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**Datasheet for the decision
of 25 January 2024**

Case Number: T 0975/22 - 3.2.05

Application Number: 10005585.4

Publication Number: 2255952

IPC: B29C65/16

Language of the proceedings: EN

Title of invention:

Method for manufacturing resin mold assembly

Patent Proprietor:

Stanley Electric Co., Ltd.

Opponents:

Leister Technologies AG
LPKF Laser & Electronics AG

Relevant legal provisions:

EPC Art. 56, 83, 84, 100(a), 123(2)
RPBA 2020 Art. 12(2), 12(4), 12(6), 13(2)

Keyword:

Grounds for opposition - lack of patentability (yes)
Inventive step - main request (no) - new first auxiliary
request (yes)
Late-filed auxiliary request - admitted (yes)
Amendments - added subject-matter (no)
Sufficiency of disclosure (yes)
Claims - clarity (yes)
Late-filed objections - admitted (no)

Decisions cited:

G 0003/14, T 1540/14



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Case Number: T 0975/22 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 25 January 2024

Appellant: Leister Technologies AG
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 21 February
2022 rejecting the oppositions filed against
European patent No. 2255952 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman P. Lanz
Members: T. Vermeulen
 F. Blumer

Summary of Facts and Submissions

- I. Opponent 1 lodged an appeal against the decision of the opposition division rejecting the two oppositions filed against European patent No. 2 255 952 on the basis of the grounds for opposition under Article 100(a) together with Article 54 EPC (lack of novelty) and Article 56 EPC (lack of inventive step).
- II. Among the documents filed before the opposition division, the following were relevant to the appeal proceedings.
- D1 "Laserstrahlschweißen thermoplastischer Kunststoffe", Deutscher Verband für Schweißen und verwandte Verfahren E.V. (DVS), Guideline DVS 2243, January 2005
 - D4 "Mit Laser Kunststoff schweissen", Schweizer Maschinenmarkt (SMM) Verbindungstechnik (8), 2002, 20-24
 - D5 US 2005/0258152 A1
 - D6 F. Bachmann and U. Russek, "Laser Welding of Polymers Using High Power Diode Lasers", Proceedings of SPIE Conference, vol. 4637, 2002, German translation
 - D8 M. Klimm, "Quasi-Simultanes LASER-Durchstrahlschweißen an Kunststoffgehäusen für elektronische Kfz-Steuergeräte mit hoher Dichtheitsanforderung", Master's thesis, Georg-Simon-Ohm Fachhochschule Nürnberg, 2004
 - D9 A. Eltze, "Leistung in Produktivität umsetzen", Kunststoffe (2), 2004, pages 26, 28 and 29.

III. Together with its statement of grounds of appeal, the appellant filed *inter alia* following documents:

D13 F. Backes, "Technologieorientierte Bahnplanung für die 3D-Laserstrahlbearbeitung", PhD thesis, Friedrich-Alexander-Universität Erlangen-Nürnberg, ISBN 3-87525-093-1, 1997

D14 U. Russek, "Laserschweißen von Kunststoffen - Grundlagen, Einflussgrößen, Anwendungen", ISBN 978-3-937889-90-0, 2009, index, 48-49

D18 US 2005/0284851 A1

D19 US 2006/0163214 A1.

IV. With letter dated 20 December 2023, opponent 2 informed the board that it would not attend the oral proceedings for which a summons was issued on 10 May 2023.

V. In a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) issued on 22 December 2023, the parties were informed of the board's provisional opinion on the issues of the appeal.

VI. Oral proceedings before the board were held on 25 January 2024.

VII. The appellant (opponent 1) requested that the decision under appeal be set aside and that the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed (main request) or that the decision under appeal be set aside and the patent be maintained as amended on the basis of the claims of one of the new

first to ninth auxiliary requests filed with letter dated 16 January 2024.

Opponent 2, who was a party as of right pursuant to Article 107, second sentence, EPC, did not file any request in appeal.

VIII. Claim 1 of the patent as granted has the following wording (the feature numbering used in the decision under appeal appears in square brackets):

"1. A method for manufacturing a resin mold assembly, comprising the steps of: **[1A]** disposing a light transmitting resin member (22) on a light absorbing resin member (21) in such a manner that a first weld region of the light transmitting resin member (22) faces a second weld region of the light absorbing resin member (21); **[1B]** applying a pressure (P) between the light transmitting resin member (22) and the light absorbing resin member (21) to bring the first weld region of the light transmitting resin member (22) and the second weld region of the light absorbing resin member (21) in a pressed contact in a mutually facing direction; and **[1C]** applying a laser beam (12s) through the light transmitting resin member (22) on the second weld region of the light absorbing resin member (21), and **[1D]** scanning the laser beam (12s) over a whole area of the second weld region, to repetitively radiate the laser beam (12s) on the second weld region to heat and melt a whole of the first weld region and second weld region simultaneously, and **[1E]** welding the light transmitting resin member (22) and the light absorbing resin member (21); characterized in that **[1F]** a contact surface between said first weld region and said second weld region has a three-dimensional structure, and **[1G]** an incidence angle of said laser beam (12s) upon said

contact surface changes with a position and [1H] a scan velocity of said laser beam (12s) is changed with the position to average a heating temperature."

- IX. Claim 1 of the new first auxiliary request has the following additional feature.

"[1I] wherein the scan velocity is changed in accordance with the incidence angle".

- X. The parties essentially argued as follows.

Main request - patent as granted

(a) Interpretation of claim 1

- Appellant

Regarding the interpretation of claim 1 as granted, the meaning of features 1G and 1H was rather unspecific. Paragraphs [0046] and [0071] of the patent used a different wording. Anyway, a change in velocity with changing incidence angle was implicit; it all came down to the amount of energy transmitted per unit length. The patent description did not contain any information on averaging a heating temperature. Feature 1H was understood as keeping the energy per unit length within a process window, as explained in document D14.

- Respondent

Features 1G and 1H had to be read in combination. Construing these features in the sense that the incidence angle and the scan velocity might change completely independently of each other at various positions which did not need to coincide, unnaturally

and unreasonably separated features 1G and 1H and neglected the technical context as well as the linguistic structure of claim 1. Because of the use of the definite article in "the position" of feature 1H, it was unequivocally clear that this was a direct reference to the "position" of feature 1G along the three-dimensional welding path. Otherwise, claim 1 would have used expressions as "a second position", "another position" or the like. Thus, the scan velocity of the laser beam was changed at the same position along the welding path at which also the incidence angle changed, i.e. it changed in function of the incidence angle. This understanding was supported by the description of the patent, notably in paragraphs [0046] and [0071]. It did not make sense to have a change in incidence angle of the laser beam without adjusting the scan velocity accordingly when attempting to average the heating temperature of the material to be welded.

(b) Inventive step

- *Appellant*

Document D8 was a thesis related to quasi-simultaneous laser transmission welding. In the scanning arrangement shown in Figure 2-10 of document D8, an f-theta lens focused the laser beam on the workpiece at an incidence angle that changed with position. The different diameter of the spot mentioned in this context referred to the alternative of using a simple lens. It was disclosed in document D8 that the welding parameters, including the scan velocity, had to be adapted to the welding task. The skilled person would thus have adjusted the scan velocity if the process did not provide the desired weld temperature at each position

of the contact surface between the weld regions of the resin members. In fact, in the specific example of section 4.3.2, document D8 already disclosed that the scan velocity was increased in the corners of the workpiece to prevent thermal damage. Bubbles and voids caused by overheating could also lead to leakage. The only distinguishing feature was thus feature 1F. The objective technical problem had to be formulated as to improve the teachings of document D8 for laser welding of three-dimensional parts. Regarding obviousness, it was firstly noted that document D8 already contained suggestions of the solution by indicating that quasi-simultaneous welding was not limited to a completely planar welding seam geometry and that contour welding allowed complex seam geometries. But the skilled person also received a clear hint from document D9, which was not incompatible with document D8, that larger three-dimensional parts could be quickly processed using beam scanners. Accordingly, when starting from document D8, the skilled person would have automatically arrived at the solution of claim 1 as granted by routine experimentation and taking into consideration the teaching of document D9. Therefore, the subject-matter of claim 1 as granted did not involve an inventive step.

- *Respondent*

Firstly, it had to be considered that Figure 2-10 of document D8 was schematic. In practice, f-theta lenses were normally telecentric so that the laser beam impinged perpendicularly on the workpiece irrespective of the angle of deflection caused by the scanning mirrors. Secondly, the reason for using two different velocities when scanning the DQ 250 housing in document D8 was unknown. It was highly doubtful that this was

done to prevent leaks and burns at the corners. Figures 3-2 and 3-3 of document D8 showed that the alternative FCVT housing, which was welded at a constant scan velocity, actually had sharper corners compared to the DQ 250 housing. Even if the slightly higher scan velocity in the corners might help to avoid burns, it definitely did not prevent leaks which occurred when welding was insufficient. It seemed that the different scan velocities of document D8 were found by trial and error in the test environment used for the DQ 250 housing and had nothing to do with averaging a heat temperature. A possible explanation might be that, in practice, there was often a delay when scanning around corners so that the scan velocity had to be locally increased. Furthermore, the scan velocity did not change in function of the incidence angle along the contact surface of the DQ 250 housing. In contrast, it changed at a position in the corners where the incidence angle did not change, and it remained constant along the straight edges. Even if, contrary to customary practice, a non-telecentric f-theta lens was used in document D8 so that the laser beam did not impinge perpendicularly on the contact surface, the scan velocity would still not change in function of the incidence angle. At the very least, document D8 failed to clearly teach a change in scan velocity to average a heating temperature. The reason was that Figure 2-10 implied that the angle of incidence of the laser was the highest, and thus the irradiation intensity of the laser the lowest, in the corners of the workpiece. In order to average the temperature, i.e. to keep the amount of energy supplied to the surface of the contact area per area constant and the temperature deviations as small as possible, the scan velocity should thus be reduced, not increased, in the corners. The solution of document D8 actually led to an even lower amount of

energy supplied per area and time. Hence, document D8 not only failed to disclose feature 1F, also feature 1H in combination with feature 1G was not disclosed. The objective technical problem was to provide a flexible welding method. Document D9 disclosed that, for laser welding of larger three-dimensional parts, the laser focus was not only scanned in a plane by scanning mirrors, but also followed the contour of the part in the elevational direction. As such, the teaching of document D9 was incompatible with the disclosure of planar scanning in document D8. As had been correctly noted by the opposition division in point 4.3.2.1 of the decision under appeal, the method shown in Figure 2-10 of document D8 was limited to two-dimensional geometries of the contact surface. The skilled person had no reason to use the method known from Figure 2-10 of document D8 for transmission welding of a three-dimensional contact surface and would thus not have consulted document D9 without hindsight. The welding method of document D8 might be made more flexible in many different ways. But even if the laser focus of the scanner of document D8 were moved in the z-direction in order to follow an elevational contour of a workpiece to be welded and to weld three-dimensional parts, such combination would still fail to yield the method as claimed including the combined features 1G and 1H.

Hence, the subject-matter of claim 1 involved an inventive step over a combination of documents D8 and D9.

New first auxiliary request

(a) Admittance

- *Appellant*

The claims of the new first auxiliary request were filed at a very late stage, namely one week before the oral proceedings before the board. The respondent had not provided sufficient reasons why the request should be admitted. It could not have been surprising that the board arrived at a different claim interpretation in its communication. In the statement of grounds of appeal, it was already pointed out that the scan velocity in document D8 increased in the corners. The respondent should thus have been prepared for such an interpretation. Moreover, the amendment to claim 1 of the new first auxiliary request was not based on the claims as granted, but on the description. The appellant had not been able to properly prepare its reaction to the new request in such a short time. It would seem that the new wording "in accordance" in claim 1 gave rise to a clarity objection, possibly also to objections under Article 83 EPC and Article 123(2) EPC. Therefore, the new first auxiliary request should not be admitted into the appeal proceedings.

- *Respondent*

The submission of the claims of new first auxiliary request at a late stage of the appeal proceedings was justified by the following cogent reasons. In point 4.2.2 of the decision under appeal, the opposition division had ruled that features 1G and 1H were clearly linked since in feature 1G "a position" was defined and feature 1H referred to "the position". It was thus clear for the skilled person that for a three-dimensional contact surface of the weld region, when the incidence angle of the laser beam changed with a position, also the scan velocity of the laser was actively changed with the position in order to average

the heating temperature. When discussing documents D8 and D9 in section 4.8 of the statement of grounds of appeal, the appellant did not question this finding of the opposition division. As such, the respondent had not reason to assume and could not foresee that the board, without cause and of its own motion, arrived at a new and different claim interpretation as expressed in point 18 of its communication pursuant to Article 15(1) RPBA. In view of this new situation which could not have been anticipated, the respondent prepared as soon as possible new auxiliary requests which specifically addressed this unexpected issue. Therefore, the new first auxiliary request should be admitted under Article 13(2) RPBA.

(b) Added subject-matter

- *Appellant*

The passage of paragraph [0040] of the application as filed had to be read in its context. The preceding paragraph [0039] referred to Figure 1F, which concerned an embodiment with a flat two-dimensional plane. The feature of paragraph [0040] was therefore not disclosed in the context of a contact surface with a three-dimensional structure. Regarding paragraph [0065] of the application as filed, its disclosure was part of the description of Figures 6A to 6C. Immediately before, in paragraph [0064], it was disclosed that the weld plane was tilted. Furthermore, the exact words in paragraph [0065] were "controlling the laser beam scan velocity", which had a more narrow meaning compared to the amendment to claim 1. The term "changing" was more abstract and implied that the scan velocity did not have to change at the same time as the incidence angle.

Hence, the requirements of Article 123(2) EPC were not met.

- *Respondent*

The amendment to claim 1 was based on paragraphs [0040] and [0065] of the application as filed. It clarified even more explicitly the term "changed" of feature 1H of claim 1 as granted and, thus, the relationship between the incidence angle and the scan velocity. There was no difference between changing and controlling in the context of the amended claim 1. Paragraph [0040] of the application as filed did not mention a two-dimensional or three-dimensional structure; the passage was thus perfectly applicable to both. As regards paragraph [0065] of the application as filed, it did not mention tilting. Hence, the requirements of Article 123(2) EPC were met.

(c) Clarity and sufficiency of disclosure

- *Appellant*

It was not clear from reading claim 1 of the new first auxiliary request how the scan velocity was changed, i.e. whether it increased or decreased. It was a result to be achieved. Therefore, the claim was not clear, contrary to Article 84 EPC.

Furthermore, the invention was not sufficiently disclosed. The teaching of claim 1 was to simply change the velocity. But also the curvature of the contact surface and the heat dissipation should play a role. In fact, the amendment to claim 1 was so broad and vague that there was no sufficient disclosure of the claimed

invention. It was merely an invitation to make experiments. Articles 83 and 84 EPC were linked.

- *Respondent*

The "change in accordance with" of feature 1I was clear to a skilled person who had to average a heating temperature. It was evident that the scan velocity had to change with the incidence angle so as to reduce the amount of energy dissipating in the material.

Regarding the requirements of Article 83 EPC, if the feature that formed the basis for the amendment was already in the description of the patent, then it could not itself make the claimed method so insufficiently disclosed that the skilled person could not implement it any more when they could before the amendment.

(d) Admittance of novelty and inventive step objections

- *Appellant*

The subject-matter of claim 1 of the new first auxiliary request lacked novelty in view of document D4 or document D6. Furthermore, it did not involve an inventive step in view of document D1 in combination either with the common general knowledge or with document D13, in view of document D8 in combination with document D9, in view of each of documents D1, D4, D6 and D8 in combination with either document D18 or document D19 - be it as separate prior art documents or as evidence of the common general knowledge -, and in view of document D5 in combination with document D1. These objections constituted a reaction to the late-filed new first auxiliary request. All documents were already cited in the statement of grounds of appeal.

Moreover, apart from document D13 and documents D18 and D19 (the latter two were already cited in the proceedings before grant), all documents had been presented in the proceedings before the opposition division. The objections should therefore be admitted into the appeal proceedings.

- *Respondent*

Several new objections were filed on appeal. The following objections should not be admitted into the appeal proceedings under Article 12(6) RPBA.

- lack of novelty in view of document D4 or document D6,
- lack of inventive step in view of document D1 in combination with the common general knowledge or in combination with document D13,
- lack of inventive step in view of any of documents D1, D4, D6 or D8 in combination with either document D18 or document D19, as separate prior art documents or as evidence of the common general knowledge, and
- lack of inventive step in view of document D5 in combination with document D1.

All of these objections could and should have been submitted in the proceedings before the opposition division. There were no exceptional circumstances justifying their late filing. Moreover, documents D18 and D19 were regular prior art documents, not evidence of the common general knowledge.

(e) *Inventive step*

- *Appellant*

Document D1 was a directive regarding laser beam welding of thermoplastics. It included a description of quasi-simultaneous welding in sections 5.1.3 and 8.2. A contact surface with a three-dimensional structure was mentioned in section 8.2.2.1. The incidence angle of the laser beam changed with a position along the welding path. The subject-matter of claim 1 of the new first auxiliary request thus differed from the method of document D1 only by features 1H and 1I. The objective technical problem was to provide a laser welding method that uniformalised the temperature distribution in the weld region. The example of section 8.2.2.1 of document D1 already indicated that, in order to keep the process parameters for laser welding of complex three-dimensional contours in a desired range, the radiation intensity could be varied. Section 8.2.2.2 of document D1 taught that the laser power and the scan velocity were the most important parameters; they had to be adapted to the welding task. The skilled person would have been aware of the underlying physics and would have realised that the right amount of energy per surface area had to be delivered to join the workpieces together in a certain process window. As the laser power and the scan velocity were presented as two straightforward alternative solutions in document D1, it would thus have been obvious to modify the scan velocity in order to compensate for a reduced energy per surface area on a tilted surface and to arrive at an average heating temperature that prevented thermal damage, in particular since section 10.1.1 of document D1 suggested to use a pyrometer for measuring temperature and controlling the process. Therefore, the subject-matter of claim 1 of the new first auxiliary request did not involve an inventive step in view of D1 and the common general knowledge.

When starting from document D8, the skilled person would have also arrived at the claimed subject-matter in an obvious manner. Once the geometry of the contact surface of document D8 was adapted in line with the teaching of document D9, it had inclined surfaces where the welding method would run the risk of leaving the process window, be it by producing burns or by insufficient welding. It would have been obvious then in view of the teaching of document D8 to adapt the scan velocity in order to return to within the process window. Implementing the additional feature of claim 1 of the new first auxiliary request did not go beyond routine experimentation.

Document D5 generally related to laser beam machining of three-dimensional workpieces. It explicitly referred to transmission welding of resin materials in paragraph [0005]. Furthermore, document D5 also addressed the welding of three-dimensional shapes in paragraphs [0010] to [0013]. Further disclosed was a welding condition in which a quantity of welding heat was large by an increase in the laser beam output and/or a decrease in the welding speed. In order to set that welding condition, the laser output and the welding speed were changed. It was therefore a suitable starting point for assessing inventive step. The objective technical problem was to provide an alternative parameter for controlling the welding task. From document D1, section 8.2.2.2, the skilled person would have learned that the laser power and the scan velocity were the most important control parameters that had to be adjusted to the welding task. Accordingly, it would have been the straightforward choice for the skilled person to change the scan velocity as an alternative to the laser power. The subject-matter of claim 1 was therefore not inventive

when starting from document D5 in combination with document D1.

- *Respondent*

Document D1 did not mention averaging a heating temperature over the contact surface between the two weld regions. Also, it did not propose to change the scan velocity with changing angle of incidence of the laser beam. According to section 8.2.2.2, the scan velocity was kept constant and one of the other parameters, such as laser power or joining pressure, was changed. It did not teach that any of the parameters were controlled or adjusted during the welding process. There was no teaching to correlate the scan velocity to the incidence angle. The sensor mentioned in section 10.1.1 of document D1 would only measure the temperature in a particular point, at one position, but could not determine the temperature differences along the welding path caused by different incidence angles. Also feature 1F was missing. Document D1 did not disclose a three-dimensional structure in conjunction with quasi-simultaneous welding, except when several scanning systems were used (see section 5.1.3). Section 8.2.2.1 of document D1 was irrelevant because it related to contour welding, i.e. using a laser robot. It had to be taken into account that, unlike with contour welding, the laser beam of a quasi-simultaneous welding method passed several times at a high velocity over each position of the welding path. In agreement with the opposition division, it was submitted that the skilled person, starting from D1 and without hindsight, would not have arrived at the welding method defined in claim 1 of the new first auxiliary request. Thus, the claimed subject-matter

involved an inventive step in view of document D1 in combination with the common general knowledge.

For the same reasons as already argued with respect to claim 1 as granted, claim 1 of the new first auxiliary request must involve an inventive step over document D8 in combination with document D9, in particular since the board's understanding of claim 1 was now in line with that of the opposition division. Document D8 did not correlate the scan velocity to the incidence angle. The different scan velocities mentioned for the DQ 250 housing were only caused by the geometry of the corners.

Document D5 was not a suitable starting point. It related to a welding robot irradiating a three-dimensional workpiece with a laser beam by changing the locus speed of the robot and controlling the intensity of the laser beam according to this locus speed in order to prevent the occurrence of voids. Document D5 did not mention averaging a heating temperature over the contact surface between the two weld regions. It did not propose to change the scan velocity with changing angle of incidence of the laser beam. In paragraph [0005] of document D5 transmission welding was mentioned, but only in the context of a prior art discussion. Furthermore, paragraph [0008] indicated that the three-dimensional weld could be made by a robot. Also the further description of the prior art referred to the use of a robot. However, contour welding using a robot was fundamentally different from quasi-simultaneous welding.

In sum, the subject-matter of claim 1 of the new first auxiliary request involved an inventive step.

Reasons for the Decision

Main request - patent as granted

Interpretation of claim 1

1. Claim 1 as granted concerns a method for manufacturing a resin mold assembly by means of laser transmission welding. The basic principle of this joining method is that laser energy is used to weld two resin members at their interface. In order to achieve that, the first resin member transmits light and the second resin member absorbs light (feature 1A). Pressure is applied to bring the weld region of each resin member in a pressed contact (feature 1B). A laser beam then passes through the light transmitting resin member on the weld region of the light absorbing resin member (feature 1C) where it is converted into thermal energy. The laser beam is scanned over a whole area of that weld region in a way that repetitively radiates the laser beam on the weld region in order to heat and melt a whole of the weld regions of both resin members simultaneously (feature 1D).

2. Simultaneous heating and melting would imply that the entire weld region is irradiated at once, effectively requiring multiple laser sources. In view of the statements in paragraphs [0044] ("*approximately uniformly at the same time*") and [0072] ("*almost at the same time or simultaneously*") of the patent, however, feature 1D of claim 1 as granted is understood to mean that first and second weld regions heat and melt *almost* at the same time or *quasi*-simultaneously.

3. Feature 1F of claim 1 as granted limits the first and second weld regions to those having a contact surface with a three-dimensional structure. Thus, the contact surface cannot extend entirely in a two-dimensional plane.

4. The last two features 1G and 1H of claim 1 as granted require that an incidence angle of the laser beam upon the contact surface changes with a position and that a scan velocity of the laser beam is changed with the position to average a heating temperature. The expression "changes with a position" is understood to refer to a position on the contact surface between the first and second weld regions, which is subjected to laser beam radiation, i.e. a position along the welding path. In at least one such position the laser beam impinges on the contact surface under a different angle compared to a second position. As regards the scan velocity, the definite article in the expression "is changed with the position" confirms that it also refers to the position on the contact surface subjected to laser beam radiation, i.e. the position along the welding path. When taken together, features 1G and 1H thus express the condition that both the incidence angle and the scan velocity must not remain constant along the entire welding path. This does not mean, however, that the scan velocity changes at the same position along the welding path as the incidence angle. Nor does the wording of features 1G and 1H require that the scan velocity is adjusted *in function of* the incidence angle. Both parameters may change independently along the welding path.

5. The respondent is correct when arguing that this interpretation is at odds with the way in which the embodiments of Figures 1A to 1F and 6A to 6C are

described in paragraphs [0046] and [0071] of the patent. However, the wording used in these paragraphs ("*the scan velocity is controlled in accordance with the incident angle or the distance*", "*controlling the laser beam scan velocity in accordance with an incident angle*") considerably differs from that of claim 1 as granted. Instead of "controlling" or "controlled" the much broader terms "changes" and "is changed" are used in the claim. Moreover, the scan velocity of feature 1H is, if at all, only indirectly connected to the incidence angle of feature 1G through the intermediary of an undefined "position". Claim 1 does not require any "accordance" between the parameters. The board does not see any reason to read into claim 1 as granted a restrictive feature mentioned only in the description and not suggested by the claim wording.

6. It seems appropriate to add that the above understanding of features 1G and 1H is not without technical sense when considering that other unclaimed parameters may also affect the laser energy applied per unit area to the weld region. For example, laser beam diameter and weld line width are mentioned in the context of Figures 8 and 9 of the patent (see paragraphs [0092] to [0098]).

Inventive step

(a) Document D8 as starting point

7. Document D8 is a master's thesis published in 2004 concerning quasi-simultaneous laser transmission welding of plastic housings used in the automotive field. It is undisputed that features 1A to 1E of claim 1 as granted are disclosed by document D8. Section 2.2.4.3, in particular, explains by means of schematic

Figure 2-10 how the prior art welding method is carried out. The laser beam is deflected at high speed in x- and y-direction via two scanning mirrors. A so-called f-theta lens then focuses the laser beam onto a flat welding surface. Since the workpiece illustrated in Figure 2-10 has straight edges, the laser beam must irradiate the welding surface with varying incidence angle. The same applies to the cover of the sample housing of substantially rectangular shape shown and discussed in sections 3.2 and 4.2 of document D8 ("*Deckelkontur DQ 250*"; "*DQ 250-Deckel*"). It must thus be concluded that the incidence angle of the laser beam changes with a position along the welding path (feature 1G).

8. The respondent countered the board's view on feature 1G by arguing that f-theta lenses were normally telecentric so that the laser beams would always impinge perpendicularly on the workpiece. This allegation was, however, not corroborated by any evidence. There is no mention of telecentric lenses in document D8. Nor is there any indication that an f-theta lens, which is standardly used to focus a laser beam onto a planar imaging field (see also paragraph [0040] of the patent), is inherently telecentric. Rather, the radiation lines in Figure 2-10 of document D8 imply that the laser beam is directed towards the welding surface under an angle with the vertical axis.
9. Regarding feature 1H, section 2.2.4.3 of document D8 already mentions that the scan velocity is a parameter of quasi-simultaneous welding; it may thus vary along the welding path ("*die Scangeschwindigkeit muss nicht konstant sein*"). A concrete example is provided in section 4.3.2 of document D8, at the bottom of page 47:

the cover of the DQ 250 control unit housing is welded using two different scan velocities, 150 mm/s along the straight edges of the joint and 160 mm/s in the corners. As a consequence, the scan velocity is changed with the position of the laser beam along the welding path. In the respondent's view, the burns mentioned in the sentence bridging pages 47 and 48 of document D8 ("*wegen Leckagen und Verbrennungen in den Ecken*") could be explained by a delay caused by a change in scanning direction around the corners. This argument is convincing. Increasing the scan velocity to 160 mm/s in the corners therefore has the consequence that the heat input is locally reduced. This will bring the heating temperature in the corners closer to an average temperature along the welding path. So, even if the respondent were correct when arguing that the scan velocities disclosed by document D8 were found by trial and error in a test environment, the method for manufacturing the DQ 250 housing of document D8 provides for a change in scan velocity in the sense of feature 1H.

10. In view of the above, the only distinguishing feature of claim 1 as granted with respect to the disclosure of document D8 is that a contact surface between said first weld region and said second weld region has a three-dimensional structure (feature 1F). Contrary to this requirement, document D8 mentions at more than one occasion that its quasi-simultaneous welding method is confined to two-dimensional contact surfaces (page 9: "*außer Quasisimultan, da nur 2D*"; page 12: "*eine praktische ebene Schweißnahtgeometrie*").

(b) Objective technical problem

11. The technical effect of feature 1F lies therein that there are less constraints on the resin members that can be welded. The method thus becomes more flexible. In agreement with the respondent, the objective technical problem can then be formulated as to provide a flexible welding method.

(c) Obviousness

12. The skilled person facing the problem of how to provide a flexible welding method would have readily found a solution in document D9, which also concerns the manufacture of plastic housings in the automotive field by way of quasi-simultaneous laser transmission welding (page 26, right column: "[b]eim hier eingesetzten *Quasi-Simultanschweißen*"). In the section on page 28 entitled "*3D-Bauteile bearbeiten*", document D9 describes a new generation of scanning systems that are able to scan the x- and y-coordinates while adjusting the focal distance to control the z-coordinate and, hence, allow welding of larger three-dimensional components. Such scanning systems are said to open up new possibilities in component design and seam weld geometry that conventional cutting processes cannot achieve. In other words, the welding method becomes more flexible compared to standard two-dimensional welding methods.
13. The respondent argued that the teaching of document D9 was incompatible with the disclosure of planar scanning in document D8. The board disagrees. In the section on three-dimensional components, document D9 further suggests to produce three-dimensional welding seams by means of a standard quasi-simultaneous welding method without the need of a dedicated 3D-scanner ("*Allerdings kann auch schon ohne den Einsatz dieser 3D-Scanner in*

gewissen Grenzen ein Bauteil mit einer Schweißnaht, die nicht in einer Ebene liegt, produziert werden"). With the good depth of field obtained at longer focal distances deviations from the plane of around 15 mm can be processed with consistent results (*"Daher können Bauteil-Unebenheiten bzw. Abweichungen aus der Ebene von etwa 15 mm bei gleich bleibenden Ergebnissen bearbeitet werden").* This means that no drastic changes are required to make the welding method of document D8 more flexible; it suffices to use the minor change in focal diameter at larger focal distances to weld the light transmitting resin member and the light absorbing resin member also at uneven, i.e. three-dimensionally structured regions on the contact surface. No hindsight is required to realise this. Therefore, the teaching of document D9 would have prompted the skilled person to extend the method of document D8 also to contact surfaces having a three-dimensional structure, in accordance with feature 1F.

14. In view of the above considerations, the board concludes that the subject-matter of claim 1 as granted does not involve inventive step having regard to the combination of documents D8 and D9. Hence, the ground for opposition under Article 100(a) together with Article 56 EPC prejudices the maintenance of the patent as granted.

New first auxiliary request

Admittance

15. The claims of the new first auxiliary request were filed after the date on which the board's communication under Article 15(1) RPBA was notified to the parties.

Pursuant to Article 13(2) RPBA in the version which entered into force on 1 January 2024 and applies to all appeal proceedings pending on or after that date (see OJ EPO 2023, A103), any amendment to a party's appeal case made after the expiry of a period specified by the Board in a communication under Rule 100, paragraph 2, EPC or, where such a communication is not issued, after notification of a communication under Article 15, paragraph 1, is, in principle, not taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

16. It was the respondent's case that the late submission was a legitimate and timely response to the claim interpretation advanced for the first time in point 18 of the board's communication pursuant to Article 15(1) RPBA. The board agrees. Neither the opposition division in the decision under appeal nor the appellant in its statement of grounds of appeal had hinted at a broad understanding of features 1G and 1H in the sense that the scanning velocity did not have to be adjusted in function of the incidence angle. When the board raised this issue in its communication and subsequently inferred a lack of inventive step in view of the combination of documents D8 and D9, new and unforeseen developments occurred in the appeal proceedings which lead to circumstances that can be qualified as exceptional.

17. Furthermore, the amendment to claim 1 in the new first auxiliary request addressed the board's interpretation of features 1G and 1H. It did not seem to make the proceedings more complex or give them a new direction. Rather, it was considered to be a legitimate attempt to adapt the claim wording in terms of the relationship

between scan velocity and incidence angle so as to yield an interpretation that the parties had already agreed on before the board's communication.

18. For the above reasons, the board exercised its discretion under Article 13(2) RPBA and took the claims of the new first auxiliary request into account.

Interpretation of claim 1

19. Claim 1 of the new first auxiliary request has the additional requirement that the scan velocity is changed *in accordance with* the incidence angle (feature 1I). This requirement is understood to imply a certain relationship or function between the scan velocity and the incidence angle in the sense that the value of the scan velocity follows from a specified value of the incidence angle. The incidence angle is thus known or has to be determined, and serves as an input to control the scan velocity.

Added subject-matter

20. Basis for the amendment of claim 1 can be found in paragraphs [0040] and [0065] of the description of the application as filed. Both passages disclose that the scan velocity is controlled in accordance with the incidence angle. Paragraph [0040] immediately follows the description of Figure 1F, in which a two-dimensional weld region is scanned. It discusses a mode of operation wherein the weld region deviates from a perfectly circular shape. Paragraph [0065] pertains to the detailed description of Figure 6C and, as such, relates to geometries with a tilted weld plane. In view of the limits to achieving a uniform heating temperature by tilting the weld plane (paragraph

[0064]) it is proposed also here to control the scan velocity in accordance with the incidence angle. At the end of paragraph [0062], the following statement can be found: "*this embodiment is similarly applicable to the three-dimensional structure of the weld region*". Further considering that claim 6 as filed already discloses the change in scan velocity in combination with a contact surface with a three-dimensional structure, the board concludes that there is no inextricable link between feature 1I and the tilted weld plane of Figure 6C so that the amendment is disclosed in the context of general contact surfaces with a three-dimensional structure (feature 1F).

21. The requirements of Article 123(2) EPC are thus met.

Sufficiency of disclosure

22. The appellant saw a non-compliance with Article 83 EPC therein that unmentioned parameters such as the curvature of the contact surface and the heat dissipation also had to play a role in averaging the heating temperature at the weld region. The board disagrees. Firstly, it is important to note that the features of claim 1 of the new first auxiliary request were already disclosed in the patent as granted. However, the appellant did not raise the ground for opposition under Article 100(b) EPC to object against a lack of sufficient disclosure. Furthermore, the patent in suit repeatedly mentions the objective to achieve a constant incidence energy per unit time and unit area at any position in the weld region (see, for example, paragraphs [0046], [0062], [0071]). The person skilled in the art may rely on common general knowledge to supplement the information contained in the patent and fill in possible gaps in the patent disclosure, for

example by realising that the incidence angle for a contact surface with a three-dimensional structure would be determined by the local curvature of the surface and the heat dissipation would depend on the thermal conductivity of the materials used. As the appellant failed to provide any detailed arguments why the skilled person would be unable to put the method of claim 1 into practice without the burden of exercising inventive skill, the board must conclude that the requirements of Article 83 EPC are met.

Clarity

23. It was further disputed by the parties whether the amendment to claim 1 of the new first auxiliary request introduced a lack of clarity pursuant to Article 84 EPC. The board observes that claim 1 as granted already required the laser beam scan velocity to change with the position to average the heating temperature. This requirement of feature 1H may thus not be examined for compliance with Article 84 EPC (cf. G 3/14, OJ EPO 2015, A102). Also outside the board's extent to examine clarity lies the question how the scan velocity is changed with different positions; this immediately touches on the requirement of feature 1H. What can be examined under Article 84 EPC is thus limited to the subject-matter introduced by the amendment of feature 1I, namely that the change in scan velocity occurs *in accordance with the incidence angle*. However, the appellant did not raise any objection against this new subject-matter. Its grievance with regard to Article 84 EPC was restricted to the subject-matter already contained in claim 1 as granted.
24. In any case, the board adds that it cannot see how the claimed relationship between the scan velocity and the

incidence angle of feature 1I is unclear or in contradiction with any other features of claim 1. The appellant's objection under Article 84 EPC is therefore not convincing.

Admittance of novelty and inventive step objections

25. At the oral proceedings held before the board, the appellant raised several novelty and inventive step objections against claim 1 of the new first auxiliary request. The respondent requested not to admit the novelty objections in view of document D4 or document D6, the inventive step objections in view of document D1 in combination with the common general knowledge or in combination with document D13, the inventive step objections in view of any of documents D1, D4, D6 or D8 in combination with either document D18 or document D19 - as separate prior art documents or as evidence of the common general knowledge -, and the inventive step objection in view of document D5 in combination with document D1.

(a) Novelty objections in view of document D4 or document D6

26. The provision of Article 12(6), second sentence, RPBA stipulates that the board shall not admit objections which should have been submitted, or which were no longer maintained, in the proceedings leading to the decision under appeal, unless the circumstances of the appeal case justify their admittance.

27. It follows from page 1 of the minutes of the oral proceedings held before the opposition division that neither the appellant nor opponent 2 contested the novelty of the subject-matter of claim 1 as granted.

Point 8 of the 'Facts and Submissions' and point 3.1 of the reasons for the decision under appeal confirm that none of the novelty objections raised during the written proceedings before the opposition division were maintained.

28. When the appellant raised a novelty objection in view of document D4 in its statement of grounds of appeal, it effectively resubmitted an objection that it had withdrawn in the proceedings leading to the decision under appeal. This was no different when it argued lack of novelty in respect of the subject-matter of claim 1 of the new first auxiliary request at the oral proceedings held before the board. Under Article 12(6), second sentence, RPBA such an objection is not admitted, unless the circumstances of the appeal case justify their admittance. The appellant did, however, not present any such justification other than that the novelty objection was a reaction to a newly filed claim request. Given that claim 1 had been further limited compared to the granted version with the result that its understanding by the board was now fully in line with both the opposition division's and the parties' interpretation of the subject-matter of granted claim 1 (see points 1. to 6. and 19. above; see also point 17. above), it was not apparent why the novelty objection was previously withdrawn and then reintroduced at the appeal stage. Further considering that the purpose of an appeal is to review what was decided at first instance, not what was not decided, the board decided not to admit the novelty objection in view of document D4 into the appeal proceedings (Article 12(6), second sentence, RPBA).
29. The novelty objection in view of document D6 was presented for the first time on appeal. But also here,

no justification for its late-filing was provided by the appellant, nor was it apparent from the file that there were circumstances that would speak in favour of the admission of the new objection. In particular, no matters seem to have arisen for the first time either during the oral proceedings held before the opposition division or in the reasons for the decision under appeal which could not have been foreseen by the parties and which prompted the appellant's reaction in the form of a new novelty objection presented both in the statement of grounds of appeal and at the oral proceedings held before the board. On the contrary, at the oral proceedings held before the opposition division, the appellant opted to drop its novelty objections and not to pursue the inventive step objections it had presented in the written proceedings in view of document D6 (see page 1 of the minutes). Taking further into account that the subject-matter of claim 1 of the new first auxiliary request was limited compared to claim 1 as granted in a way which reflected the opposition division's and the parties' previous understanding of the claimed subject-matter, the board came to the conclusion that the novelty objection in view of document D6 could and should have been submitted in the proceedings leading to the decision under appeal. It was therefore not admitted into the appeal proceedings (Article 12(6), second sentence, RPBA).

(b) Inventive step objection over document D1 in combination with the common general knowledge

30. It is evident from point 4.3.1 of the reasons for the decision under appeal that the appellant had raised an objection of lack of inventive step against claim 1 as granted starting from either document D1 or document

D5. The main argument of the appellant apparently was that, "[f]aced with the problem of a three-dimensional weld region where the incidence angle and thus the irradiation density of the laser changes with the position of the laser beam on the weld region the skilled person would [...] consider changing the scan velocity in order to keep the irradiation intensity constant". In point 4.3.1.1 of the reasons for the decision under appeal, the opposition division made its own analysis of document D1 and concluded "*that the skilled person, starting from D1 and without hindsight, would not arrive at the welding method defined in claim 1 as granted*".

31. In view of the above, the board judges that the inventive step objection starting from document D1 in combination with common general knowledge was already part of the decision under appeal. In consequence, it was also part of the appellant's appeal case, which in accordance with Article 12(2) RPBA is directed to the requests, facts, objections, arguments and evidence on which the decision under appeal was based. Hence, the inventive step objection starting from document D1 in combination with common general knowledge was not an amendment of the appellant's appeal case in the sense of Article 12(4), first sentence, RPBA. It was thus *de facto* in the appeal proceedings.

(c) Inventive step objection over document D1 in combination with document D13

32. At the oral proceedings held before the board, the appellant raised an objection of lack of inventive step over a combination of documents D1 and D13 against claim 1 of the new first auxiliary request. Such an objection had not been presented before, neither during

the proceedings before the opposition division nor in the written appeal proceedings. The admittance of this inventive step objection thus underlay the provisions of Article 13(2) RPBA (see point 15. above).

33. The appellant did not present any convincing reasons why the circumstances invoked by the filing the claims of the new first auxiliary request had to be regarded as exceptional. Nor can the board identify any causal link between the amended wording of claim 1 of the new first auxiliary request and the new inventive step objection. In contrast, as a result of the amendments to claim 1 as granted, the board's understanding of the subject-matter of claim 1 of the new first auxiliary request was identical to how the subject-matter of claim 1 as granted was understood by the opposition division and the parties (see points 1. to 6. and 19. above; see also point 17. above). Consequently, the addition of feature 1I to claim 1 as granted, even if it occurred at a very late stage in the appeal proceedings, did not justify raising an inventive step objection based on a new combination of two documents. The board therefore exercised its discretionary power under Article 13(2) RPBA and did not take the new objection into account.

(d) Inventive step objection over document D1, D4, D6 or D8 in combination with either document D18 or D19

34. Documents D18 and D19 were cited for the first time in the statement of grounds of appeal mainly as evidence of the skilled person's common general knowledge (see section 4.6.5 "[i]n order to further illustrate the knowledge of the skilled person by the time of the invention"). The appellant did not present any

convincing reason why it had not presented these documents, which were cited in the search report of the European patent application leading to the impugned patent, and the inventive step objections based thereon already in the proceedings before the opposition division. Further considering that common general knowledge is not normally established on the basis of the content of patent documents (see T 1540/14, Reasons 5), the board decided not to admit the inventive step objections starting from any of documents D1, D4, D6 and D8 in combination with document D18 or document D19, be it as separate prior art documents or as evidence of common general knowledge, into the appeal proceedings pursuant to Article 12(6), second sentence, RPBA.

(e) Inventive step objection over document D5 in combination with document D1

35. In view of the board's conclusion in point 43. below that document D5 does not qualify as a suitable starting point for assessing inventive step of the subject-matter of claim 1 of the new first auxiliary request, it could be left open whether or not the inventive step objection in view of a combination of documents D5 and D1 should have been admitted into the appeal proceedings.

Inventive step

(a) Document D8 in combination with document D9

36. New feature 1I further distinguishes the subject-matter of claim 1 from the method known from document D8. Only two different scan velocities (150 mm/s vs. 160 mm/s) are mentioned in the context of the DQ 250 housing in

section 4.3.2 of document D8. There is no indication that the change from 150 mm/s to 160 mm/s occurs in accordance with a change in incidence angle of the laser beam. On the contrary, the scan velocity of 150 mm/s remains constant along the straight parts of the joint despite the continuous change in incidence angle.

37. The appellant argued that the geometry of the contact surface of document D8, when adapted in line with the teaching of document D9, would inevitably result in situations which lay outside the process window so that skilled person would have had to adapt the scan velocity correspondingly. The board notes, however, that neither document D8 nor document D9 links the scan velocity to the incidence angle. Moreover, the prior art documents do not even mention that the incidence angle is determined. Changing the scan velocity in accordance with the incidence angle would thus not have been obvious to the skilled person. Quite the opposite, it goes against the explicit disclosure of document D8 to use more than two different scan velocities along the welding path.

38. In view of the above, the subject-matter of claim 1 of the new first auxiliary request involves an inventive step over the combination of documents D8 and D9 (Article 56 EPC).

(b) Document D1 in combination with the common general knowledge

39. Document D1 is an industrial guideline entitled "Laser welding of thermoplastics" issued by the German Welding Society ("DVS") in 2005. In section 5.1.3 of the document, a method of quasi-simultaneous welding is described in accordance with features 1A to 1E of claim

1. The reference at the end of section 5.1.3 to three-dimensional welding contours implies that also contact surfaces having a three-dimensional structure can be welded (feature 1F), albeit by the combined use of multiple scanner systems. Regarding feature 1G, the example of Figure 24 on page 14 of document D1 concerns a lid welded onto a sensor housing by means of quasi-simultaneous transmission welding, wherein the geometry of the lid is such that the welding must have involved a laser beam with varying incidence angle.
40. The subject-matter of claim 1 of the new first auxiliary request thus differs from the disclosure of document D1 by the features 1H and 1I. Following paragraphs [0046] and [0071] of the patent, the board formulates the objective technical problem in agreement with the appellant as to provide a laser welding method that uniformalises the temperature distribution in the weld region.
41. The appellant argued with reference to sections 8.2.2.1 and 8.2.2.2 of document D1 that it would have been obvious to the skilled person to change the velocity of the laser beam with the incidence angle in order to average a heating temperature. Section 8.2.2.1, however, is concerned with contour welding, an alternative to quasi-simultaneous welding in which a kinematic system such as an articulated robot arm moves over or relative to three-dimensional surface geometries (see sections 5.1.1 and 6.4.1 of document D1). Controlling the laser intensity in function of the temperature by means of contactless pyrometry (see the last sentence of section 8.2.2.1) is thus only suggested for contour welding, not for quasi-simultaneous welding. The board concurs with the respondent that a pyrometer measuring the temperature

in a particular point of the welding path would be of little use in case of a quasi-simultaneous welding method where the laser beam repetitively radiates over the weld region. Nevertheless, it is credible that the skilled person would have deduced from section 8.2.2.1 of document D1 that laser power is an important parameter in transmission welding. This is confirmed by section 8.2.2.2 which also mentions scanning velocity as an important set-up parameter ("*Einstellparameter*"). It is explained that, when using materials with low transmission, the laser intensity at high scanning velocity may not be sufficient to achieve melting in an acceptable process time. The board understands this to mean that both laser intensity and scanning velocity may have to be changed at the outset of the process in function of the properties of the light transmitting resin member. Yet this is not the same as adjusting these parameters *during* welding. A position-dependent velocity change cannot be deduced from section 8.2.2.2 of document D1, let alone that it hints at a velocity change in function of the incidence angle. Even if it is acknowledged that the skilled person had been aware of the underlying physics, the argument that the scan velocity would have been adjusted in order to compensate for a change in energy per surface area due to, for example, a tilted surface, whereas other parameters such as the laser intensity were to remain constant, is considered to be based on hindsight.

42. In view of the above considerations, the appellant has not convinced the board that the subject-matter of claim 1 of the new first auxiliary request does not involve an inventive step over document D1 in combination with the common general knowledge (Article 56 EPC).

(c) Document D5 in combination with document D1

43. Document D5 relates to a laser beam machining method with relative movement between a robot (see claim 1 of document D5) and the workpiece. Neither the embodiment of Figure 1 nor that of Figure 3 of document D5 discloses a welding method with the features 1A to 1E. The reference in paragraph [0005] of document D5 to "*a welding technique, using laser beams*" is made in the context of a discussion of the prior art and concerns a general description of laser transmission welding. Moreover, it follows from the advantage mentioned in paragraph [0008] that, similarly to the prior art discussed in paragraph [0010], the welding involves the use of a robot. A repetitive radiation of the laser beam on the weld region of the light absorbing resin member to heat and melt a whole of the weld regions simultaneously (feature 1D) is thus not disclosed. The board concludes that document D5 is not a suitable starting point for assessing inventive step of the subject-matter of claim 1 of the new first auxiliary request.

Conclusion

44. Having regard to the above considerations, the board concludes that the new first auxiliary request meets the requirements of the EPC so that the patent can be maintained as amended on the basis of this request pursuant to Article 101(3)(a) EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the following documents:
 - claims 1 to 13, filed as new first auxiliary request by letter dated 16 January 2024;
 - description and drawings of the patent specification.

The Registrar:

The Chairman:



N. Schneider

P. Lanz

Decision electronically authenticated