
Candidate's answer

Amended set of claims

1. A roof tile (1) comprising a transparent cover (3) and a solar collector (5), wherein the solar collector (5) comprises:
 - a metal plate (7); and
 - a fluid-tight passageway (9) for fluid,
 - characterised in that the metal plate (7) is arranged between the fluid-tight passageway (9) and the transparent cover (3) in such a way that heat can be transferred from the metal plate (7) to the fluid.
2. A roof tile (1) according to claim 1, comprising a frame (4) which supports the transparent cover (3) and which holds the solar collector (5).
3. A roof tile (3) according to claim 1 or 2, wherein the solar collector (5) comprises a photovoltaic module (6) mounted on the metal plate (7).
4. A roof tile (1) according to claim 1 or 3, wherein the fluid-tight passageway (9) is formed by a metal tube (12) having a circular cross section or by the metal plate (7) and the metal wall (13) having a U-shaped cross section.
5. A roof tile (1) according to claim 1 or 4, wherein the solar collector (5) comprises a plug connector (11a) and a socket connector (11b) through which the fluid can enter and exit the fluid-tight passageway (9).
6. A roof tile (1) according to claim 5, wherein the plug connector (11a) and the socket connector (11b) are so located on opposite sides of the roof tile (1), that when a plurality of such roof tiles (1) are mounted as part of a roof, the plug connector (11a) of a roof tile (1) engages with the socket connector (11b) of a neighbouring roof tile (1).
7. A solar collector system comprising a plurality of roof tiles (1) according to any of the above claims.

LETTER TO THE EPO

Dear Sirs,

This is in response to the recent A.94(3) EPC Communication.

1. Amendments (A.123(2) EPC)

Please find enclosed an amended set of claims to replace those on file. In the amended claims, the following amendments have been made:

- Amended claim 1:
 - previous claims 1, 3 (which was directly dependent on claim 1) and 5 (which was indirectly dependent on claim 1 via claim 3) have been combined;
 - the “passageway” has been specified as being “fluid-tight”, which has support, for example, on p.2, I.25 (embodiment 2) and p.3, I.20 (embodiment 3); and
 - the position of the metal plate has been specified and clarified using wording from the description on p.2, II.29-32 (embodiment 2) and p.4, II.3-5 (embodiment 3)
 - it is noted, from p.4, II.1+2 that the photovoltaic modules and electrical wires are not essential for embodiments 2 and 3

- Amended claim 2:
 - no amendments

- Amended claim 3:
 - previous claim 4 with dependencies changed accordingly

- Amended claim 4:
 - previous claim 6, with dependencies changed accordingly;
 - “passageway” has been specified as “fluid-tight passageway”
 - Same support as claim 1

- Amended claim 5:
 - previous claim 7, with dependencies changed accordingly;
 - reference sign “(5)” is added after “solar collector” (R.41(7) EPC); and
 - “passageway” has been specified as “fluid-tight passageway”
 - Same support as claims 1 and 4

- Amended claim 6:
 - new claim having support in the description on p.3, II.14-17

- Amended claim 7:
 - previous claim 8, clarified to refer to the roof tiles of the preceding claims; support can be found in the description on p.4, II.7+8.

- Characterising
 - In accordance with R.43(1) EPC and GL C-III, 2.2, claim 1 has been re-cast in two-part form, based on D2.

These amendments do not add subject-matter to the application as filed, in accordance with A.123(2) EPC.

2. Clarity (A.84 EPC)

In para. 10 of the Examination Report, the Examiner considers that previous claim 8 (= amended claim 7) is unclear. Amended claim 7 now specifies that the system comprises a plurality of roof tiles according to any of the preceding claims, which is believed to overcome this objection.

3. Novelty (A.52(1) + A.54 EPC)

It is noted that it is not permissible to combine prior art documents for the purposes of novelty (GL, C-IV, 9.1).

3.1 Claim 1 (Independent)

Amended claim 1 is novel over each of D1 to D3, which all form part of the state of the art under A.54(2) for the following reasons:

- D1
 - D1 does not disclose a fluid-tight passageway for fluid.
 - Instead, in D1, “passageways” 109 are formed between fins 114, past which air flows. However, these are not open to “natural convection” and are not fluid-tight (D1: p.1, ll.22-24; Fig. 2).

- D2
 - D2 does not disclose a metal plate arranged between a fluid-tight passageway and a transparent cover in such a way that heat can be transferred from the metal plate to the fluid.
 - Instead, in D2, a metal tube 212 is located above a metal plate 207 (D2: p.1, ll.9+10) such that a part of solar radiation that passes through the transparent cover 203 directly heats the tube and some of the incident radiation reflects from the metal plate 207 to the tube 212 so that heat is transferred from the plate 207 to the tube 212 (D2: p.1, ll.16-19). The plate 207 is [therefore] not “between” the tube 212 and the cover 203.
 - Furthermore, even if the roof tile 201 of D1 were to be turned upside-down (as suggested by the Examiner in para. 9 of the Exam. Report), claim 1 would still be new since the metal plate 207 would be arranged above both the transparent cover 203 and the tube 212; not between them, as required by amended claim 1.

- D3
 - D3, likewise, does not disclose a metal plate arranged between a fluid-tight passageway and a transparent cover in such a way that heat can be transferred from the metal plate to the fluid.
 - Instead, in D3, photovoltaic modules 306 are mounted on a metal plate 307, upon which are formed fluid-tight passageways 309 (D3: p.1, ll.12-14). Heat is transferred from the photovoltaic modules 306, not the metal plate 307, to the water.

3.2 Summary

Thus, claim 1 is novel over each of D1 to D3.

4. Inventive Step (A.52(1) + A.56 EPC)

4.1 Claim 1 (Independent)

Following the problem-and-solution approach, set out in GL C-IV, 11.7, document D2, against which claim 1 is characterised, is considered to be the closest prior art, because (GL C-IV, 11.7.1):

- It is that combination of features which, disclosed in a single reference, constitutes the most promising starting point for an obvious development:
- In particular, D2 is directed to a similar purpose to that of the claimed invention, i.e. a solar roof tile for providing thermal energy (D2: p.1, ll.3+4), whereas D1 is a roof tile but for providing electrical energy only (D1: p.1, ll.3+4) and D3 is for (electrical and) thermal energy (D3: p.1, ll.8+9), but is not a roof tile; rather it is an entire solar panel (D3: p.1, l.3; Fig. 1).
- Furthermore, D2 also corresponds to a similar use, i.e. thermal energy from a roof tile and required the minimum of structural and functional modifications to arrive at the claimed invention (T606/89). For example:
- D1 would require that the open fluid passageways 109 be replaced with fluid-tight passageways. Although this is relatively straightforward in engineering terms, natural convection removes the accumulated heat from around the fins 114 to improve the efficiency of the photovoltaic modules 106. Since the passageways 109 are open to allow this, making them fluid-tight, e.g. air-tight, would require a complete re-design of the roof tile 101.
- D3 is similar, in that it relies on the passageways 309 to focus incident radiation onto photovoltaic modules 306. To reconfigure the panel 315 such that the metal plate 307 were between the cover 303/passageways 309 and the photovoltaic modules 306 would block the incident radiation from hitting the photovoltaic modules 306, which would inhibit provision of electrical energy.
- On the other hand, although, in D2, the metal tube 212 is provided above the metal plate 207, it would be very straightforward to raise the level of the plate 207 relative to the tube 212 so that it is between the cover 203 and the metal tube 212. Since some of the incident radiation falling on the plate 207 would be transferred to the metal tube 212 (D2: p.1, l.19), there would still be some (indirect) heating effect via the metal plate 207.

Thus, D2 is the closest prior art.

As explained in Section 3.1 above, the claimed invention differs from D2 in that the metal plate is arranged between the fluid-tight passageway and the transparent cover in such a way that heat can be transferred from the metal plate to the fluid (GL C-IV, 11.7.2).

The technical effect of this difference is that of improved robustness of the roof tile in adverse weather conditions. This can be seen in the description on p. 1, ll.16-19, which concern the problems of adverse weather conditions on the roof tiles.

The objective technical problem is therefore how to modify the roof tile of D2 to be more robust in adverse weather conditions.

Although this is a reformulation of the originally stated technical problem, the skilled person would recognise this technical problem on the basis of the above effect as implied by the originally stated technical problem (GL C-IV, 11.7.2, para. 5).

Starting from D2 and with the objective technical problem in mind, the claimed solution is not obvious in the light of the prior art.

Specifically, it cannot be said that the skilled person would (not simply could, but would) have modified the roof tile of D2 to arrive at the claimed invention in order to solve the objective technical problem, while taking the prior art into account (GL C-IV, 11.7.3).

Starting from D2 alone, the skilled person would not find a solution to this problem since it is not addressed in D2. In any case, the skilled person would actually be led away from arranging the metal plate 207 between the tube 212 and the cover 203. It is clear from D2 that the amount of thermal energy produced would be vastly decreased if the incident radiation could not fall directly onto the metal tube 212 or be reflected onto it from the metal plate 207. Since this would result in a decreased temperature of the domestic hot water which D2 seeks to provide, the skilled person would not modify the D2 roof tile 201 to arrive at the claimed invention.

Although it is permissible to combine prior art documents for the purposes of inventive step (GL C-IV, 11.8), the skilled person would be unlikely to consider D1 because it is inherently incompatible with the roof tile 201 of D2. As explained above, the roof tile 101 of D1 requires “open” passageways 109 to allow effective heat removal by natural convection; in D2, the tube 212 must be water-tight, else the water would simply leak out of the tubes 212 and would not be available for domestic hot water. Thus, the skilled person would be unlikely to consider D1.

However, if the skilled person did, for some reason, consider D1 with a view to improving robustness of the roof tile 201 in the case of adverse weather conditions, he would actually find that D1 addresses this problem on p.1, ll.10+11 by providing a strong transparent cover 103 to protect the solar collector (i.e. photovoltaic module 106) in all kinds of weather conditions.

Thus, even if the skilled person were to consider using the teaching of D1, he would simply replace the cover 203 of D2 with the more robust cover 103 of D1, which would still not lead him to the claimed invention.

Turning now to D3, the skilled person seeking to solve the objective technical problem of improving robustness of the roof tile 201 of D2 would also be unlikely to consider D3 because it is structurally so different from D2. In particular, the passageways 309 are made of transparent, corrugated transparent cover 303 in D3, whereas they are formed by a continuous, meandering metal tube 212 in D2; and the solar collectors in D3 are individual photovoltaic modules 306 in D3, whereas the solar collector in D2 is the metal tube 212.

However, in the unlikely event that the skilled person were to consider D3, he would find that D3 does not, in fact, provide a solution to the objective technical problem of improving robustness of the solar panel 315 in the event of adverse weather conditions.

D3 is merely concerned with the problem of increasing efficiency (D3: p.1, ll.4-6) and, in any case, would not lead the skilled person to the claimed invention, because, as explained in Section 3.1, the metal plate 307 is not arranged between the photovoltaic modules 306 and the cover 303; rather the photovoltaic modules 306 are mounted on the plate 307 (D3: p.1, ll.11+12).

Thus, even in view of D1 and D3, the skilled person would still not arrive at the claimed invention.

For completeness, even if the skilled person were to start from the roof tile 201 of D2 and were to be faced with the objective technical problem of improving the robustness of the roof tile 201 in adverse weather, he would still not arrive at the claimed invention using his common general knowledge (GL C-IV, 11.8(iii)).

The skilled person would replace the cover 203 with a stronger cover (as suggested by D1), strengthen the metal tube 212 by using a stronger, but still thermally effective material or even perhaps provide better sealing of the roof tile 203 such that, in the event of minor damage to the roof tile 203, none of the water within the tile 203 would be leaked outside the tile 203. However, the skilled person simply would not change the position of the plate 207 to be arranged between the tube 212 and the cover 203 in such a way that heat can be transferred from the plate 207 to the water since it would actually result in decreased heat efficiency, which would go against the common general knowledge of a person skilled in the art of thermal roof tiles.

In summary, the claimed invention provides a particularly robust roof tile which is not suggest by any of the prior art. A further advantage of the claimed invention is that the fluid-tight passageways are not seen in the roof tiles when they are mounted to give an improved aesthetic appearance, as mentioned on p.1, ll.15+16 of the present application.

4.2 Summary

Thus, amended claim 1 is new (Section 3) and involves an inventive step (Section 4.1). The remaining claims, amended claims 2-7, are new and inventive by way of their dependency upon amended claim 1 (GL C-IV, 11.12). It is clear that amended claim 7 is dependent on amended claim 1 since it includes all of its features (c.f. GL C-III, 3.4; R.43(4) EPC).

With reference to the following paragraphs of the Examination Report, it is believed that all of the objections have been overcome or rendered moot by the above amendments:

- Paragraphs 1-9: Sections 1, 3 and 4 above.
- Paragraph 10: Sections 1 and 2 above.
- Paragraph 11: Sections 3 and 4 above.
- Paragraph 12: Sections 1 to 4 above.

Yours faithfully

Mr Rufus
Authorised Representative