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**Datasheet for the decision
of 15 January 2015**

Case Number: T 2107/12 - 3.2.03
Application Number: 97920407.0
Publication Number: 0892877
IPC: E04D13/18, H01L31/048,
H01L31/042
Language of the proceedings: EN

Title of invention:

Lightweight, self-ballasting photovoltaic roofing assembly

Patent Proprietor:

SunPower Corporation, Systems

Opponents:

Spaniol, Werner
Knubix GmbH

Headword:

Relevant legal provisions:

EPC 1973 R. 55(c)
EPC 1973 Art. 56, 54(2)
RPBA Art. 12(4)

Keyword:

Admissibility of opposition - opposition substantiated (yes)
Late-filed evidence - admitted (yes)
Novelty - main request (yes)
Inventive step - main request (yes)

Decisions cited:

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 2107/12 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 15 January 2015

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
27 July 2012 concerning maintenance of the
European Patent No. 0892877 in amended form.**

Composition of the Board:

Chairman	G. Ashley
Members:	V. Bouyssy
	E. Kossonakou

Summary of Facts and Submissions

- I. European patent No 0 892 877 (in the following: "the patent") concerns a lightweight self-ballasting photovoltaic assembly adapted to resist wind uplift forces when laid on a roof.
- II. The patent was already granted at the time of the entry into force of the EPC 2000 on 13 December 2007. Where Articles or Rules of the earlier version of the EPC apply in accordance with the relevant transitional provisions, their citations are followed by "1973".
- III. The patent as a whole was opposed on the grounds of Article 100(a) EPC 1973 for lack of novelty and inventive step. An intervention was filed during the opposition proceedings, which was based on the same grounds for opposition. The Opposition Division decided that the subject-matter of claim 1 as granted lacked an inventive step (Article 100(a) EPC 1973 with Article 52(1) EPC and Article 56 EPC 1973) but that the patent could be maintained on the basis of auxiliary request 3 filed before it (Article 101(3) (a) EPC).
- IV. This interlocutory decision has been appealed by the patent proprietor (here Appellant I) as well as by the Intervener/Opponent 2 (here Appellant II).
- V. Opponent 1 did not file an appeal nor provided any submissions, but is party as of right in the appeal proceedings.
- VI. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA) indicating to the parties its preliminary opinion of the case.

VII. Oral proceedings before the Board were held on 15 January 2015 without the participation of the duly summoned Opponent 1 (party as of right). Reference is made here to the minutes of the oral proceedings.

VIII. Requests

Appellant I requested that the decision under appeal be set aside and the patent be maintained as granted (main request), alternatively on the basis of auxiliary requests 1 and 2 filed with the letter of 28 November 2012, clarified auxiliary request 2 filed with the letter of 5 September 2014, or auxiliary request 3 filed with the letter of 28 November 2012.

Appellant II requested that the decision under appeal be set aside and the patent be revoked.

IX. Claims of the main request

a) Independent claim 1 as granted reads as follows:

"A self-ballasting photovoltaic assembly comprising:
a photovoltaic module (106, 206) having sides and upper and lower surfaces; and
at least one spacer (116, 132, 222) secured to the lower surface of the photovoltaic module and which is to be mounted on top of a roofing membrane (112);
said at least one spacer (116, 132, 222) sized and configured to define an open region (123) beneath said lower surface and access openings (150, 152) for fluidly coupling said open region to said upper surface;
characterized by [sic] in that

said access openings (150, 152) extend along at least two sides of said photovoltaic module; such that wind uplift forces are resisted when said self-ballasting photovoltaic assembly is mounted to the roofing membrane, and the assembly has a weight in a range of roughly 1/3 - 1/6 of a conventional roofing ballast weighting between 48,8 - 73,2 kg/m²".

b) Independent claim 2 as granted reads as follows:

"2. A self-ballasting photovoltaic assembly, comprising:
an insulation member (324, 322, 320) disposed as a layer on top of a roofing member (302);
at least one spacer (314, 312, 316) configured for disposal on top of said insulation member (320, 324, 322);
a photovoltaic module (304, 306, 308) having an upper and lower surface and first, second, third and fourth sides and disposed on top of said spacer (312, 314, 316) to form a self-ballasting photovoltaic assembly;
said at least one spacer (312, 314, 316) are characterized in that [sic] arranged in a geometry which generally follows the sides of said photovoltaic module (304, 306, 308); and defines an open region beneath said lower surface and access openings for fluidly coupling said open region to said upper surface,
said access openings are between 5% and 50% of the length of each of the first, second, third and fourth sides of the photovoltaic module (304, 306, 308);
whereby said geometry enables said self-ballasting photovoltaic assembly to resist forces of wind uplift."

c) Independent claim 13 as granted reads as follows:

"13. Array of a plurality of self-ballasting photovoltaic assemblies according to claim 1 or 2, comprising a perimeter securement situated around the array."

d) Dependent claims 3 to 12 and 14 to 20 respectively define preferred embodiments of the assembly of claim 1 or 2 and of the array of claim 13.

X. Cited prior art

a) In their statements of grounds of appeal, Appellants I and II have referred to the following prior art documents which were filed in the opposition proceedings and are cited in the decision under appeal:

D1: WO 96/00827 A1

E8: DE 36 11 542 A1

E9: T. L. Dinwoodie and D. S. Shugar, "Optimizing Roof-Integrated Photovoltaics: A Case Study of the PowerGuard™ Roofing Tile", Proceedings of the IEEE 1st World Conference on Photovoltaic Energy Conversion, 5 to 9 December 1994, Hawaii, pages 1004 to 1007

Of these, D1 and E8 are cited in the patent specification (see paragraphs [0006] and [0007]).

b) In its statement of grounds of appeal, Appellant II also relied on the following document for the first time:

E14: DE 295 03 315 U1

XI. The arguments of Appellants I and II in the written and oral proceedings, insofar as relevant for the present decision, can be summarised as follows:

a) Admissibility of the opposition by Opponent 1

Appellant I's case:

The opposition of Opponent 1 should be rejected as inadmissible because it did not fulfil the requirements of Rule 55(c) EPC 1973. In particular, the arguments provided by Opponent 1 with respect to the combination of the teachings of D1 and E8 to argue lack of inventive step did not fulfil the third requirement of Rule 55(c) EPC 1973 because Opponent 1 did not explain where the following features of claim 1 are disclosed or suggested:

- that the assembly is "self-ballasting";
- that the at least one spacer is "secured to the lower surface of the photovoltaic module and ... is to be mounted on top of a roofing membrane";
- that the assembly has "a weight in a range of roughly 1/3 - 1/6 of a conventional roofing ballast weighting between 48,8 - 73,2 kg/m²".

Appellant II's case:

In its objection of lack of inventive step in view of D1 and E8, Opponent 1 discussed in detail all features that, according to the applicant/proprietor during the oral proceedings before the Examining Division, distinguish the subject-matter of claim 1 from D1. By doing so, Opponent 1 has sufficiently substantiated its objection of lack of inventive step.

b) Consideration of E14 in the appeal proceedings

Appellant II's case:

Even though E14 has been filed for the first time with the statement of grounds of appeal, it should be considered in the proceedings because it is highly relevant for the question of novelty and possibly inventive step.

Appellant I's case:

The Board should decide not to admit late-filed document E14 into the appeal proceedings because it is *prima facie* not relevant for the decision.

c) Claim 1 of main request - Novelty with respect to D1

Appellant II's case:

The claimed subject-matter is anticipated by the embodiments shown in Figures 1b, 2b, 6a, 6b and 8c of D1.

As acknowledged by the Opposition Division in its decision, "access openings" as defined in claim 1 are implicitly disclosed in Figures 6a, 6b and 8c, since D1 teaches that the illustrated assembly allows convection and equalisation of air pressure between the lower and upper surfaces of the modules. In Figures 1b and 2b, the illustrated spacers are point supports under the edges or corners of the modules (see page 8, lines 24 and 25 and page 11, lines 27 and 28) and such point supports inevitably define access openings as specified in claim 1.

The claimed range for the assembly weight is broad and the patent does not disclose any technical effect of this selected range. Thus, the claimed range is an arbitrary, i.e. not purposive, selection of the assembly weight, which cannot be used to distinguish the claimed assembly from D1. In addition, the claimed range is implicitly disclosed in D1 in view of the facts that the assembly of D1 is "lightweight relative to conventional roofing assemblies" (page 10, line 29), that a conventional photovoltaic module normally weighs 12 kg/m² and that the spacers are point supports made of lightweight plastic, insulation material or the like (page 9, lines 8 to 11).

Appellant I's case:

It is neither expressly nor implicitly disclosed in D1 that the photovoltaic assembly shown in any of Figures 1b, 2b, 6a, 6b and 8c comprises access openings as defined in claim 1 and has a low weight in the range specified in claim 1.

- d) Claim 1 of main request - Novelty with respect to E14

Appellant II's case:

The claimed subject-matter is anticipated by the photovoltaic assembly shown in Figures 1 and 2 of E14. The open spaces along the module sides form access openings in the sense of the claim. The claimed range for the assembly weight is an arbitrary selection which cannot be used to distinguish the claimed assembly from E14. Irrespective of this, the weight of the assembly as disclosed therein is implicitly in the specified

range because it essentially consists of photovoltaic modules 1, which normally weigh about 12 kg/m², and the supporting brackets 2 and rails 3, which are slender elements and thus of low weight. The foot plates 4 are optional ballasting means and, even if present, they distribute the assembly weight over a sufficiently large area of the roof so that the weight is kept within the claimed range.

Appellant I's case:

The photovoltaic assembly in Figures 1 and 2 of E14 fails to disclose the access openings and the assembly weight required in claim 1. The brackets 2 do not define openings along two sides of a module 1. The term "opening" means an aperture or hole having a perimeter and being surrounded by material and, in Figure 1, there is no opening between the brackets and the module sides. The foot plates 4 are mandatory to resist wind uplift forces and thus not optional, and are required to have a weight that is so high that the assembly weight is outside the claimed range.

e) Claim 1 of main request - Inventive step

Appellant II's case:

In the photovoltaic roof assembly shown in Figure 1b or 2b of D1, access openings are implicitly present along the module sides, thereby creating air passageways. Starting from this disclosure, it would be an obvious design modification for the skilled person to choose an assembly weight of 19.6 kg/m². Indeed, the assembly of D1 is said to weigh "roughly one half the weight of conventional ballasted roofs" (page 4, lines 6 to 8), and E9 discloses a similar photovoltaic roof assembly,

weighing less than half the weight of aggregate ballasted roofs, i.e. 4 lbs/sf instead of 10 lbs/sf (page 1005, right column, lines 21 and 22). The skilled person would consider E9 because its author is the inventor of D1. Thus, he would obviously reduce the weight of the assembly of D1 down to 4 lbs/sf, i.e. 19.6 kg/m², which anticipates the claimed range of 8,1 to 24,4 kg/m². Should the Board consider that D1 does not disclose access openings as specified in claim 1, their provision is a further obvious design modification that is disclosed in E8 for the same purpose. Hence, the subject-matter of claim 1 lacks an inventive step against D1 in combination with E9, and possibly E8.

Alternatively, the subject-matter of claim 1 lacks an inventive step against E14 in combination with E9. Claim 1 differs from the photovoltaic roof assembly shown in Figures 1 and 2 of E14 only in the specified range for the assembly weight. This range, however, is part of common general knowledge and taught explicitly in E9 (see weight of 4 lbs/sf on page 1005, right column, lines 21 and 22).

Appellant I's case:

The subject-matter of claim 1 differs from D1 in that it comprises access openings and that its weight is in the specified range. These distinguishing features provide for reduced wind uplift forces as well as simple and economical installation on roofs.

When trying to achieve this effect, the skilled person would most likely consider providing integral locking means for interlocking adjacent assemblies and/or inclining the modules to disrupt the laminar flow of

wind, as taught in D1. By doing so, he would not arrive at the claimed solution.

Alternatively the skilled person might consider the teaching of E9 and/or E14. However, neither E9 nor E14 discloses or suggests the distinguishing features and thus their teachings cannot lead to the claimed solution in an obvious manner. E9 does not contain any information concerning the structure of the photovoltaic assembly. E14 only suggests improving the resistance to wind uplift forces by providing a photovoltaic assembly with heavy ballasting plates.

The skilled person would not consider E8 to improve the resistance to wind uplift because this document concerns a photovoltaic assembly which is fixed to the substrate by screws or pins, and thus is not self-ballasting. In case the skilled person would consider E8, he would then inevitably fix the photovoltaic assembly to the roof by screws or pins and thus not a loosely laid, self-ballasting assembly as claimed.

The same reasoning applies if the skilled person were to start from E14.

f) Claim 2 of main request - Novelty

Appellant II's case:

In the photovoltaic roof assembly according to D1 wherein the spacers are point supports under the edges or corners of the modules, access openings are implicitly present along all four sides of the photovoltaic module. The Opposition Division considered that this assembly fails to disclose the claimed range for the opening size, i.e. "between 5% and 50% of the

length" of each module side. However, this claimed range is broad and not linked to any specific technical effect. Thus, it is an arbitrary selection which cannot distinguish the claimed subject-matter from the assembly of D1. Hence, claim 2 lacks novelty over D1.

Appellant I's case:

D1 discloses neither access openings as defined in claim 2 nor the specified range for the opening size.

g) Claim 2 of main request - Inventive step

Appellant II's case:

Starting from the assembly of D1 having point supports as spacers, it would be an obvious measure for the skilled person to select an opening size "between 5% and 50% of the length" of each module side in order to spare material and thereby reduce costs.

Appellant I's case:

The subject-matter of claim 2 differs from D1 in that it comprises access openings and that the opening size is in the specified range. These distinguishing features provide for reduced wind uplift forces as well as simple and economical installation on roofs. For the reasons set out with respect to claim 1, the provision of these distinguishing features involves an inventive step, even if the teachings of E8 or E14 were taken into account.

Reasons for the Decision

1. Admissibility of opposition by Opponent 1
 - 1.1 Appellant I's objection concerning the admissibility of Opponent 1's opposition is based on the argument that, in the notice of opposition of Opponent 1, the arguments provided with respect to the combination of the teachings of D1 and E8 in alleging a lack of inventive step did not fulfil the third requirement of Rule 55(c) EPC 1973 (now Rule 76(2)(c) EPC) because Opponent 1 did not explain where the following features of claim 1 are disclosed or suggested:
 - 1) that the assembly is "self-ballasting";
 - 2) that the at least one spacer is "secured to the lower surface of the photovoltaic module and ... is to be mounted on top of a roofing membrane";
 - 3) that the assembly has "a weight in a range of roughly 1/3 to 1/6 of a conventional roofing ballast weighting between 48.8 and 73.2 kg/m²".
 - 1.2 In its communication pursuant to Article 15(1) RPBA the Board addressed this objection as follows (point 4.2 of the communication):

"In the Board's opinion the facts, evidence and arguments as presented in the notice of opposition fully enable the opposition division and the proprietor to follow this inventive step argument (in the notice, see section II, in particular page 3, last paragraph to page 4, paragraph 7). Firstly, as argued by appellant II, it is apparent that opponent 1 relies on the fact that, in the examination proceedings, the proprietor acknowledged that all features in the preamble of claim 1, and thus also features (1) and (2), are known from

D1 (see page 3, last paragraph; page 4, paragraph 3). The patent itself teaches that feature (1) is disclosed in D1 (see paragraph [0006] in the patent specification). Secondly, the notice does explain in detail why feature (1) is anticipated by D1 (page 4, paragraph 3, first sentence; page 4, paragraph 6, third sentence; page 5, paragraph 4, first sentence). Thirdly, the notice indicates how a skilled person would arrive at the preferred assembly weight in claim 3 in an obvious manner (page 5, paragraphs 5 and 6) and this reasoning applies equally for feature (3). Hence, in the view of the Board, the notice of opposition contains sufficient information for the case of opponent 1 to be properly understood. Consequently, the opposition of opponent 1 seems to be admissible."

- 1.3 In response Appellant II did not provide any new argument. The Board sees no reason to depart from the preliminary opinion expressed in the communication. Hence, the opposition of Opponent 1 is deemed sufficiently substantiated and admissible.
2. Consideration of E14 in the appeal proceedings
 - 2.1 E14 was filed for the first time in the appeal proceedings by Appellant II with its statement of grounds of appeal.
 - 2.2 The Board takes the view that, *prima facie*, claim 1 as granted differs from E14 only by the claimed range for the assembly weight, as submitted by Appellant II. In view of this and of the fact that E14 addresses a problem similar to that in the patent, i.e. how to ensure resistance to wind and thereby avoid any modification of the roof, E14 is *prima facie* a promising starting point for assessing the inventive

step of claim 1. Thus, the Board decided to take this document into consideration, pursuant to Article 114(2) EPC and Article 12(4) RPBA.

3. Interpretation of the claims

3.1 Before turning to the questions of novelty and inventive step, it is necessary to construe the features "self-ballasting" and "access openings" and the definition of the assembly weight and the access opening size in independent claims 1 and 2.

3.2 "Self-ballasting"

3.2.1 Claims 1 and 2 both define a self-ballasting photovoltaic assembly comprising a photovoltaic module supported by at least one spacer and being capable to resist wind uplift forces when mounted/disposed on a roof. Thus, the claims are directed to an engineer having experience in the design of such assemblies, including common general knowledge in aerodynamics.

3.2.2 It is clear to this skilled reader that the term "self-ballasting" means that the claimed assembly is configured to be loosely laid on a flat or mildly sloping roof, without any need for fixing means penetrating the roof. This understanding is confirmed in the patent specification (e.g. in paragraphs [0002], [0011] and [0022]).

3.3 "Access openings"

3.3.1 The above defined skilled reader of claim 1 also knows that, as the wind flows, an imbalance in the dynamic air pressures on the lower and upper surfaces of the photovoltaic module may create an uplift force and that

this effect depends, among other parameters, on the geometry and air-permeability of the spacer(s).

- 3.3.2 Claim 1 defines the "access openings" by means of
- physical features ("said at least one spacer ... sized and configured to define ... access openings"; "said access openings ... extend along at least two sides of said photovoltaic module") and
 - functional features ("for fluidly coupling said open region to said upper surface"; "such that wind uplift forces are resisted when said self-ballasting photovoltaic assembly is mounted to the roofing membrane").

From this definition, it is clear that the access openings are responsible for achieving the desired effect.

In addition, in the context of the claim, the term "opening" is itself clear and, in the absence of any other specific indication in the claim, it can only be given its normal meaning of a hole or aperture having a perimeter and being surrounded by material.

- 3.3.3 In the light of common general knowledge in aerodynamics and the teaching in the description and drawings, it is apparent for the skilled reader of claim 1 that the access openings enable a free exchange of air, thereby ensuring that the dynamic air pressure on the lower surface of the module is equal to or lower than the dynamic air pressure on the upper surface of the module, i.e. ensuring that the air pressure holds down the loosely laid photovoltaic assembly.

3.3.4 The skilled reader of the claim would also understand that the size and configuration of the access openings may vary considerably, whilst still providing this desired effect. Clearly, the access openings must be large enough to guarantee free air exchange. However, beyond a certain size the module could trap or catch the wind and the wind uplift forces would be increased. In practice, the skilled reader would have no difficulty in determining the necessary size and configuration of the access openings, as well as that of the spacer(s), by applying routine test procedures, e.g. by wind-tunnel testing or numerical simulations.

3.3.5 The same reasoning holds for claim 2 that is directed to an alternative self-ballasting photovoltaic assembly. This claim also defines the access openings by means of physical features (the at least one spacer is "arranged in a geometry which ... defines ... access openings"; "said access openings ... extend along at least two sides of said photovoltaic module"; "said access openings are between 5% and 50% of the length of each of the first, second, third and fourth sides of the photovoltaic module") as well as functional features ("for fluidly coupling said open region to said upper surface"; "whereby said geometry enables said self-ballasting photovoltaic assembly to resist forces of wind uplift"). In the context of claim 2, it is clear that the spacer geometry and particularly the access openings defined between spacer and module sides are responsible for resisting the wind uplift forces. Thus, as in claim 1, it is implicit that the access openings enable free air exchange with the open region beneath the module so as to reduce the wind uplift forces on the module.

3.4 Assembly weight (claim 1)

Claim 1 requires that "the assembly has a weight in a range of roughly $1/3 - 1/6$ of a conventional roofing ballast weighting between 48,8 - 73,2 kg/m²". This defines a clear limitation of the assembly weight: it must be in the range of about 8,1 to 24,4 kg/m².

3.5 Access opening size (claim 2)

Claim 2 requires that "said access openings are between 5% and 50% of the length of each of the first, second, third and fourth sides of the photovoltaic module". This indicates a clear limitation of the opening size.

4. Claim 1 of main request - Novelty

4.1 Novelty against D1

4.1.1 D1 discloses a self-ballasting and lightweight photovoltaic roofing assembly comprising, *inter alia*, a plurality of photovoltaic modules and a plurality of pre-formed spacers located below the photovoltaic modules. A fluid, preferably air, convects within the passageways created by the spacers, transferring heat from the backside of the photovoltaic modules. A fan or pump unit may be added to force convection of the fluid. Figures 1 to 8 of D1 disclose sectional views of eight different embodiments of this photovoltaic assembly. Preferably, the photovoltaic modules and the spacers are joined to form integral units. It is apparent that, in the context of D1 (e.g. see Figure 9 and claim 5), the terms "assembly" and "unit" respectively correspond to the terms "array" and "assembly" in the context of the claims of the patent (see claims 1, 2 and 13).

4.1.2 Appellants I and II have disputed whether the embodiments in Figures 1b and 2b of D1 disclose the access openings and the assembly weight as defined in claim 1. Figures 1b and 2b are reproduced below.

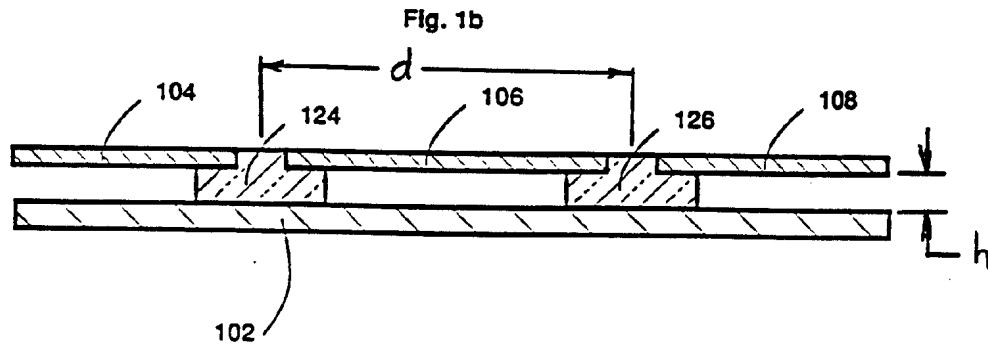
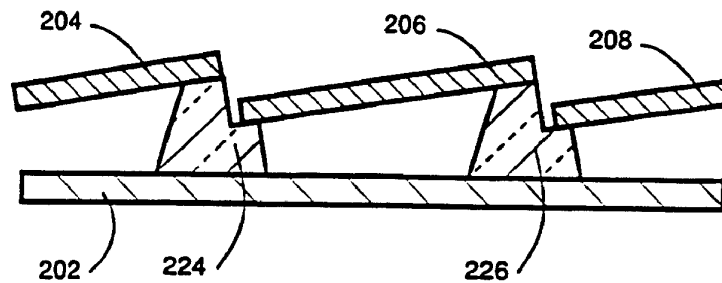


Fig. 2b



(a) Access openings

The spacers in Figure 1b provide point supports along the edges or corners for the modules to which they are fixedly connected or made integral (page 8, lines 22 to 26). From this, Appellant II draws the conclusion that access openings as claimed are implicitly formed along all module sides. The Board is not convinced. Firstly, within a single unit consisting of a module and spacers, the latter do not necessarily define openings along two module sides. For instance, as illustrated by Appellant I during the oral proceedings, the upper portion of spacer 124 shown in Figure 1b might extend all along the side of module 106 and be

joined to it in an airtight manner. Secondly, even if the spacers do define openings along the module sides, it cannot be clearly derived from D1 that such openings enable a free air exchange with the open region beneath the module so as to reduce wind uplift forces, as it is implicitly required in claim 1. The openings might be too small or too large to achieve this effect: if they were too small, they would be unable to provide the desired air pressure (im)balance; if the openings were too large, the assembly would be more susceptible to catching the wind, thereby causing increased uplift.

With reference to Figure 1b, D1 teaches that a ratio $d/h \geq 2$ is preferred to facilitate pressure equalisation between the top and bottom side of the photovoltaic modules and thereby reduce the forces of wind uplift, with d being the spacing between modules and h the distance between module and roofing membrane, (page 8, lines 32 to 35). Thus, pressure equalisation is achieved by dimensioning the passageways created by the spacers under the array of modules. This can be achieved even if, in each unit consisting of a module and spacers, the latter do not define access openings along two module sides.

Figure 2b of D1 shows a sectional view of another embodiment wherein spacers 224 and 226 provide point supports along the edges or corners for the modules to which they are fixedly connected or made integral (page 11, lines 25 to 29). As is the case for the embodiment of Figure 1b, it is neither expressly nor implicitly disclosed that, within a single unit consisting of the module and the spacers, the spacers define access openings as defined in claim 1.

With reference to Figure 2b, D1 teaches that spacers 224 and 226 enable water drainage (page 11, lines 29 to 31). The skilled reader knows that water drainage may be achieved in many ways and that it does not necessarily require the provision of openings along two module sides which would correspond to the access openings of claim 1.

(b) Assembly weight

It cannot be derived from D1 that, in either Figure 1b or Figure 2b, the weight of a single unit consisting of a module and spacers is in the range of about 8,1 to 24,4 kg/m². D1 is silent with respect to the weight of an integral unit consisting of a module and spacers. According to page 4, lines 6 to 8 of D1 it is one of the objects and advantages of the roofing assembly as disclosed therein that it "weighs roughly one half the weight of conventional ballasted roofs". However, when reading this passage in the context of D1, with the term "assembly" in D1 meaning "array" in the patent (point 4.1.1 above), there is no information on the mass per unit area of the integral unit, i.e. of the assembly consisting of a module and spacers.

4.1.3 Appellant II has also argued that the embodiments of Figures 6a, 6b, and 8c of D1 disclose the access openings and the assembly weight as defined in claim 1. Figures 6a, 6b and 8c are reproduced below.

Fig. 6a

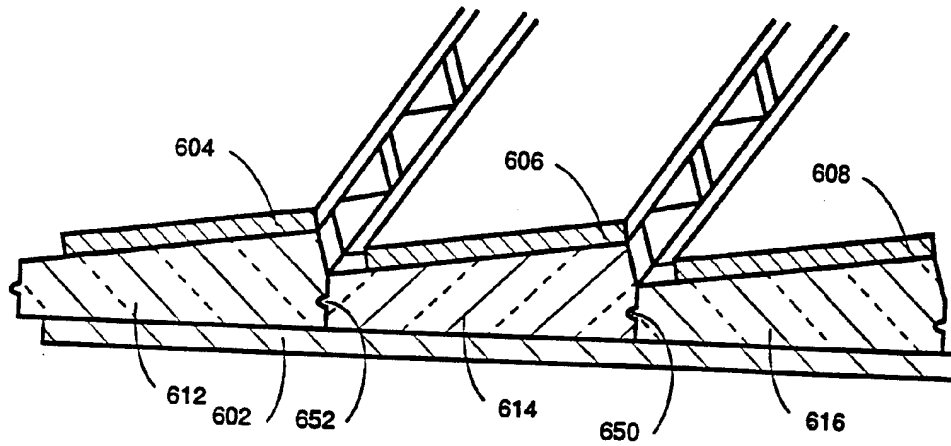


Fig. 6b

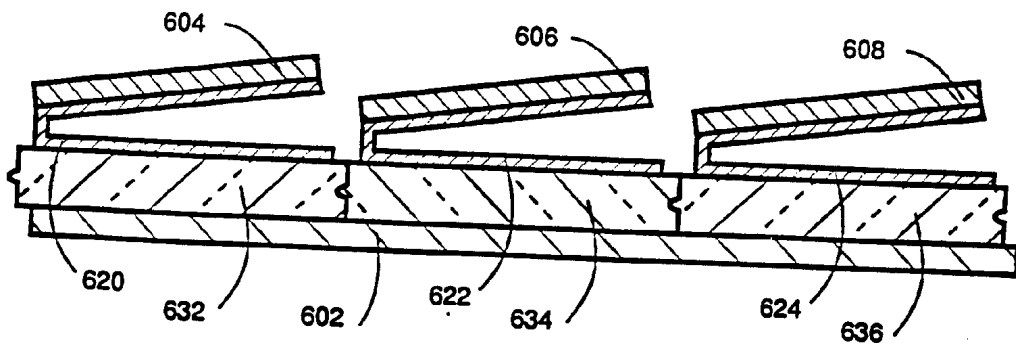
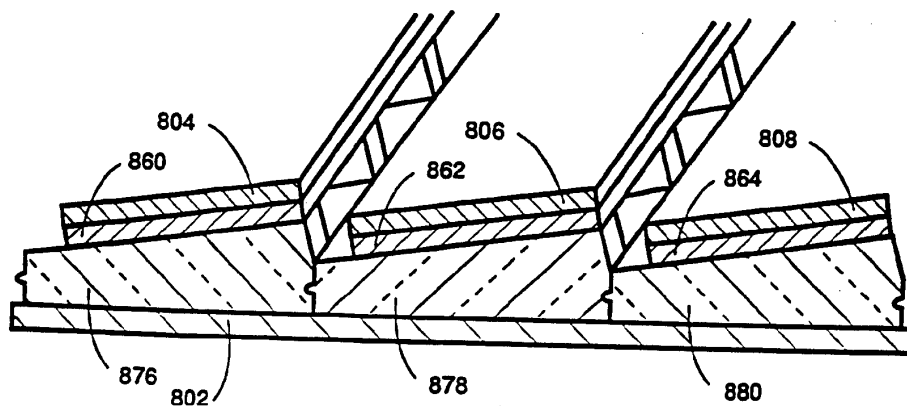


Fig. 8c



(a) Access openings

Figures 6a, 6b and 8c of D1 show a plurality of photovoltaic modules and a plurality of tapered

insulation blocks disposed below the modules and integral therewith, or fixed thereto (page 17, line 35 to page 18, line 3; page 19, lines 28 to 35). The photovoltaic modules are inclined, thereby enhancing natural convection using outside air as a convection fluid; they also disrupt the laminar flow of the wind to reduce wind uplift forces (page 18, lines 20 to 29). It cannot be derived from this disclosure that, in a single unit consisting of a module and spacers, the latter define access openings as required in claim 1.

Appellant II contends that natural convection with outside air can be attained only when there are openings on the left and right sides of the module in Figures 6a, 6b and 8c, so that this feature is implicitly disclosed in these drawings. The Board is not convinced. The inclination of the module would facilitate natural convection with outside air, even if the unit were opened only on the right side in the above drawings.

The Opposition Division also argued that, in these drawings, wind uplift forces can be reduced only if openings are present on the left and right sides of the modules (point 3.1 of the reasons, page 13). D1 teaches that the wind uplift forces are reduced not because of openings on the left and right sides, but because the inclined modules disrupt the laminar flow of wind (e.g. page 18, lines 25 to 29). This effect would be attained even if the unit were opened only on the right side, with the left side being kept closed.

(b) Assembly weight

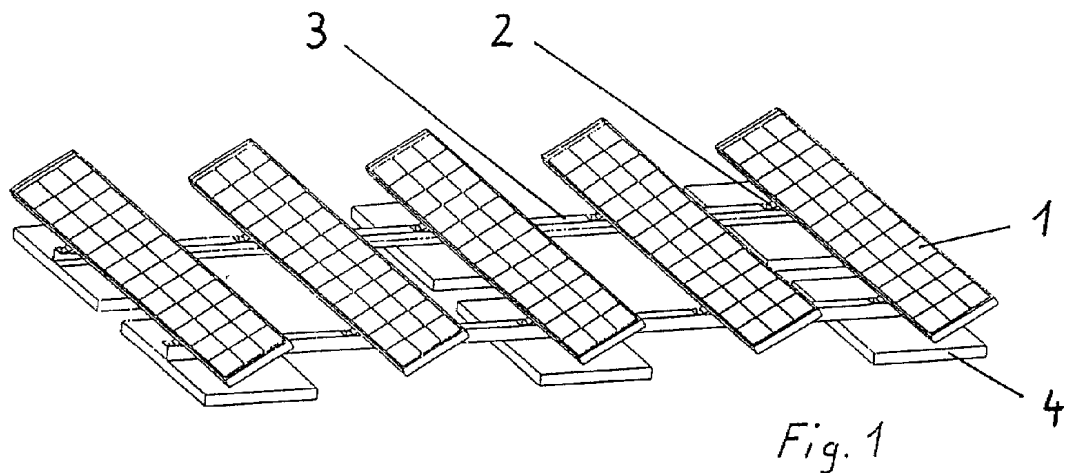
As for Figures 1b and 2b, it cannot be derived from D1 that, in any of Figures 6b, 6b and 8a, the weight of an

integral unit consisting of a module and spacers is in the range of about 8,1 to 24,4 kg/m².

4.2 In conclusion, the subject-matter of claim 1 is novel over D1 because D1 fails to disclose the access openings and the assembly weight as defined in the claim.

4.3 Novelty against E14

4.3.1 E14 discloses, in Figures 1 and 2, a photovoltaic assembly comprising a plurality of inclined photovoltaic modules 1 supported by brackets 2 which are fixed to support rails 3 having foot plates 4 that rest on top of a roof without penetrating it. Figure 1 is reproduced below.



4.3.2 Appellant II submits that this assembly discloses the access openings and the assembly weight as required in claim 1:

(a) Access openings

In Figures 1 and 2, each module 1 is supported by two brackets 2, each forming a spacer in the sense of the

claim. However, although air can freely flow through the assembly, the open spaces along the module sides cannot be seen as being openings defined by the spacers 2, as required in claim 1 (see point 2.2.2 above). It is also not plausible that the open spaces could help resisting the wind uplift forces, since the high inclination angle of the modules in Figure 1 would result in them catching a wind traveling from the right of the drawing. The only information about wind loading that can be gleaned from E14 is that the wind uplift forces are resisted by means of the base plates 4 having sufficient weight (see the wording "Fußplatten 4 (Gewicht)" on page 2). Hence, the open spaces do not form access openings in the sense of the claim.

(b) Assembly weight

E14 is silent with respect to the weight of the photovoltaic assembly as described therein. Even if the brackets 2 and rails 3 are slender elements that might be relatively lightweight, the base plates 4 are implicitly heavy to resist wind uplift forces. Further, contrary to Appellant II's contention, the base plates 4 are not optional because they are essential for resisting the wind uplift forces. Thus, it cannot be derived from E14 that the assembly has a low weight within the range specified in claim 1.

4.3.3 In conclusion, the subject-matter of claim 1 is novel over E14 because it fails to disclose the access openings and the assembly weight as defined in the claim.

5. Claim 1 of main request - Inventive step

- 5.1 Inventive step with respect to D1
 - 5.1.1 There is no dispute that the photovoltaic assembly in either Figure 1b or Figure 2b of D1 is an appropriate starting point for the assessment of inventive step.
 - 5.1.2 As established in point 4.1.2 above, the subject-matter of claim 1 is distinguished from this assembly by the access openings and the assembly weight as defined in claim 1.
 - 5.1.3 These distinguishing features provide the technical effect that the wind uplift forces and the assembly weight can both be reduced, and that the installation of the assembly remains simple and economical, without the need for roof penetrations for holding down the assembly (see e.g. paragraphs [0002], [0008], [0018] in the patent specification).
 - 5.1.4 Starting from D1, the objective technical problem solved by these features thus is how to improve the wind resistance of the assembly while still allowing simple and economical installation on roofs (see paragraph [0002] and paragraph [0011], point 1 in the patent specification).
 - 5.1.5 The claimed solution to this objective problem is not part of common general knowledge and is neither disclosed nor suggested in any of the documents D1, E8, E9 and E14.
 - 5.1.6 D1 discloses a number of solutions to improve the resistance of the assembly to wind uplift forces, namely: dimensioning the passageways under the array of modules to facilitate pressure equalisation and thereby reduce the wind uplift forces (see Figure 1b and

point 4.1.2-a) above); forming interlocking joints between adjacent assemblies to improve the resistance to the wind uplift forces (e.g. Figures 6a and 8C page 9, lines 29 to 31); providing a spoiler at the perimeter of the array of modules to reduce the wind uplift (Figure 9 and page 11, lines 6 to 8); inclining the modules up to a certain angle to disrupt the laminar flow of the wind and thereby reduce the wind uplift forces (e.g. Figures 2b, 6a, 6b and 8c and page 12, lines 14 to 29). For a skilled person facing the above defined problem, it would be straightforward to apply one or the other of these solutions. By doing so, however, he would not arrive at the distinguishing features of the claim at hand.

- 5.1.7 In the unlikely event that the skilled person was not satisfied with the different solutions disclosed in D1, he might consider E9. This conference paper describes a self-ballasting photovoltaic assembly for flat roofs, namely the PowerGuard™ roofing system, which is similar to that disclosed in D1, presumably because one of the authors of E9 is the inventor of D1. E9 teaches that "the weight of the PV panel together with edge to edge connection between tiles work to create a significant safety factor against wind uplift" (page 1005, left column, bottom paragraph) and that the photovoltaic assembly as disclosed therein weighs "less than half the weight of aggregate ballasted roofs (4 lbs/sf vs. 10 lbs/sf)" (page 1005, right column, lines 21 and 22). This teaching of E9, however, cannot lead to the claimed solution, as it relies on the fact that the PV panels are arranged flat, i.e. horizontally and are connected edge to edge to create an overall panel on the roof (Figure 1). It neither discloses nor suggests the provision of access openings along the module sides, as specified in claim 1. In fact, E9 does not

contain any information regarding the spacer geometry and does not show there to be spacers under the PV panels.

5.1.8 When seeking to solve the objective problem starting from D1, the skilled person might also consider E14 since it deals with the resistance to wind of a self-ballasting photovoltaic assembly. However, as indicated above (point 4.3.2), the gist of E14 is that the wind uplift forces are resisted by ballasting the assembly with heavy foot plates. Thus, when combining the teachings of D1 and E14, the skilled person would provide the assembly of D1 with heavy foot plates. This, however, is not the claimed solution. E14 fails to disclose any of the distinguishing features (see point 4.3 above) and does not lead to the claimed solution.

5.1.9 A skilled person facing the above defined problem would disregard the teaching of E8. Firstly, this document does not concern a self-ballasting photovoltaic assembly of the type disclosed in D1, but a photovoltaic assembly secured to the substrate by screws or pins (column 3, lines 1 to 4). Secondly, E8 aims to improve the cooling of the photovoltaic modules by allowing air to flow underneath (column 1, lines 43 to 63 and Figure 1), and does not address the problem of wind uplift. Be that as it may, even if the skilled person were to consider E8, he is taught to fix the photovoltaic assembly to the roof by screws, pins or the like and thus he would not arrive at a self-ballasting assembly as claimed.

5.1.10 Thus, the subject-matter of claim 1 involves an inventive step when starting from D1.

5.2 Inventive step with respect to E14

5.2.1 As set out in point 4.3 above, the subject-matter of claim 1 is distinguished from the photovoltaic assembly in Figures 1 and 2 of E14 by the access openings and the assembly weight as defined in claim 1.

5.2.2 Starting from E14, the objective problem to be solved is formulated as when starting from D1, i.e. how to further improve the wind resistance while still allowing simple and economical installation on roofs.

5.2.3 The claimed solution to this problem is not obvious for the reasons given in points 5.1.5 to 5.1.9 above.

5.2.4 Thus, the subject-matter of claim 1 involves an inventive step when starting from E14.

6. Claim 2 of main request - Novelty

6.1 Appellants I and II have disputed whether the photovoltaic assembly of D1 having point supports as spacers discloses the access openings and the opening size as specified in claim 2.

6.2 Photovoltaic assemblies having point supports as spacers are shown only in Figures 1b and 2b of D1. As explained in point 4.1.2-a) above, D1 does not contain any information to suggest that, in these assemblies, the point supports define access openings along the module sides which enable free air exchange to the open region beneath the module. Thus, D1 fails to disclose access openings as defined in claim 2 and also the further feature that these openings "are between 5% and 50% of the length of each of the first, second, third and fourth sides of the photovoltaic module".

- 6.3 In conclusion, the subject-matter of claim 2 is novel over D1.
7. Claim 2 of main request - Inventive step
- 7.1 The above mentioned features distinguishing the subject-matter of claim 2 from the photovoltaic assembly in Figures 1b and 2b of D1 aid rapid pressure equilibration between the lower and upper surfaces of the photovoltaic module, thus reducing the wind uplift forces (see e.g. paragraph [0022], point 6 and paragraphs [0030] and [0031] in the patent specification).
- 7.2 As for claim 1, the objective problem to be solved is formulated as how to further improve the wind resistance while still allowing simple and economical installation on roofs.
- 7.3 For the reasons set out in points 5.1.6 to 5.1.9 above, the claimed solution to this problem is not rendered obvious by common general knowledge, nor by the teachings of D1, E8, E9 and E14.
- 7.4 Thus, the subject-matter of claim 2 involves an inventive step when starting from D1.
8. The above reasoning applies *mutatis mutandis* to the subject-matter of independent claim 13 as well as that of the dependent claims.
9. In conclusion, the cited grounds for opposition according to Article 100(a) EPC, namely that of lack of novelty and of lack of inventive step, do not prejudice the maintenance of the patent as granted.

10. Under these circumstances, there is no need to consider the auxiliary requests of Appellant I.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

The Registrar:

The Chairman:



C. Spira

G. Ashley

Decision electronically authenticated