first switch leading to the power of the power supply circuit being supplied again to the plasma processing chamber) occurs when the claimed power supply device is in use.
- 4.3 Therefore, claim 1 of the main request is clear (Article 84 EPC).
5. Main request, Article 56 EPC
- 5.1 Closest state of the art (see sections XII. (c) and XIII. (c) above)

Both the proprietor and the opponent regarded D5 as representing the closest state of the art, in agreement with the contested decision.

Both D5 and the patent are directed at a power supply device for plasma application. They also have many essential features in common. Further, both D5 and the patent concern the same problem, namely, removing energy when an arc event occurs. The Board thus sees no reason to disagree with the parties on this point.

It was, however, a point of dispute whether figure 6 of this document and the corresponding description represented an enabling disclosure and could be used to represent the closest prior art or not.

The argument of the proprietor that the capacitor C shown in figure 6 of D5 would be charged in the wrong direction when switch SS was closed is based on the particular connection of diode D2 shown in figure 6, in

which its cathode is connected to capacitor C, diode D3 and switch SS, while its anode is connected only to the plasma chamber. In this configuration, current from the current source or capacitor C (when pre-charged by the current source) could in principle pass through switch SS without being blocked by diode D2.

However, the Board concurs with the opponent that this possible flaw in the disclosure of figure 6 of D5 concerns the transfer of energy to capacitor C and does not directly affect the discharge of energy stored therein by transfer into the power supply unit.

In addition, as pointed out by the opponent in their letter dated 6 October 2017 (page 3, point 2.3.4.2 and footnote 1), each part of any document has to be construed in the context of the document as a whole according to the *Case Law of the Boards of Appeal of the EPO* (9th edition 2019, section I.C.4.1).

In the present case, in all the embodiments of D5 other than the one shown in figure 6 (i. e. in figures 1 to 5), diode D2 is arranged such that current provided by the pre-charged capacitor C cannot flow through switch SS when the latter is closed. In particular, in the embodiments which are most similar to the one shown in figure 6, that is, the embodiments where switch SS is arranged on the negative side of the power supply unit 5 and where the discharging circuit 7.2 is explicitly shown (figures 2 and 5), diode D2 is arranged with its anode not only connected to the plasma chamber, but also to switch SS, thereby blocking any current from pre-charged capacitor C through switch SS.

In the context of D5 as a whole, the skilled person would thus realize that figure 6 contained an error and

that diode D2 in that figure should in fact be connected in a similar manner as in the embodiments shown in figures 2 and 5. They would thereby know that diode D2 was to be connected to switch SS with its anode side, as suggested by the opponent. The Board notes that this latter arrangement would then also be in agreement with figure 7 of D5, in which the switch SS is connected to the anode of D2.

The Board thus considers that the embodiment of figure 6 of D5 is disclosed in an enabling manner in the context of D5 as a whole, contrary to the submissions of the proprietor. It is therefore suitable as closest prior art in the present case.

5.2 Disclosure of D5 (see sections XII. (d) and XIII. (d) above)

In the words of claim 1 of the main request, the embodiment of figure 6 of D5 discloses:

(1a) A power supply device for plasma processing (page 11, lines 1 to 4), wherein electric arcs may occur (page 2, lines 11 to 16 and 24 to 26), comprising

(1b) a power supply circuit (*power supply unit 5*, see figures) designed to generate a DC voltage across a negative and a positive output terminal (*outputs 4.2, 4.1*, see page 11, lines 1 to 12 and figures),

(1c) the output terminals being for connection to a plasma processing chamber (*plasma chamber 2*, see figures) by means of conductors (*leads 3.2, 3.1*, see page 11, lines 1 to 12 and figures),

(1d) a first switch (*serial switch SS*, see figures) connected between the power supply circuit and one of the output terminals for interrupting the power supply to the plasma processing chamber in case of the occurrence of an arc (page 13, lines 1 to 4), and

(1e) a recovery energy circuit (*discharging circuit 7.2*, see figure 6) connected to the output terminals (*outputs 4.2, 4.1*) and to the power supply circuit (*power supply unit 5*),

(1f) the recovery energy circuit (*discharging circuit 7.2*) serving for feeding at least partially the energy which is stored in the conductors (*leads 3.2, 3.1*) when the first switch (*serial switch SS*) is actuated to interrupt the power supply to the plasma processing chamber (*plasma chamber 2*) back to the power supply circuit (see page 7, lines 10 to 12; page 9, lines 4 to 6 and page 21, lines 7 to 11),

(1g) which is configured to reuse the energy fed back by the recovery energy circuit (*discharging circuit 7.2*) for the power supplied to the plasma processing chamber (see page 21, lines 9 to 11, "*energy is actually 'recycled'*").

This was not disputed by the parties.

The Board shares the opinion of the opponent that a DC power supply, like the one disclosed in D5, implicitly comprises capacitors and that thereby the power supply unit 5 of D5 implicitly discloses (at least one) capacitor.

However, the Board concurs with the proprietor that the power supply unit 5 of D5 does not directly and unambiguously disclose a *particular* capacitor connected

to the output terminals of the power supply unit 5 *for storing energy fed back when the switch SS is opened*, as defined in the first part of feature (1h). Hence, the lines and terminals connecting such a particular capacitor as defined in features (1i) and (1j ii) are not directly and unambiguously disclosed in D5, either.

Consequently, contrary to the submissions of the opponent, D5 does not disclose all of features (1h), (1i) and (1j ii). However, D5 discloses the following features:

(1h part b) wherein, in use, closing the first switch SS has the effect that the power of the power supply circuit (*power supply unit 5*) is supplied again to the plasma processing chamber (*plasma chamber 2*) (in view of the arrangement of serial switch SS in all figures 1 to 6, it is a requirement that it be closed before power can be supplied again to the plasma chamber 2),

(1j i) the recovery energy circuit (*discharging circuit 7.2*) being connected by a first line to the negative output terminal (*output 4.2*) (via diode D2), by a second line to the positive output terminal (*output 4.1*) (via the line connecting the positive output terminal of the power supply unit 5 to the output 4.1).

5.3 Distinguishing features

The subject-matter of claim 1 of the main request thus differs from the embodiment of figure 6 of D5 in that

(1h part a) the power supply circuit comprises a capacitor for storing at least partially the energy fed back,

(1i) the capacitor being connected to a first input terminal of the power supply circuit and a second input terminal of the power supply circuit, and

(1j ii) the recovery circuit being connected by a third line to the first input terminal and by a fourth line to the second input terminal.

The Board notes that neither the position of the capacitor within the power supply circuit nor the role of the capacitor with respect to the normal operation of the power supply circuit are defined in the claims (see the section on Article 84 EPC above).

The capacitor defined in the distinguishing features could thus be any capacitor that is either already present in the power supply circuit or is an additional capacitor provided only for the purpose of storing the energy fed back (see also point 18.11 of the contested decision).

5.4 Obviousness (see sections XII. (e) and XIII. (e) above)

As discussed above, the capacitor in which the energy fed back is stored could be *any* capacitor at any position within the power supply circuit, as acknowledged by the proprietor during the discussion relating to Article 84 EPC. This capacitor as claimed is thus not necessarily directly involved in providing power to the output terminals during normal operation of the power supply circuit.

Thereby, the Board does not believe that storing the energy fed back in a capacitor within the power supply circuit as claimed achieves, in itself, the technical effect that the energy fed back is *immediately discharged to the plasma chamber when switch 25 is closed*, contrary to the submission of the proprietor. To achieve that technical effect alleged by the proprietor, at least the role of the capacitor in providing power to the output terminals during the normal operation of the power supply would have to be defined in claim 1, e. g. by claiming that the capacitor for storing the energy fed back is the main reservoir capacitor of the power supply circuit as shown in figure 1 of the contested patent.

However, nothing of the sort is defined in claim 1 which is formulated in very general terms with respect to the capacitor mentioned.

In line with the submissions of both the opponent and the proprietor, D5 discloses the general idea that the excess energy stored in the leads is fed "*into the power supply unit 5 such that energy is actually 'recycled'*" (page 21, lines 9 to 11), whereby it has to be stored within the power supply unit 5, but fails to mention any details relating to how this was done. Only an arrow from the discharging circuit 7.2 to the power supply unit 5 is shown in figure 6.

This is reflected by the distinguishing features (1h part a), (1i) and (1j ii). Consequently, the technical effect of these features is to define one particular way of storing the energy fed back by the recovery circuit to the power supply circuit.

Thereby, the skilled person starting from D5 would be faced with the objective technical problem of implementing the general idea disclosed in D5, or - figuratively speaking - implementing the "arrow" from the discharging circuit 7.2 to the power supply unit 5 according to the proprietor's submission. That is, they would have had to find a way to transmit the energy to and store it in the power supply unit 5.

Contrary to the proprietor's submission, the skilled person would not have considered an energy storage *outside* of the power supply unit 5 or a direct connection to the output terminals thereof, since D5 gives the instruction to feed the excessive energy *into* the power supply unit 5.

The skilled person might also have thought of using an inductor in the power supply unit 5 to store the energy fed back, as submitted by the proprietor. However, as submitted by the opponent, using a capacitor is one of the- if not *the*- most obvious way of storing DC energy. The skilled person, using their common general knowledge, would thus have chosen a capacitor in the power supply unit for that purpose as a matter of routine practice depending on the circumstances without the exercise of inventive skills (see also the contested decision, point 18.11 of the Reasons) and without hindsight, contrary to the submission of the proprietor.

The Board notes that the capacitor chosen in that manner by the skilled person would not necessarily be a reservoir capacitor of the power supply unit 5. This is, however, not required by claim 1 of the main request. Instead - in accordance with the proprietor's submissions - the capacitor mentioned therein can be

any capacitor in the power supply circuit (see the submissions with respect to Article 84 EPC).

Once having chosen a capacitor for storing the energy fed back, the skilled person would have inevitably used two lines to connect it to the discharging circuit 7.2. Each of these lines would have had a connection point at the housing of the power supply unit 5. These connection points can be considered to correspond to the first and second input terminals of feature (1i), while the lines connecting the connection points to the chosen capacitor can be considered to correspond to the third and fourth lines of feature (1j ii).

Thereby, starting from the embodiment represented by figure 6 of D5, the skilled person would have arrived at the subject-matter of claim 1 of the main request using their common general knowledge without the involvement of an inventive step under Article 56 EPC.

This finding of the Board corresponds to the conclusion of the Opposition Division set out in points 18.11 and 18.13 of the Reasons in the contested decision.

6. Auxiliary request 1 (see sections XII. (f) and XIII. (f) above)

As set out above with respect to feature (1j i), the discharging circuit 7.2 of figure 6 of D5 is connected by diode D2 to the negative output terminal 4.2. The Board notes that irrespective of whether diode D2 is connected with its anode or its cathode to switch SS, energy fed back to capacitor C would have to pass diode D2, contrary to the submission of the proprietor that diode D2 was not used for feeding back energy. Thus, D5 also discloses feature (1j i').

The Board accepts that page 6, lines 13 to 15 of D5 mentions that the power supply must be interrupted, as submitted by the proprietor. However, as noted by the opponent, in the general description of the operation of the power supply device on page 13, lines 8 to 27, this requirement is not mentioned and on page 19, lines 12 to 14 relating to figure 5, interrupting the power supply is presented as optional. The interruption of the power supply is thus not presented as mandatory throughout D5 in a consistent manner.

Irrespective thereof, interrupting the power supply circuit is not excluded by the wording of claim 1 of auxiliary request 1. Thereby, even if such an interruption were required in the embodiments of D5, it would be of no consequence for the establishment of the distinguishing features of claim 1 of auxiliary request 1 vis-à-vis D5. The same holds for switch DS which has to be closed according to D5 in order to discharge capacitor C, as noted by the proprietor. The presence of such a switch is not excluded by the wording of claim 1 of auxiliary request 1.

In view of the above, the subject-matter of claim 1 of auxiliary request 1 differs from D5 by features (1h part a), (1i) and (1j ii').

With respect to claim 1 of the main request, claim 1 of auxiliary request 1 thereby differs from D5 additionally in that the connection of the recovery energy circuit to the first input terminal by the third line comprises a *diode*.

The Board notes that the technical effect of immediate feedback of the excess power to the power supply

without having to shut down the power supply alleged by the proprietor might be achieved by the complete circuit shown for example in figure 1. It is, however, not achieved by the distinguishing features of claim 1 as set out above, which only concern the type of element in which the energy is stored in the power supply circuit and connections therefore in a very general manner.

Instead, the technical effect of the additional distinguishing feature is that the current can flow only in one direction to the capacitor, as submitted by the opponent. The Board further agrees with the opponent that in the context of using a transformer to charge a capacitor, a conversion from alternating current to directed current is required. D17 (figure 6.46, upper left corner) and D18 (page 535) cited by the opponent show examples of such conversions using diodes and the Board is not aware of any practical implementation of such a conversion without using at least one diode.

Thus, the Board holds that once the skilled person starting from D5 had chosen a capacitor in the power supply unit 5 to store the energy to be recycled, the use of at least one diode in the line between the secondary winding of the transformer shown in figure 6 of D5 and the capacitor was mandatory and therefore a "one-way street" situation, contrary to the finding of the Opposition Division in points 21.11 and 21.12 of the Reasons of the contested decision.

Thereby, the Board considers that the presence of at least one diode between the secondary winding of the transformer and the capacitor is a direct consequence of the choice of a capacitor as energy storage device.

The skilled person would then place this (at least one) diode in the third or the fourth line or between the first or the second terminal and the capacitor as a matter of routine practice depending on the circumstances, without the exercise of inventive skills.

Thus, the skilled person would have arrived at the subject-matter of claim 1 of auxiliary request 1 without the involvement of an inventive step under Article 56 EPC starting from the embodiment represented in figure 6 of D5 and using their common general knowledge by choosing a capacitor as energy storage device.

7. Auxiliary request 2 (see sections XII. (g) and XIII. (g) above)

The symbol shown in the discharging circuit 7.2 of figure 6 of D5 is a transformer symbol showing a primary and a secondary winding. On the other hand, the description of D5 refers to a "converter" (page 21, lines 7 to 9). According to the proprietor this rendered the disclosure of D5 inconsistent.

However, as submitted by the opponent, a standard way of implementing a DC-DC converter is by means of using a switching circuit, a transformer, and a rectifier. That is, a converter may well comprise a transformer. The Board thus does not see any contradiction between the transformer symbol in figure 6 and the corresponding part of the description of D5 mentioning a converter.

Thereby, D5 also discloses that the discharging circuit comprises a transformer and thereby feature (1j 0).

The argument of the proprietor that D5 did not disclose any diode connected to the transformer and that instead switches were provided whose timing had to be controlled is not fully accepted by the Board.

The Board shares the opinion of the proprietor to the extent that figure 6 of D5 does not show explicitly any diode connected to the secondary winding of the transformer, i. e. between the discharging circuit 7.2 and the power supply unit. D5 thus does not disclose (1j ii').

However, no switch is disclosed between discharging circuit 7.2 and the power supply unit 5. Moreover, switch DS present in the discharging circuit 7.2 is not provided *instead* of a diode, but *in addition* to diode D2 and has a different purpose than diode D2.

Further, as submitted by the opponent, the claim does not require a direct connection and the line connecting the negative output terminal 4.2 to the discharging circuit 7.2 via diode D2 must inevitably, at least in an indirect manner, be connected to the primary, i. e. input, winding of the transformer via switch DS. In the same manner, the line connecting the positive output terminal 4.1 to the discharging circuit 7.2 must inevitably be connected to the primary winding of the transformer as well.

Therefore, D5 also discloses feature (1j i').

Claim 1 of auxiliary request 2 thereby differs from figure 6 of D5 by feature (1h part a), (1i) and (1j ii').

Emphasizing what is set out above in relation to auxiliary request 1, the technical effect of immediate automatic feed back of the energy stored in the cables

in the case of an arc to the power supply without having to shut the power supply down alleged by the proprietor might be achieved by the complete circuit shown for example in figure 1. It is, however, not achieved by the distinguishing features of claim 1 of auxiliary request 2 vis-à-vis D5 as defined above, which only concern the type of element in which the energy is stored in the power supply circuit and connections therefore in a very general manner.

Instead, the distinguishing features defined above correspond, with the exception of explicitly mentioning the secondary winding of the transformer, to the features distinguishing claim 1 of auxiliary request 1 from D5.

The secondary winding of the transformer was however already considered when discussing lack of inventive step with respect to auxiliary request 1 above.

Thus, the subject-matter of claim 1 of auxiliary request 2 is not inventive under Article 56 EPC in view of D5 combined with the common general knowledge for the same reasons as those set out above for claim 1 of auxiliary request 1.

8. Auxiliary request 3

Claim 1 of auxiliary request 3 is identical to claim 1 of auxiliary request 2. Auxiliary request 3 thus does not fulfill the requirements of Article 56 EPC for the same reasons as set out above for auxiliary request 2.

It is therefore not necessary to discuss inventiveness of independent claim 2 of auxiliary request 3.

9. Revised versions of the main request and auxiliary requests 1 to 3

The conditionally filed revised versions of the main request and auxiliary requests 1 to 3 did not have to be considered since the condition (negative finding of the Board concerning sufficiency of disclosure of claim 12 of the main request) was not fulfilled.

In any case, since the independent claims of the revised versions of these requests are unchanged the same objections as for the main request and auxiliary requests 1 to 3 apply to them, as well.

10. Auxiliary request 4 (see sections XI. (h) and XII. (h) above)

According to Article 13(2) RPBA 2020, any amendments to a party's appeal made after notification of a summons to oral proceedings shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

In the present case, both the proprietor and the opponent appealed the contested decision. The principle of "reformatio in peius" thus does not apply. The proprietor must have been aware thereof and thus of the possibility that the Board may revoke the patent in its entirety at the time of filing their grounds of appeal, since the opponent's notice of appeal had been filed two months earlier. Furthermore, the grounds of appeal of the opponent comprise arguments against auxiliary request 2, according to which the Opposition Division maintained the patent and which essentially corresponds to present auxiliary request 2. Claim 1 of auxiliary

request 3 is identical to claim 1 of auxiliary request 2.

The proprietor must therefore have been aware of the possibility that the Board could come to a different conclusion than the Opposition Division with respect to present auxiliary requests 2 and 3. Consequently, they should have considered their strategy against the appeal of the opponent, including the possible filing of corresponding auxiliary requests with their reply to the grounds of appeal of the opponent.

For these reasons, the Board cannot consider the proprietor's "surprise" with respect to the adverse conclusion of the Board vis-à-vis claim 1 of both auxiliary requests 2 and 3 as an exceptional circumstance within the meaning of Article 13(2) RPBA 2020 justifying the filing of a new request at such an extremely late stage of the proceedings.

The representative of the proprietor expressed the view that the conclusion of the Board with respect to auxiliary requests 2 and 3 was surprising and shocking for a physicist. However, the conclusion was reached after an exchange of arguments between the parties. In the end the Board found the arguments of the opponent to be more convincing. The proprietor may strongly disagree with the Board, but that is not an exceptional circumstance either.

The technical problems at the beginning of the oral proceedings referred to by the proprietor essentially concerned the provision of the English interpretation channel and were solved immediately after they had been notified to the Board and before continuing the oral proceedings. No further technical problems occurred in the course of the rest of the oral proceedings. The

proprietor has furthermore not explained how the alleged technical shortcomings could be causal for the need to file auxiliary request 4 only at the end of the oral proceedings rather than at an earlier stage of the appeal proceedings. The Board also notes that the proprietor only mentioned the alleged technical shortcomings after all the auxiliary requests on file had been discussed. Neither before the oral proceedings (which were also requested by the proprietor) nor during the discussions, the proprietor expressed concerns with using video-conference technology for conducting oral proceedings, including the use of a headset in order to facilitate the work of the interpreters.

Therefore, the Board does not consider these technical problems as exceptional circumstances within the meaning of Article 13(2) RPBA 2020, either.

Consequently, the Board decided that auxiliary request 4 was not to be taken into account under Article 13(2) RPBA 2020.

11. Summary / Conclusion

The subject-matter of claim 1 of the main request does not fulfill the requirements of Article 56 EPC. The same holds for claim 1 of auxiliary requests 1 to 3. Thereby, none of these requests is allowable. It is therefore not necessary to further elaborate on the other issues discussed for these requests during the written procedure and the oral proceedings.

Furthermore, it was not necessary to consider the conditionally filed revised versions of the main request and auxiliary requests 1 to 3. Auxiliary request 4 is not taken into account pursuant to Article 13(2) RPBA 2020.

Due to the absence of any allowable request on file,
the patent has to be revoked under Articles 101(3)(b)
and 111(1) EPC.

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:



S. Sánchez Chiquero

T. Häusser

Decision electronically authenticated