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Datasheet for the decision of 29 June 2021

Case Number: T 0561/17 - 3.4.03

Application Number: 11006037.3

Publication Number: 2448009

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Language of the proceedings: EN

Title of invention:
Photovoltaic module frame with reinforcement beam

Applicant:
LG ELECTRONICS INC.

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 13(1), 13(2), 25(1)

Keyword:
Inventive step - main request, first auxiliary request (no) - effect not made credible within the whole scope of claim
Late-filed second to fourth auxiliary requests - admitted (no)

Decisions cited:
G 0001/19

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Case Number: T 0561/17 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 29 June 2021

Appellant: (Applicant)	LG ELECTRONICS INC. 20, Yeouido-dong Yeongdeungpo-gu Seoul 150-721 (KR)
Representative:	Wuesthoff & Wuesthoff Patentanwälte PartG mbB Schweigerstraße 2 81541 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 6 October 2016 refusing European patent application No. 11006037.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	M. Stenger
Members:	M. Ley
	G. Decker

Summary of Facts and Submissions

I. The appeal lies from the decision of the examining division to refuse European patent application No. 11 006 037.3.

The examining division decided that the subject-matter of claim 1 of the main request and an auxiliary request did not involve an inventive step (Article 56 EPC).

II. At the end of the oral proceedings, the appellant requested that the decision under appeal be set aside and that a European patent be granted on the basis of the claims according to the main request or the first auxiliary request, both requests filed with the letter dated 19 May 2016 and underlying the impugned decision, or according to one of the second to fourth auxiliary requests, all filed with the letter dated 25 May 2021.

III. It is referred to the following documents:

D4 JP 10 294485

D10 US 2009/313937 A1

D13 *Design Manual Development for a Hybrid, FRP Double-Web Beam and Characterization of Shear Stiffness in FRP Composite Beams*, T.J. Schniepp, Thesis submitted to the Faculty of the Virginia Polytechnic and State University in partial fulfillment of the requirements for the degree of Master of Science in Engineering Science and Mechanics, 2002

IV. Wording of the independent claims of the requests (labelling **(a)**, **(b)**, ... , underlining and ~~terms in strike-through~~ added by Board)

Claim 1 of the main request has the following wording:

A photovoltaic module comprising:
(a) *a photovoltaic panel (110) having one or more photovoltaic cells (119);*
(b) *a frame (150) surrounding an edge of the photovoltaic panel (110); and*
(c) *a reinforcement beam (130) connecting two separate sides of the frame (150) at a rear of the photovoltaic panel (110), which is opposite to a light receiving surface of the photovoltaic panel (110) upon which solar light is incident,*
(c1) *the reinforcement beam (130) having a hollow space (130a) defined therein,*
characterized in that the reinforcement beam (130) comprises:
(c2) *a first flange (131) disposed at the photovoltaic panel side so that the first flange (131) is parallel to the photovoltaic panel (110);*
(c3) *a second flange (132) disposed spaced apart from the first flange (131) so that the second flange (132) is parallel to the first flange (131); and*
(c4) *a plurality of webs (133) disposed perpendicular to the first flange (131) and the second flange (132) while being spaced apart from each other for connecting the first flange (131) and the second flange (132);*
(c5) *and wherein the hollow space (130a) is surrounded by the webs (133), the first flange (131), and the second flange (132),*
(c6) *the webs (133) are depressed from sides of the first flange (131) and the second flange (132) so that*

the sides of the first flange (131) and the second flange (132) protrude,
(c7) *wherein the webs (133) are depressed from the sides of the first flange (131) and the second flange (132) by a distance less than a thickness of the first flange (131),*
wherein the frame (150) comprises:
(b1) *a first long side horizontal part (153-1) contacting the first flange (131) of the reinforcement beam (130) and the rear surface of the photovoltaic panel (110),*
(b2) *a second long side horizontal part (153-2) contacting the second flange (132) of the reinforcement beam (130), and*
(b3) *a third long side horizontal part (153-5) contacting the light receiving surface of the solar panel (110),*
(d) *wherein the photovoltaic panel (110) is coupled to the frame (150) between the first long side horizontal part (153-1) and the third long side horizontal part (153-5),*
(e) *wherein the reinforcement beam (130) is coupled to the frame (150) between the first long side horizontal part (153-1) and the second long side horizontal part (153-2),*
(f) *wherein the photovoltaic module further comprises a coupling member (154) inserted through the frame and the reinforcement beam (130) from the rear of the photovoltaic panel (110) for coupling the frame (150) and the reinforcement beam (130), and*
(g) *wherein the coupling member (154) protrudes into the hollow space (130a) of the reinforcement beam (130).*

Claim 1 according to the first auxiliary request corresponds to claim 1 according to the main request

with the additional feature (c8) after feature (c3) and the additional feature (c9) after feature (c7), wherein features (c8) and (c9) have the following wording:

(c8) *wherein the second flange (132) has a greater thickness than the first flange (131);*

(c9) *wherein each of the webs (133) has a less thickness than the first flange (131);*

Claim 1 according to the second auxiliary request corresponds to claim 1 according to the main request, wherein features (c4) to (c7), (f) and (g) are amended as follows:

(c4') *a ~~plurality~~ pair of webs (133) disposed perpendicular to the first flange (131) and the second flange (132) while being spaced apart from each other for connecting the first flange (131) and the second flange (132);*
(c5') *and wherein the hollow space (130a) is surrounded by the pair of webs (133), the first flange (131), and the second flange (132),*
(c6') *the webs (133) of the pair of webs (133) are depressed from sides of the first flange (131) and the second flange (132) so that the sides of the first flange (131) and the second flange (132) protrude,*
(c7') *wherein the webs (133) of the pair of webs (133) are depressed from the sides of the first flange (131) and the second flange (132) by a distance (t4) less than a thickness (t1) of the first flange (131), wherein t4 = 0.6 * t1,*

(f') *wherein the photovoltaic module further comprises a coupling member (154) inserted through the second long side horizontal part (153-2) of the frame and the*

second flange (132) of the reinforcement beam (130) from the rear of the photovoltaic panel (110) for coupling the frame (150) and the reinforcement beam (130), and

(g') *wherein the coupling member (154) protrudes into the hollow space (130a) of the reinforcement beam (130) through a hole formed at the second long side horizontal part (153-2) of the frame and a corresponding second flange hole (132a) of the second flange (132).*

Claim 1 according to the third auxiliary request corresponds to claim 1 of the first auxiliary request, wherein features (c4) to (c7), (f) and (g) are replaced by features (c4') to (c7'), (f') and (g') and wherein feature (c9) is amended as follows:

(c9') *wherein each of the webs (133) of the pair of webs (13) has a less thickness than the first flange (131);*

Claim 1 according to the fourth auxiliary request corresponds to claim 1 according to the second auxiliary request, wherein features (f') and (g') are removed and the following feature is added:

(h) *wherein the photovoltaic module further comprises a shock absorbing member (141) provided between the rear of the photovoltaic panel (110) and the reinforcement beam (130).*

V. The appellant's arguments can be summarized as follows:

(a) Inventive step of the main request

Starting from D4 as the closest prior art, the appellant agreed with the examining division that features (c1), (c4) to (c7), (g) were not disclosed in D4, see the statement setting out the grounds of appeal, III.3. In its letter dated 25 May 2021, the appellant added that paragraph [0010] of D4 did not disclose that the coupling member was inserted from the rear side of the photovoltaic module (part of feature (f)) as the screw could also be inserted from a side of the frame 3 into the rib 6.

For the appellant, the distinguishing features all enhanced the handling by a user and thus the safety of the photovoltaic module and were therefore related to each other, see the statement setting out the grounds of appeal, section III.5. The appellant considered the objective technical problem to be "the provision of a photovoltaic module that can be easily and safely handled by a user", see the statement setting out the grounds of appeal, section III.6.

Regarding features (c4) to (c7), in particular, the appellant argued in its letter dated 25 May 2021, page 6, fourth and fifth paragraphs, that the technical effect arising therefrom was that the strength of the photovoltaic module was enhanced while simultaneously maintaining an enhanced handling, i.e. to provide "an optimum relation between the mechanical strength and a convenient handling of the photovoltaic module", see said letter, page 7, antepenultimate paragraph. As to feature (g), the appellant argued in the same letter, page 10, first paragraph, that the technical problem

was to provide a way of connecting the frame and the reinforcement beam by a coupling member while ensuring a convenient and safe handling of the beam.

None of the prior art documents cited by the examining division taught to use a double-web beam with protruding flanges in order to increase the handling of the photovoltaic module for a user or to use the claimed depressed webs as gripping-structure. In particular, D10 referred to large-sized double-web beams made of steel used in floor and bridge systems and the skilled person would not contemplate this document when seeking a solution for increased handling of photovoltaic modules. D13 generally discussed double-web beams and their stability without providing any information regarding a beneficial handling of photovoltaic modules. Even if the skilled person were to use a double-web beam in D4, it would still lack the teaching that the flanges had to protrude by an appropriate amount such that the finger tips could engage the webs and that the coupling member had to protrude into the hollow space in order not to interfere with the handling by a user.

Regarding feature (g), in particular, the appellant argued that it would not be obvious to implement the screw in D4 in the claimed way. D4 taught holes 9 provided for installing the solar panel 2 to a roof top at a part of the rack-shaped frame that corresponded to the "second long side horizontal part". The skilled person would not choose that part as an appropriate location for fixing the rib 6 to the frame 3 by means of a screw; such a position of a screw would interfere with the installing of the solar panel to a rooftop.

(b) Inventive step of the first auxiliary request

In its statement setting out the grounds of appeal, section IV.1, the appellant argued that the added features (c8) and (c9) increased the stability of the reinforcement beam and enabled a more secure coupling due to a thicker flange 132. Furthermore, the weight was reduced due to a lower thickness of the webs and the handling improved due to a thicker flange 132.

In its letter dated 25 May 2021, the appellant did not provide any arguments specific to the first auxiliary request. During oral proceedings, the appellant added that, in D4, the thickness t1 of the first flange, the thickness t2 of the second flange and the thickness t3 of the web were identical. Features (c8) and (c9), i.e. t2 > t1 and t1 > t3, implied a better mechanical stability due to the increased thickness t2 and a improved handling due to the reduced thickness t3 resulting in a lower weight.

(c) Admission of the second to fourth auxiliary requests

The appellant justified the filing of the second to fourth auxiliary requests as being a reaction to the objections raised under Article 123(2) EPC for the first time in the Board's communication pursuant to Article 15(1) RPBA 2020. Moreover, the amendments were made to overcome the objections under Article 56 EPC without giving rise to any new objections and were clearly allowable. The Board should exercise its discretion to admit the second to fourth auxiliary requests into the proceedings.

Reasons for the Decision

1. The appeal is admissible.

2. The invention

The present application concerns a photovoltaic module including a solar panel having one or more solar cells, a frame surrounding an edge of the photovoltaic panel, and a reinforcement beam connecting two separate sides of the frame at the rear of the photovoltaic panel, which is opposite to a light receiving surface of the photovoltaic panel upon which solar light is incident, the reinforcement beam being implemented as a so-called double-web beam with two parallel flanges and two webs defining a hollow space. The frame is arranged so as to hold the photovoltaic panel and the reinforcement beam.

3. Main request

3.1 Closest prior art

Both the examining division and the appellant used document D4 as the closest prior art. The Board has no reasons to put this choice into question.

3.2 Distinguishing features

In the wording of claim 1, D4 discloses a photovoltaic module comprising:
a photovoltaic panel (2, 10, 11, 12, 13, figures 2 and 1) having one or more photovoltaic cells (11);
a frame (3, 3a, 3b, 3c, 3d, 4a, 4b) surrounding an edge of the photovoltaic panel (figures 2 and 4) and
a reinforcement beam (figure 8, H-shaped rib 6, figure 3) connecting two separate (opposite sides,

figure 2) sides of the frame (3, 3a, 3b, 3c, 3d) at a rear of the photovoltaic panel (figure 2), which is opposite to a light receiving surface of the photovoltaic panel upon which solar light is incident, the reinforcement beam (3) having a hollow space defined therein (figure 8),
the reinforcement beam comprises:
a first flange (figures 3 and 6) disposed at the photovoltaic panel side (figure 2) so that the first flange is parallel to the photovoltaic panel (2);
a second flange (figures 3 and 6) disposed spaced apart from the first flange so that the second flange is parallel to the first flange (figure 2);
and a ~~plurality of~~ web~~s~~ (figure 8) disposed perpendicular to the first flange and the second flange ~~while being spaced apart from each other~~ for connecting the first flange and the second flange (figure 8); and
wherein the hollow space (figure 8) is surrounded by the web~~s~~, the first flange and the second flange (figure 8 shows two "hollow" spaces defined by the flanges and the one web),
the web~~s~~ ~~are~~ is depressed from sides of the first flange and the second flange (figure 8) so that the sides of the first flange and second flange protrude (figure 8),
~~wherein the webs are depressed from sides of the first flange and the second flange by a distance less than a thickness of the first flange~~,
wherein the frame (3) comprises
a first long side horizontal part (figure 2) contacting the first flange of the reinforcement beam (3) and the rear surface of the photovoltaic panel (figures 2 and 3),
a second long side horizontal part contacting the second flange of the reinforcement beam (figures 2 and 3), and

a third long side horizontal part contacting the light receiving surface of the solar panel (figures 2 and 3), wherein the photovoltaic panel (figure 2) is coupled to the frame (3) between the first long side horizontal part and the third long side horizontal part (figure 2), and
wherein the reinforcement beam (6) is coupled to the frame between the first long side horizontal part and the second long side horizontal part (figure 2),
wherein the photovoltaic module further comprises a coupling member (paragraph [0010], "screw") inserted through the frame and the reinforcement beam ~~from the rear of the photovoltaic panel~~ for coupling the frame and the reinforcement beam (see the human translation of [0010] provided by the appellant in a letter dated 13 June 2016 or the human translation of paragraphs [0009] - [0013] provided by the examining division on the same date), ~~and~~
~~wherein the coupling member protrudes into the hollow space of the reinforcement beam.~~

The Board is of the view that the two flanges and the one web of the H-shaped rib 6 of D4 define two spaces, see figure 8, which can be qualified as "hollow" so that a "hollow space" according to feature (c1) is also disclosed in D4. None of the "hollow" spaces is surrounded by two or more webs, because the reinforcement beam of D4 has only one web. Thus, a hollow space within the meaning of (c5) is not shown in D4.

The Board accepts the appellant's argument given in its letter dated 25 May 2021, page 9, penultimate paragraph that D4 does not disclose that the screw mentioned in paragraph [0010] was inserted from the rear of the photovoltaic panel as shown in figure 4 of the present

application (photovoltaic panel 110, coupling member 154).

Hence, the subject-matter of claim 1 differs from D4 in that:

(i) the reinforcement beam comprises a plurality of webs disposed perpendicular to the first flange and the second flange while being spaced apart from each other for connecting the first flange and the second flange, wherein the hollow space is surrounded by the webs, the first flange and the second flange, wherein the webs are depressed from sides of the first and the second flange so that the sides of the first and second flange protrude, wherein the webs are depressed from sides of the first flange and the second flange by a distance less than a thickness of the first flange (i. e. features (c4) to (c7))

and in that

(ii) the coupling member protrudes into the hollow space of the reinforcement beam (feature (g)), while being inserted from a rear of the photovoltaic panel (part of feature (f)).

3.3 Objective technical problem(s)

3.3.1 The examining division identified three partial objective technical problems related to (c1)+(c4)+(c5), (c6)+(c7) and (g), respectively, and treated them separately, see sections 5.2, 5.3, 5.4, 5.8, 5.12 of the contested decision. As to features (c1), (c4) and (c5), the examining division regarded the problem to be solved as how "to increase the stability and rigidity of the module". With respect to features (c6) and (c7)

the examining division was not convinced that the grip of the beam by an operator was facilitated. Feature (g) was considered by the examining division inherent to using a double-web.

3.3.2 The Board is of the opinion that features (c4), (c5), (c6), (c7) and (g) do not contribute to an enhanced handling of the photovoltaic module - contrary to what the appellant argued, see V.(a) above, second and third paragraphs - for the reasons given in the following paragraphs:

(a) The appellant argued that by providing a reinforcement beam as shown e.g. in figure 1 of the application, the handling was easier, because the user did not have to grab two opposite ends (151) of the frame, which are at a distance of e.g 2 m, see the statement setting out the grounds of appeal, page 8, second paragraph.

The Board is of the opinion that this effect is already obtained by the arrangement of the H-shaped rib 6 in the photovoltaic module of D4, see figures 4 to 6.

(b) Regarding features (c4) and (c5), the appellant accepted the examining division's assessment that a double web beam (or II form beam) increased the stability and rigidity of the module. Further to that, the handling by a worker was improved, because the hollow space 130a reduced the weight of the reinforcement beam, see section III.5 i) of the statement setting out the grounds of appeal. In its letter dated 25 May 2021 (page 6, sixth and seventh paragraph), the appellant further argued that optimum mechanical strength would be achieved by

using a "bulky" reinforcement beam without any hollows parts and without depressed webs, which would, however, result in an inferior handling due to an increased weight of the photovoltaic beam. Feature (c5) thus allowed reducing weight and maintaining a convenient handling while enhancing the mechanical strength.

The Board understands from page 10, lines 15 to 16 of the application that providing a hollow space 130 reduces the weight when compared to a bulky reinforcement beam without any hollow parts. However, compared to the rib 6 of D4 (figure 8, two flanges, one web), the claimed reinforcement beam with at least one additional web does not necessarily have a lighter weight. Thus, it cannot be said that handling is necessarily improved by a weight reduction. The appellant's statements regarding bulky reinforcement beams appear not to be wrong, but they are not pertinent for defining the objective technical problem(s) solved by the distinguishing features (c4) and (c5) over the closest prior art D4, which does not use a bulky reinforcement beam, but rather an H-shaped rib.

(c) Regarding features (c6) and (c7), the appellant argued that the handling was improved by facilitating the grip of the beam by a user. The appellant referred to page 10, lines 6 to 9 for (c6) and page 11, lines 5 to 9 for (c7) of the application. The appellant further provided figures A to D to illustrate its point, see the statement setting out the grounds of appeal, pages 10 and 11, said figures being reproduced below.

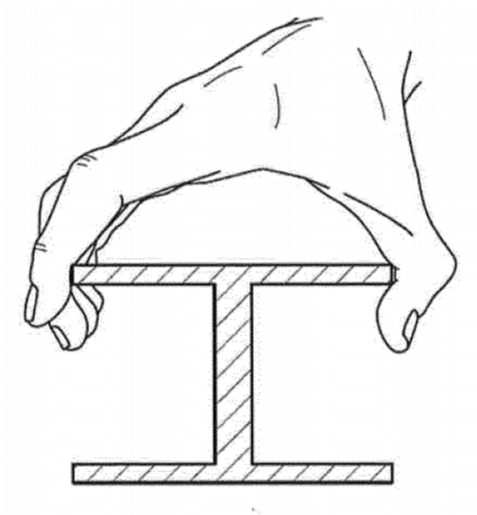

Fig. A: User handling a H-shaped rib

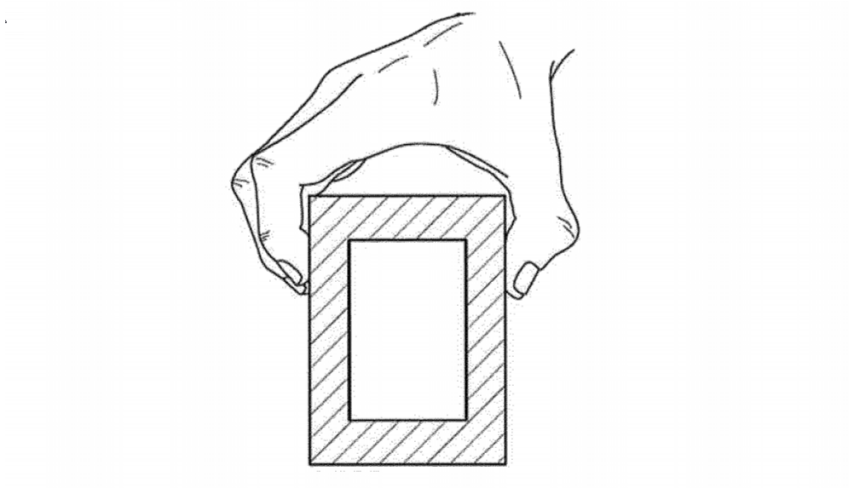

Fig. B: User handling a double-web beam without protruded flanges

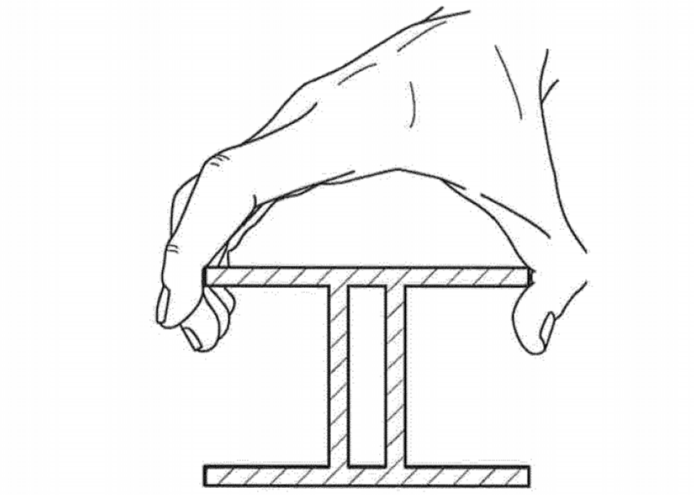

Fig. C: User handling a double-web beam, wherein t4 > t1

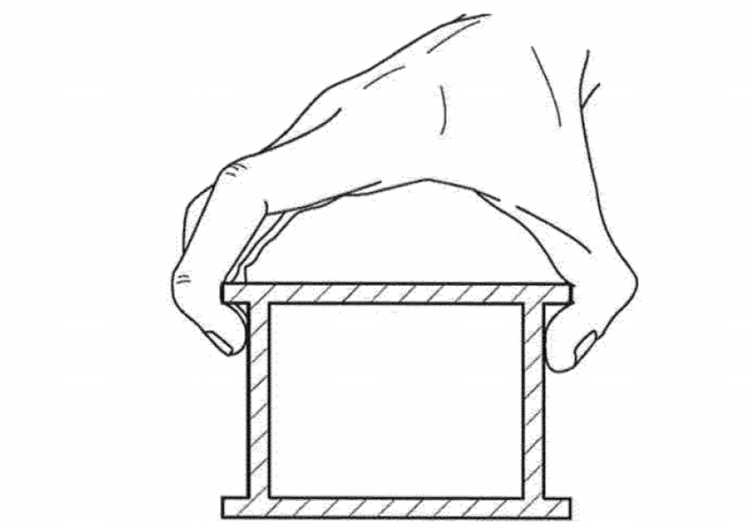

Fig. D: User handling a double-web beam, wherein t4 < t1

Figure A showed an H-shaped beam as used in D4 (see e.g. D4, figure 8), the flange of which could not be completely grabbed by the user's hand, the flange further cutting into the fingers. Figure B showed a "double web beam", wherein the webs were not depressed and the flanges did not protrude; the user's fingers would slip off this reinforcement beam. Figure C showed a "double web beam", wherein the webs were depressed and the flanges protruded "by a considerable amount", i.e. by a distance greater than a thickness of the first flange, cutting into the user's hand, similar to the H-shaped rib of D4. Figure D showed a "double web beam", wherein the webs were depressed and the flanged protruded "by a small amount", i.e. by a distance less than a thickness of the first flange. Figure D corresponded to figure 3 of the application. The user's finger tips pressed against the webs and provided maximum grip and convenience, which meant that the depression distance should not be too large. The absolute values of the depression distance and the thickness of the first flange did not have to be defined. In its letter dated

25 May 2021, page 7, second paragraph, the appellant further alleged that the mechanical stability of the beam shown in figure C was reduced compared to the beam of figure D.

Thus, features (c6) and (c7) provided an "easy-to-grip-structure" maintaining or even improving the comfortable handling compared to the H-shaped reinforcement beam 6 of D4, see the letter dated 25 May 2021, paragraph bridging pages 6 and 7. Feature (c7) improved the handling as the user's fingers might press against the webs when gripping, thereby providing maximum grip and convenience and ensuring an "optimal grip feeling and a safe handling", see said letter, page 7, third paragraph.

The Board does not share the appellant's opinion. Regarding feature (c6), the beams of figure A (corresponding to the beam of D4, see figure 8) and figure C both have the sides of the first flange and the second flange protrude either from two webs (figure C) or from one single web (figure A). For both arrangements - as also stated by the appellant - the handling of a module comprising such a reinforcement beam is "rather cumbersome and inconvenient", as the "flanges cut into the hand". Page 10, lines 1 to 9 as well as page 22, lines 5 to 8 are the only passages in the application mentioning a "convenient" grip for a worker or a user in relation to protruding portions of the first and second flanges as shown in figures A, C and D provided by the appellant or figure 8 of D4. It cannot be derived from these passages that feature (c6) would provide a better handling compared to the module of D4. In other words, with

feature (c6) alone, an improved handling (compared to D4) is not achieved.

Regarding (c7), the Board is not convinced that an improved handling is necessarily achieved by depressing the webs from the sides of the first flange and the second flange by a distance less than a thickness of the first flange. Of all the beams shown in figures A to D provided by the appellant, the example of figure B seems to have the worst handling, because the webs are not depressed at all, the flanges do not protrude and the user's fingers will slip off the beam. In the Board's view, the thickness t1 of the first flange will typically be a few millimeters (see e.g. D4, [0018], disclosing a wall thickness of the ribs 2 mm and a width of the ribs/flanges k = 20 mm). Thus, a depression distance t4 of the webs of less than t1 according to feature (c7) encompasses e.g. t4 = 0.1 mm. It does not appear plausible that depressing the webs of a beam according to figure B by about 0.1 mm improves its handling as compared to the beams shown in figure A or figure C. In other words, feature (c7) does not necessarily solve the objective technical problem indicated by the appellant, either. In the application as originally filed, the passage on page 10, line 24 to page 11, line 9 discloses feature (c7) and further geometric configurations for the reinforcement beam without, however, convincingly showing that the handling would be enhanced in comparison with the handling of a photovoltaic module as disclosed in D4.

The objective technical problem solved by distinguishing features (c4) to (c7) should be

credibly solved over the whole breadth of claim 1, i.e. for each embodiment falling within the claimed scope. Reference is made to the Case Law of the Boards of Appeal of the European Patent Office, 9th Edition, 2019, I.D.4.3 and G 1/19, point 82. The Boards accepts that under certain conditions a reinforcement beam according to claim 1 might achieve an improved handling. For example, if the width of the first and second flanges is around 10 cm and t4 = 10 mm with t1 = 11 mm, then the hand of a normal worker would probably better grab the beam compared to the one of D4. If, however, said width is 20 cm, t4 = 0.3 mm with t1 = 5 mm, then it is unlikely that a better handling is obtained. The Board agrees with the examining division that without specifying the absolute dimensions (depression distance t4, thickness t1, and the width of the flanges) of the reinforcement beam in claim 1, an improvement in handling is not necessarily obtained, see the contested decision, sections 5.15 and 5.9.

Put differently, the wording of claim 1 encompasses embodiments of photovoltaic modules with features (c4) to (c7) whose handling is less convenient than the handling of the module known from the closest prior art D4. It follows that the appellant's formulation of the objective technical problem, see V.(a), second and third paragraphs, cannot be accepted.

The Board is also not convinced by the argument that the mechanical stability of the beam without feature (c7) as shown in figure C was in a general manner reduced compared to a beam including feature (c7) as shown in figure D. This would rather depend

on the exact dimensions of the webs and flanges involved. Thus, feature (c7) *per se* does not have a measurable impact on the mechanical stability of a beam according to (c4) to (c6).

(d) During oral proceedings, it was also discussed whether the feature t4 = 0.6 * t1 (t4 being the "depression distance" according to (c7) and t1 the thickness of the first flange) would change the above conclusion. The Board is of the view that this is not the case. The wording of claim 1 - even including the term t4 = 0.6 * t1 - encompasses embodiments with very small depression distances t4 of e.g. 0.1 mm or 3 mm, because the absolute value of the first flange's thickness t1 is not specified. Thus even the above relationship between t4 and t1 would not necessarily result in a beam having an "improved handling".

According to the appellant, a skilled person would consider that the typical dimensions of a photovoltaic module were 2 m for the length, 1 m for the width and 50 mm for the height and that t1 would be in the region of a couple of centimetres (e. g. 2 cm), so that t4 = 0.6 * 2 cm would typically amount to e.g. 1.2 cm. In support of this argument, the appellant argued during oral proceedings that page 9, lines 13 to 15, disclosed a distance of 6 mm between the first flange 131 and the rear surface of the solar panel. Under the supposition that figure 3 of the application was drawn to scale, the skilled person would derive therefrom that the thickness of the first flange was several cm. For small modules, the skilled person would not consider reinforcement beams at all and for larger modules, the skilled person

would not use larger reinforcement beams, but increase their number.

These arguments have not convinced the Board, either. Concerning figure 3 and page 9, lines 13 to 15 of the application, there are no indications in the application that figure 3 is drawn to scale and actually shows the preferable arrangement mentioned on page 9, lines 13 to 15. Further, there is no standard size for photovoltaic modules, which, according to the Board's knowledge, exist on the contrary in a wide variety of sizes. Thus, neither from the content of the present application nor from their common general knowledge would the skilled person derive that the thickness of the first and second flanges as claimed is in the range of a few cm.

Instead, and as pointed out in the Board's communication (section 5.2.3.3), paragraph [0018] of D4 mentions a thickness of 2 mm for the beam shown in figure 8 for a photovoltaic module of similar dimensions (S = 1000 mm, see also figure 7) as the ones suggested as being typical by the appellant.

(e) Regarding feature (g), the appellant argued that using a double-web beam did not imply that the coupling member protruded into the hollow space thereof as a skilled person might arrange the coupling member on the protruding part of the flanges. It added that a coupling member protruding into the hollow space would improve the handling of the beam and the safety of the users, because they could then not touch the coupling member when

grabbing the beam. It referred to page 10, lines 17 to 19.

D4 discloses that the frame 3 and the reinforcement beam 6 are connected by a screw ([0010]). The Board accepts the argument that using a double-web beam does not imply that a screw used as coupling member would necessarily penetrate into the beam's hollow space.

However, the Board cannot comprehend how extending such a screw by e.g. 1 mm into a double-web beam's hollow space or the hollow space defined by the two flanges and the one web (see D4, figure 8) would have any impact on handling the photovoltaic module or the user's safety.

3.3.3 In view of the above, the Board does not share the examining division's view that features (c4)/(c5) could be treated independently from features (c6)/(c7), because they all describe the arrangement of the plurality of webs in the reinforcement beam so that they all together provide a technical effect related to the webs.

However, no synergistic effect between the arrangement of the webs according to distinguishing feature (i) and distinguishing feature (ii) is disclosed in the application as originally filed so that for each of the distinguishing features (i) and (ii) a partial objective technical problem should be formulated.

Regarding distinguishing feature (i), the only technical effect is to increase the stability and rigidity of the module so that the objective technical problem would be to achieve this effect. As stated by

the examining division and the appellant, the use of a double-web beam as defined by features (c4) and (c5) improves the mechanical strength compared to the H-beam used in D4 (figure 8). An enhanced handling is not necessarily achieved over the whole breadth of claim 1 for the reasons given above in section 3.3.2.

Regarding feature (ii), paragraph [0010] of D4 states that a screw (i.e. a coupling member) can be used to connect the frame 3 and the H-shaped rib 6 of D4, without giving any details. Therefore, the technical problem to be solved is to provide a way of connecting the frame 3 and the reinforcement beam 6 of D4 by a screw.

3.4 Obviousness

3.4.1 Regarding distinguishing feature (i), the Board shares the examining division's view that the skilled person (i.e. a mechanical engineer) wishing to solve the objective technical problem would know from their common general knowledge that a double-web beam (i.e. a beam with a pair of webs) has an improved stability and rigidity when compared to an H-beam as known from D4. This was accepted by the appellant, see the statement setting out the grounds of appeal, page 7, second paragraph, last sentence. Pages 26 and 27 of D13 concern the underlying Euler-Bernoulli beam theory (developed ca. 1750), according to which midspan deflection of a "simply supported beam" loaded at one single "load point" positioned at a distance *a* from one end decreases with increasing the second moment of inertia, see e.g. equation (3-1) on page 27 of D13. As a lower deflection results from a higher rigidity, it follows that the rigidity of a beam increases with its second moment of inertia. A beam with two webs has a

higher second moment of inertia than the same beam with a single web and, hence, a higher rigidity and mechanical stability.

Thus, it belongs to the common general knowledge of the skilled person that a single-web beam is less rigid than a double-web beam, see also D10, figures 1 and 2, [0017], [0018]: "For a beam of a given overall length, width and height, the dual web 16, 18 design affords greater strength and rigidity than a single web having a mass equal to the combined mass of the webs 16, 18." Although D10 deals with steel beams used in buildings and bridges, this statement is also valid for reinforcement beams used in photovoltaic modules. Thus, the skilled person wishing to solve the objective technical problem relating to feature (i), see section 3.3.3 above, would replace the reinforcement H-beam of D4, figures 8 and 3, by a double-web beam having two webs and hence arrive without any inventive skill at a photovoltaic module with features (c4) to (c6). As no technical effect is achieved by (c7), providing the webs depressed by a distance less than a thickness of the first flange is not more than a design choice for the skilled person, when selecting a suitable double-web reinforcement beam for the photovoltaic module of D4.

Features (c4) to (c7), i.e. distinguishing feature (i), are thus obvious in view of D4 and the common general knowledge of the skilled person.

3.4.2 Regarding feature (ii), the Board disagrees with the examining division that feature (g) was "inherent to using a double-web beam".

Paragraph [0010] in D4 does not explicitly disclose the location of the screw connecting rib 6 and frame 3. For the beam shown in figure 8 of D4, the most obvious way for the skilled person would be to provide a hole in the region of overlap between the rib and the frame, i.e. through the lower part ("second long side horizontal part") of the frame and through the second flange and insert the screw (i.e. a coupling member) into the hole from the rear side of the photovoltaic panel. When doing so, the skilled person would not provide the hole close to an edge of the second flange, but rather in the middle thereof (close to the web). It would also be obvious for the skilled person to use the whole thickness of the beam for fixing the screw, e.g. by a threaded hole traversing the beam completely, and a screw long enough to extend into the space between the first and second flanges in D4 in order to obtain the highest possible mechanical stability.

The Board is of the view that the above consideration also holds after replacing the H-shaped rib 6 of D4 by a double-web beam for the reasons given in section 3.4.1 above. In particular, if the beam to be coupled is a double-web reinforcement beam, it would be most obvious for the skilled person to place the screw and the threaded hole in the middle of the beam.

Thereby, the screw would automatically be arranged under and protruding into the hollow space of the double-web beam.

As to the appellant's argument that providing the screw in the claimed way would interfere with the way the photovoltaic module is to be installed on a rooftop, the skilled person would understand that the frame 3 comprises not only the holes 9 shown in figure 2 of D4,

but a multitude of holes provided along the periphery of the frame's lower part, said multitude being used to install the module to a rooftop as described in paragraph [0010] of D4. Providing a screw through holes in the frame and the rib as described in the previous paragraph would not be an obstacle for installing the module on a roof as described in D4.

In other words, it would have been obvious for the skilled person wishing to solve the objective technical problem relating to feature (ii) to provide a coupling member (i.e. a screw) in D4 that extends through the second long side horizontal part of the frame 3 and through the second flange of the reinforcement beam 6 from the rear of the photovoltaic panel for coupling the frame 3 and the reinforcement beam 6 in a way that the coupling member protrudes into the hollow space of the reinforcement beam 6.

Feature (ii) is thus obvious in view of D4 and the common general knowledge of the skilled person.

3.5 For the above reasons, claim 1 according to the main request lacks an inventive step (Article 56 EPC).

4. First auxiliary request

The Board opines that the objection raised against the claim 1 of the main request is not overcome by claim 1 of the first auxiliary request.

The effects alleged by the appellant in the statement setting out the grounds of appeal (see V.(b) above) might be achieved for certain ranges for the thicknesses t1 to t4. However, without any indication of the absolute values of t1 to t4, increased

stability, more secure coupling, reduced weight and improved handling are not necessarily improved compared to the beam of D4 or a double-web beam replacing that beam. For example, the fact that the second flange is thicker than the first flange does not exclude that it is so thin that it cuts into the hand of a user. Making the first flange of the beam of D4 thinner without modifying the second flange does not provide any beneficial effect on the coupling between the second flange and the frame. Making the first flange thicker than the webs (without modifying the webs) does not reduce the weight of the beam.

The Board notes that claim 1 according to the first auxiliary request does not define by which amount e.g. the thickness t2 of the second flange should be larger than the thickness t1 of the first flange. The wording of claim 1 encompasses embodiments with t2 = 1,01 * t1 and t1 = 1,01 * t3, i.e. wherein the difference in thickness might be of the order of only 1 % or even less. The Board doubts that such small differences would have any measurable impact on the stability and handling of the photovoltaic module known from D4.

The Board is also not convinced that features (c8) and (c9) provide an optimum relationship between stability and handling of the photovoltaic module, as argued by the appellant during oral proceedings. Apparently, the appellant is of the view that claim 1 is directed only to embodiments wherein the thickness t1 is unmodified, the thickness t2 is increased and the thickness t3 is reduced in comparison with figure 8 of D4. The Board points out that the wording of claim 1 also encompasses embodiments wherein t3 is unchanged and t1 as well as t2 are both increased with respect to the values used in D4. While one might accept that the mechanical

stability is increased in this case, the total weight of the beam is increased as well and thus the handling would be less convenient. The wording of claim 1 further encompasses embodiments wherein t2 is unchanged and t1 as well as t3 are both reduced with respect to the values used in D4. In this case, the weight is decreased, but the mechanical stability is not improved.

Neither the indications in the application (see e.g. page 10, line 24 to page 11, line 9) nor the appellant's arguments have convinced the Board that there is a particular technical problem solved by features (c8) and (c9) over the whole scope of claim 1.

Providing a beam according to features (c8) and (c9) is thus not more than a design choice for the skilled person, when selecting a suitable double-web reinforcement beam for the photovoltaic module of D4.

Therefore, the subject-matter of claim 1 according to the first auxiliary request lacks an inventive step (Article 56 EPC).

5. Admission of the second to fourth auxiliary requests

5.1 The second to fourth auxiliary requests were filed with a letter dated 25 May 2021 after summons to attend oral proceedings had been notified. In accordance with Article 25(1) RPBA 2020, Article 13(1) and (2) RPBA 2020 applies in the present case.

5.2 The Board is not convinced that there are exceptional circumstances, which have been justified with cogent reasons by the appellant, for filing amendments to the appellant's appeal case at this late stage of the

appeal proceedings. The appellant justified the inclusion of feature "wherein t4 = 0.6 * t1" in claim 1 by the Board's concerns expressed in the last paragraph of section 5.2.3.3 of the Board's communication. However, these issues were already addressed by the examining division in its decision (see e.g. section 5.15) so that there is no convincing justification for the modification of feature (c7) at this late stage.

Moreover, the Board notes that the amendments made according to features (c4') to (c7'), (f') and (g') in claim 1 according to the second auxiliary request and the additional amendments made according to feature (c9') according to the third auxiliary request were briefly discussed in the context of the main request and the first auxiliary request. *Prima facie*, they do not overcome the objections raised under Article 56 EPC.

For these reasons, the Board exercises its discretion under Article 13(1) and (2) RPBA 2020 and does not admit the second and third auxiliary request into the proceedings.

5.3 Likewise, the Board is not convinced that there are exceptional circumstances, which have been justified with cogent reasons by the appellant, for filing for the first time an independent claim directed to a photovoltaic module without any coupling member and with a shock absorbing element according to feature (h). This amounts to a fresh case, which runs counter to the principle underlying Article 13(2) RPBA 2020 according to which, at this stage of the appeal proceedings, amendments to a party’s appeal case are not to be taken into consideration. The fourth

auxiliary request is thus not to be taken into account in accordance with Article 13(2) RPBA 2020.

6. As no allowable request is on file, the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero M. Stenger

Decision electronically authenticated