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(71) Applicant: MT ÅSEN AS [NO/NO]; Sørbyveien 223, N-3083 Holmestrand (NO).

(72) Inventor: ÅSEN, Torkel; Sørbyveien 223, N-3083 Holmestrand (NO).

(74) Agents: ONSAGERS AS et al.; P. O. Box 1813, Vika, N-0123 Oslo (NO).

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(54) Title: SOLAR THERMAL COLLECTOR SYSTEM

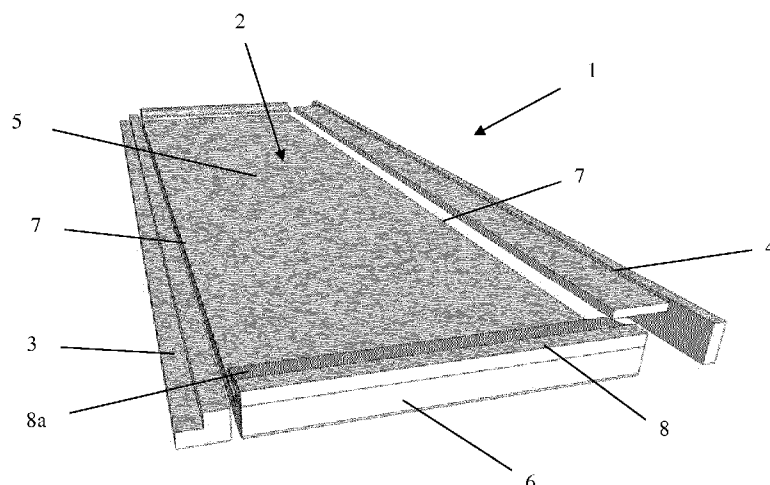


Fig. 2

(57) Abstract: The present invention provides a solar thermal collector frame system (1) comprising at least a plate module (2), a start module (3) and a stop module (4), wherein the plate module (2) comprises a frame plate (5) having two opposing first side edges (6) and two opposing second side edges (7), and a spacing element (8) arranged along each of the first side edges (6) such that a top-plate (9) may be mounted in parallel to the frame plate (5) at a predetermined distance; the second side edges (7) are complementary such that at least two plate modules (2) may be mounted against each other along said second longitudinal edges; and the start module (3) and the stop module (4) are mountable along a second longitudinal edge (7).



SOLAR THERMAL COLLECTOR SYSTEM

Technical Field

5 The present invention concerns solar thermal collectors, and more specifically a module-based solar thermal collector frame, a solar thermal collector comprising said frame, and a method for installing or assembly of a solar thermal collector frame.

10 Background of the invention

A solar thermal collector is commonly made up of a solar thermal collector frame, a solar heat absorber installed in said frame, and an above-arranged clear top-plate.

15 The effect of a solar thermal collector is restricted by the size of the area it covers. Most of the solar thermal collectors presently on the market are pre-assembled in a factory and transported to the building site for mounting. These premade solar thermal collectors often covers a relatively small area since they would be very heavy and difficult to handle if they where produced in a large format. As an
20 example of further potential disadvantages of large premade solar thermal collectors it is referred to Aventa, which is a supplier/producer of a solar thermal collector which also acts as a roof covering. The height (or length) of these solar thermal collectors has to be decided during the production at the factory, and it will naturally cause significant problems if, for instance, any of the components are
25 damaged during transportation since it will take an extended amount of time to produce a new collector.

ASV Solar is a module-based solar thermal collector system which avoids many of the problems connected to solar thermal collectors which are premade on a factory.
30 In this system the solar thermal collector frame is assembled by use of six different solar thermal collector frame modules. This solar thermal collector system may cover a small or large area and functions technically as a roof covering replacing roof covering tiles or other roof covering materials. Even if said solar thermal collector system solves some of the problems connected to solar thermal collectors
35 which are premade at a factory, the system results in complicated logistics related to production and delivery due to the large number of different solar thermal collector frame modules.

There is consequently a need for a solar thermal collector system which avoids the
40 disadvantages of factory-assembled solar thermal collectors and which at the same time avoids at least some of the disadvantages of the known module-based solutions.

Summary of the invention

The present invention provides a module-based solar thermal collector frame system, a solar thermal collector based on said system and a method for assembly of a solar thermal collector frame. The invention is defined by the appended claims, and in the following:

In one aspect, the present invention provides a solar thermal collector frame system comprising at least a plate module, a start module and a stop module, wherein

- the plate module comprises a frame plate having two opposing first side edges and two opposing second side edges, and a spacing element is arranged along each of the first side edges such that a top-plate may be mounted parallel to the frame plate at a determined distance;
- the second side edges are complementary, or equal, such that at least two plate modules may be mounted against each other along said second side edges; and
- the start module and the stop module are shaped to be mounted along a second longitudinal edge.

In one embodiment of the solar thermal collector system according to the invention, one of the spacing elements on the plate module comprises through-bores for collector pipes.

In one embodiment of the solar thermal collector system according to the invention the start module comprises a longitudinal element suitable for having a transition plate mounted thereupon, wherein the transition plate is preferably suitable for providing a transition between the longitudinal element and a roof covering.

In one embodiment of the solar thermal collector system according to the invention, the start module has a transverse cross-section being substantially L- or V-shaped.

In one embodiment of the solar thermal collector system according to the invention the stop module comprises a longitudinal element having a transition plate mounted thereupon, preferably the transition plate is suitable for providing a transition between the longitudinal element and a roof covering.

In one embodiment of the solar thermal collector system according to the invention the stop module comprises a longitudinal element which after mounting along a second side edge of a plate module has a contact surface which face away from, extend over, and is parallel to the frame plate, wherein the distance between the contact surface and the frame plate is such that a top-plate will be in contact with said contact surface after being mounted.

5 In one embodiment of the solar thermal collector system according to the invention the spacing element has a projection comprising a contact surface which face away from, extend over, and is parallel to the frame plate, the distance between the contact surface and the frame plate is such that a top-plate will be in contact with said contact surface after being mounted.

10 In one embodiment the solar thermal collector system according to the invention comprises multiple plate modules. The term “multiple” is intended to mean that the solar thermal collector system according to the invention may comprise any number of plate modules more than one, i.e. at least two.

15 In another aspect the present invention provides a solar thermal collector comprising a solar thermal collector frame system according to any of the embodiments described above, comprising a collector plate arranged on the frame plate, at least one collector pipe arranged on the collector plate, and a top-plate.

In a further aspect the present invention provides a method of mounting a solar thermal collector frame, comprising the following steps:

- 20 - arranging a first plate module on a roof, wherein the plate module comprises a frame plate having two opposing first side edges and two opposing second side edges, and wherein a spacing element is arranged along each of the first side edges, such that a top-plate may be mounted parallel to the frame plate at a determined distance;
- 25 - arranging a start module along the second side edge which is turned in the downward direction of the slope of the roof (or face away from the roof ridge); and
- arranging a stop module along the second side edge which is turned in the upward direction of the slope of the roof.

30 An embodiment of the method according to the invention comprises the step of:

- arranging a second plate module on the roof such that one of the second side edges of said module is arranged adjacent to one of the second side edges of the first plate module. Further, the spacing elements of the first and the second plate module is aligned when one of the second side edges of the second plate module is

35 arranged adjacent to one of the second side edges of the first plate module.

40 In the context of the present invention, the terms «start module» and «stop module» denote longitudinal elements suitable to constitute a side edge of a solar thermal collector frame after assembly. The start module, the stop module, the frame plate, and the spacing elements will, together with the top plate, delimit a space/volume, in which a collector plate and collector pipes are mounted.

In the context of the present invention, the term «top plate» is ment to denote a plate capable of letting sunlight pass through it. The top plate is preferably completely transparent (crystal-clear) such that the short-waved sunlight will pass through the "crystal-clear" top plate and hit the collector plate. This results in the transformation of the short-waved sunlight to long-waved heat radiation. This heat remains in the space/volume delimited by the start module, the stop module, the frame plate, the spacing elements and the top plate, and will heat the liquid in the collector pipes and the layer of air between the collector plate and the top plate. The top plate may be manufactured in various materials, preferably transparent polymers having suitable mechanic properties. Preferably, the top plate is manufactured in polycarbonate. In a particularly preferred embodiment, the top plate is 5-7 mm thick, and is preferably a corrugated plate. The advantage of having a thickness of 5-7 mm is that the top plate is easy to adapt at the construction site by for instance a utility knife, and the whole solar thermal collector frame may consequently be adapted at the construction site. In many solar thermal collectors it is common to use tempered glass. Top plates in tempered glass may also be used in the solar thermal collector system according to the invention, but the disadvantage of tempered glass is that its heavy and may not be adapted at the construction site.

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Short description of the drawings

Fig. 1 shows a known module-based solar thermal collector system.
Fig. 2 shows a module-based solar thermal collector frame system according to the invention.
Fig. 3 shows a module-based solar thermal collector frame system according to the invention comprising multiple plate modules.
Fig. 4 shows details of the start module of the solar thermal collector system.
Fig. 5 shows details of the stop module of the solar thermal collector system.
Fig. 6 shows a solar thermal collector frame according to the invention.
Fig. 7 shows details of the stop module in fig. 6.
Fig. 8 shows details of the start element in fig. 6.
Fig. 9 shows details of the start element in a fully assembled solar thermal collector according to the invention.
Fig. 10 shows details of the stop module in a fully assembled solar thermal collector according to the invention.
Fig. 11 shows a module-based solar thermal collector frame system according to the invention featuring mounted collector pipes and collector plate.

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Detailed description of the invention

A known module-based solar thermal collector frame system is shown in fig. 1. This system comprises six different modules; two stop modules (R stop and L stop), two start modules (R start and L start), and two intermediate modules (R and L). Both the planning/design of solar thermal collector systems, the logistics connected to production/stock etc., as well as assembly of these at the construction site, is complicated by the large number of different modules required for a complete solar thermal collector plate.

A solar thermal collector frame system 1 according to the invention is shown in fig. 2. The system comprises only three modules; a plate module 2, a start module 3, and a stop module 4. The plate module 2 comprises a frame plate 5, and has a pair of opposing first side edges 6, and a pair of opposing second side edges 7. Spacing elements 8 are arranged along the first side edges. During assembly of a complete solar thermal collector, a top-plate 9, see fig. 9 and 10, will be arranged upon these spacing elements such that it will be parallel to the frame plate at a given distance. The distance between the frame plate and the top plate is decided by the height of the part of the spacing element, the projection 8a, which is in contact with the top plate.

A solar thermal collector frame system comprising multiple plate modules 2 is shown in fig. 3. All the plate modules 2 are equal and have opposing second side edges 7 which are complementary such that the plate modules 2 may be mounted closely adjacent to each other along said side edges 7. In this way, the multiple frame plates 5 form a unitary surface. The number of plate modules 2, and consequently the area of the final solar thermal collector frame, or the total surface, may easily be changed according to need.

Details of the frame module 2, the start module 3 and the stop module 4 are shown in figs. 4 and 5. The start module 3, fig. 4, is made up of a longitudinal element having a transverse cross-section. The cross-section, perpendicular to the longitudinal direction of the longitudinal element, is substantially L-shaped. The start module thereby provides a down-step at one side of the completed solar thermal collector frame. The start module is mounted on the side edge of the solar thermal collector frame which is turned downwards when mounted, for instance, on a roof. The stop module 4 comprises a first 4a and a second 4b longitudinal element wherein the cross-section perpendicular to the longitudinal direction of the longitudinal element is substantially I-shaped having two broad sides and two narrow sides. The first 4a and second 4b longitudinal elements are assembled such that the first longitudinal element 4a forms a side piece, wherein one of its broad sides may be arranged along a second side edge 7 of a frame module 2. The second

longitudinal element 4b is mounted on the first longitudinal element, such that the second longitudinal element 4b extends over the frame plate 5 of the frame module. After mounting of the stop module 4, one broad side of the second longitudinal element 4b, i.e. the surface 4c which is turned away from the frame plate 5, will be at the same level as the projection 8a of the spacing element 8.

A fully assembled solar thermal collector frame according to the invention is shown in Fig. 6-8. In fig. 7, the stop module 4 is shown in more detail. The second longitudinal element 4b of the stop module is shown arranged over the frame plate at the same level (or height) as the projection 8a. A section of a top-plate 9 is shown arranged on the broad side (i.e. surface 4c) of the second longitudinal element, which is turned away from the frame plate, and the projection 8a of the spacing element.

A solar thermal collector comprising a solar thermal collector frame according to the invention is shown in figs. 9 and 10.

Fig. 9 shows a start module 3 and a first side edge 6 of a plate module 2. An underlying transition plate 10 is mounted on the start module 3 and forms a transition between the solar thermal collector and an existing roof covering. The underlying transition plate 10 is arranged below a top-plate 9. The top plate 9 is made of a transparent (crystal clear) material as described above, and is kept in place by the overlying transition plate 11. The top plate is also kept in place by a side transition plate 12 which, similar to the underlying transition plate 10, forms a transition to an existing roof covering.

Fig. 10 shows a stop module 4 and a first side edge 6 of a plate module 2. The transparent top plate 9 is kept in place by side transition plate 12 and top transition plate 13. The top transition plate 13 ensures that water from an overlying roof covering will flow over the solar thermal collectors.

Fig. 11 shows a plate module 2 having a collector plate 14 and collector pipes 15 mounted thereon. One of the spacing elements have through-bores 16 for the collector pipes 15. During assembly/mounting of a solar thermal collector according to the invention, multiple plate modules 2 may be mounted together along their second side edges, and collector plates and collector pipes arranged on the frame plate. A start module 3 is mounted on the first side edge 6 which is turned in the downwards sloping direction at the site of assembly (for example a roof) and a stop module 4 is mounted on the first side edge 6 which is turned in the upwards sloping direction at the site of assembly. The underlying transition plate 10 may then be mounted on the start module 3 before the top plate 9 is arranged on the projections 8a of the spacing elements and the second longitudinal element 4b of the stop

module 4. The top plate 9 is further kept in place by mounting the overlying transition plate 11, side transition plate 12 and top transition plate 13. In addition, the transition plates ensure a transition to the roof covering.

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Claims

1. A solar thermal collector frame system (1) comprising at least a plate module (2), a start module (3) and a stop module (4), wherein
 - 5 - the plate module (2) comprises a frame plate (5) having two opposing first side edges (6) and two opposing second side edges (7), and a spacing element (8) arranged along each of the first side edges (6), the spacing element formed such that a top-plate (9) may be mounted in parallel to the frame plate (5) at a predetermined distance;
 - 10 - the second side edges (7) are complementary such that at least two plate modules (2) may be mounted against each other along said second longitudinal edges; and
 - the start module (3) and the stop module (4) are mountable along a second longitudinal edge (7).
- 15 2. A solar thermal collector frame system according to claim 1, wherein one of the spacing elements of the plate module (2) comprises through-bores for collector pipes.
- 20 3. A solar thermal collector frame system according to claim 1 or 2, wherein the start module (3) comprises a longitudinal element having a transverse cross-section suitable for having a transition plate mounted thereon, preferably the transition plate is suitable for providing a transition between the start module and a roof covering.
- 25 4. A solar thermal collector frame system according to claim 3, wherein the start module (3) has a cross-section, perpendicular to the longitudinal direction of the longitudinal element, which is substantially L- or V-shaped.
- 30 5. A solar thermal collector frame system according to any one of claims 1-4, wherein the stop module (4) comprises a longitudinal element (4a,4b) having a transverse cross-section suitable for having a transition plate mounted thereon, preferably the transition plate is suitable for providing a transition between the stop module (4) and a roof covering.
- 35 6. A solar thermal collector frame system according to any one of claims 1-5, wherein the stop module (4) comprises a longitudinal element (4b) having a transverse cross-section (4b) which after mounting along a second side edge (7) has a contact surface (4c) which face away from, extend over, and is
40 parallel to, the frame plate (5), and the distance between the surface and the frame plate (5) is such that a top-plate (9) will be in contact with said contact surface after mounting.

- 5 7. A solar thermal collector frame system according to any one of the preceding claims, wherein the spacing element (8) has a projection (8a) which comprises a contact surface which face away from, extend over, and is parallel to the frame plate (5), the distance between the contact surface and the frame plate (5) is such that a top-plate (9) will be in contact with said contact surface after mounting.
- 10 8. A solar thermal collector frame system according to any one of the preceding claims, comprising multiple plate modules (2).
- 15 9. A solar thermal collector comprising a solar thermal collector frame system according to any of the preceding claims, comprising a collector plate (14) arranged on the frame plate (5), at least one collector pipe (15) arranged on the collector plate (14), and a top-plate (9).
- 20 10. A method of mounting a solar thermal collector frame, comprising the following steps:
- 20 - arranging a first plate module (2) on a roof, wherein the plate module (2) comprises a frame plate (5) having two opposing first side edges (6) and two opposing second side edges (7), and a spacing element (8) arranged along each of the first side edges (6), such that a top-plate (9) may be mounted parallel to the frame plate (5) at a predetermined distance;
 - 25 - arranging a start module (3) along the second side edge which is turned in the downward direction of the slope of the roof; and
 - arranging a stop module (4) along the second side edge which is turned in the upwards direction of the slope of the roof
- 30 11. A method according to claim 9, comprising the step of:
- arranging a second plate module (2) on the roof such that one of the second side edges (7) of said module is arranged adjacent to one of the second side edges (7) of the first plate module (2).

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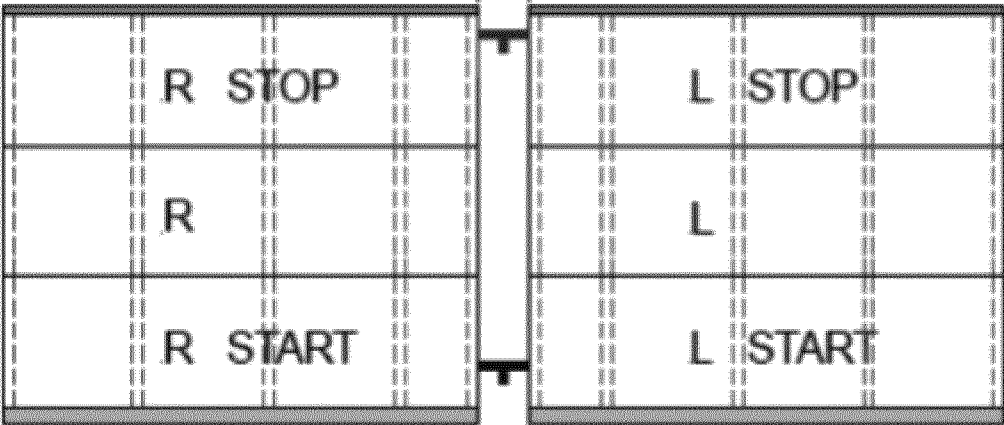


Fig. 1. Prior art

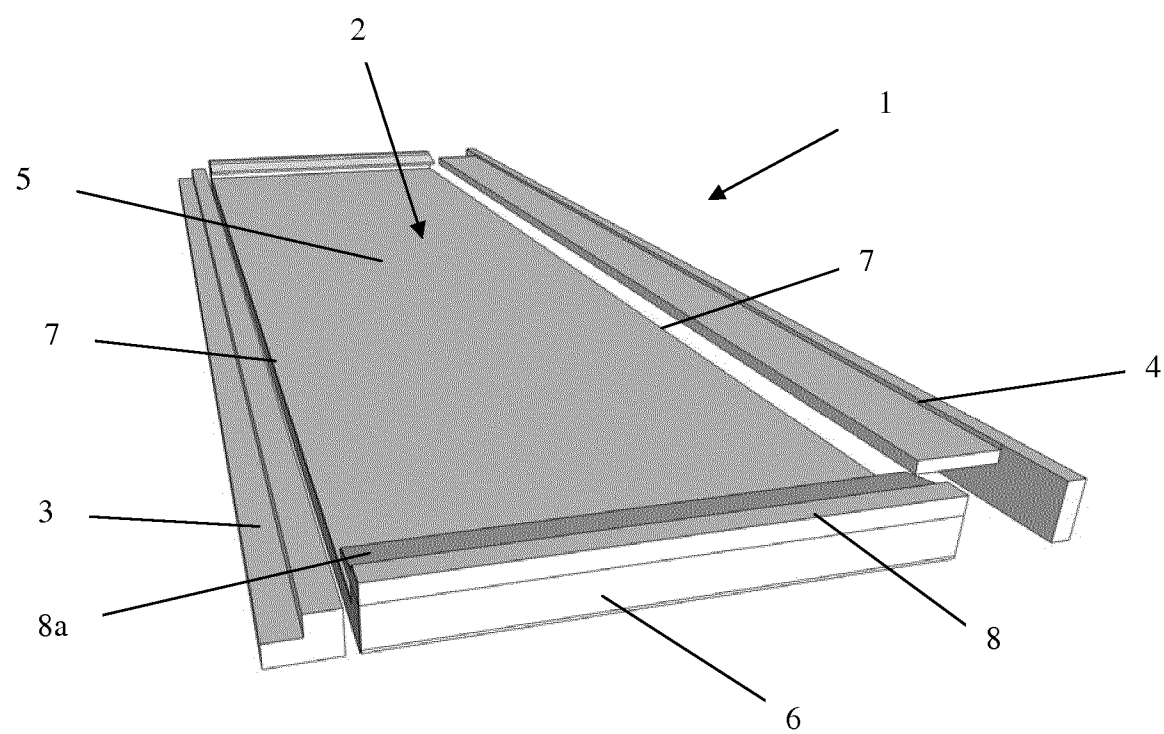


Fig. 2

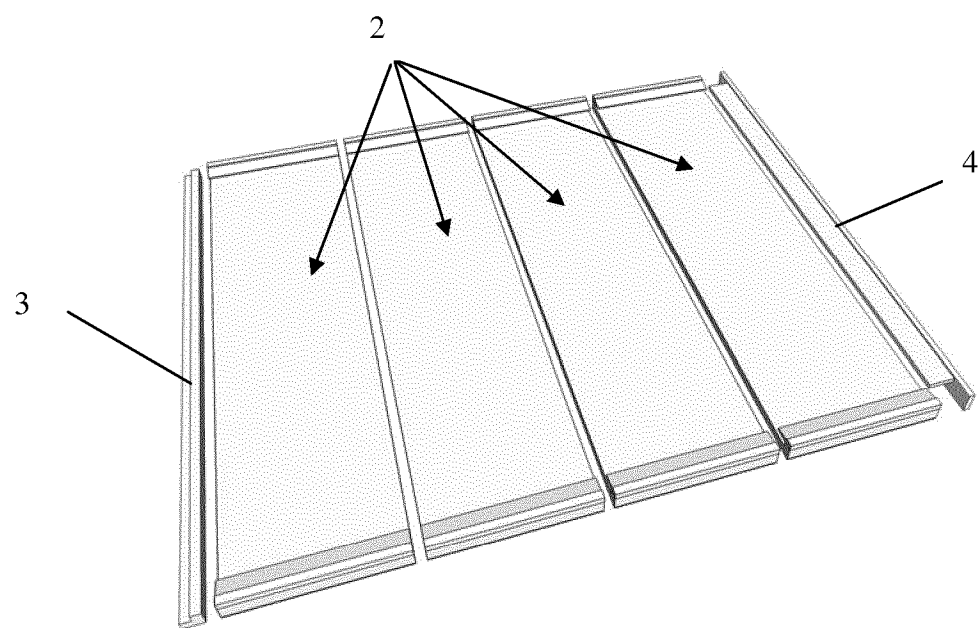


Fig. 3

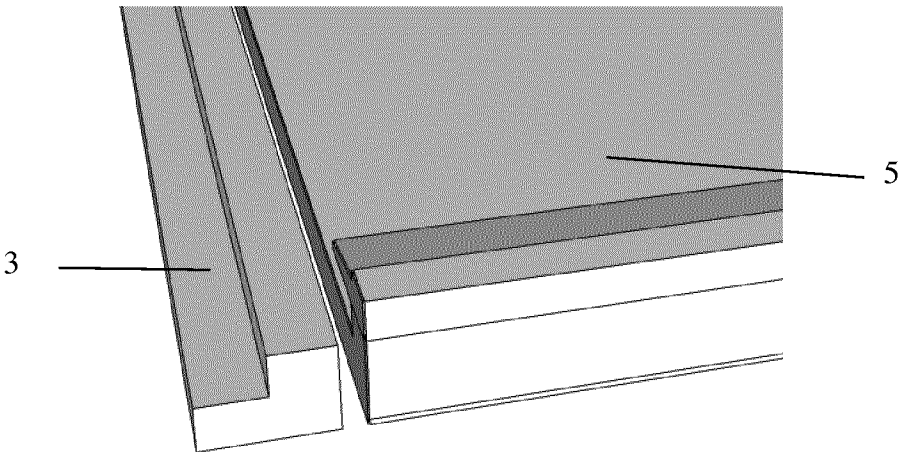


Fig. 4

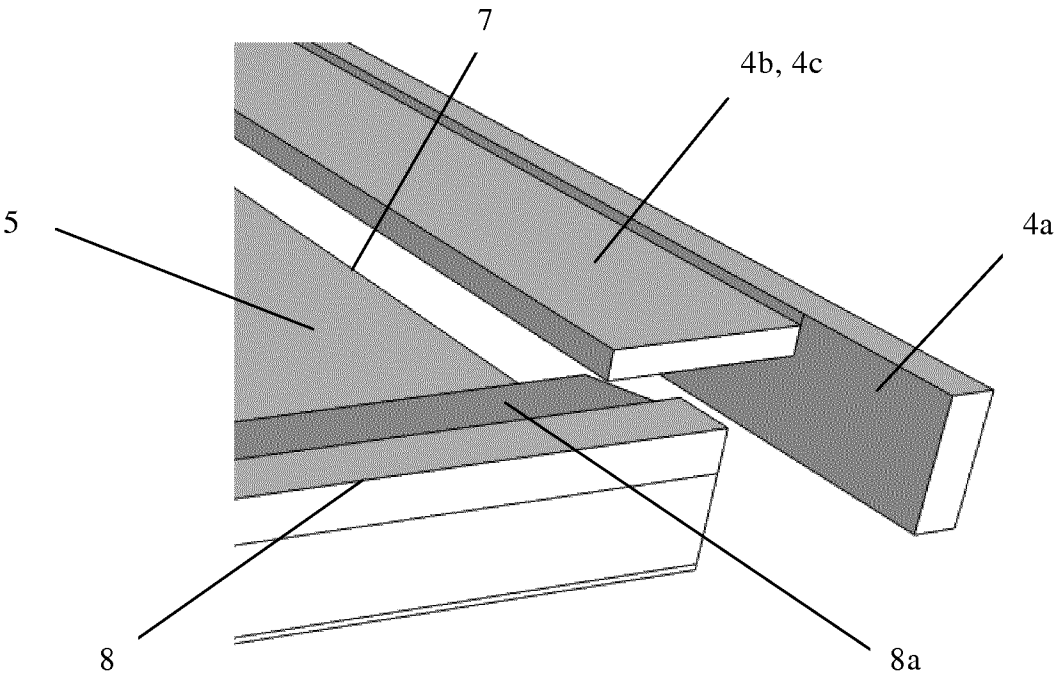


Fig. 5

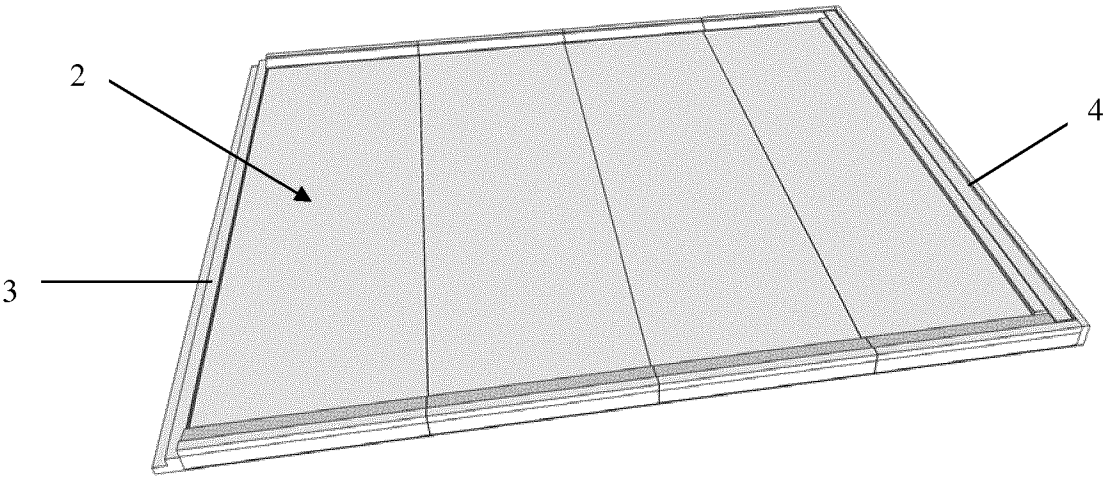


Fig. 6

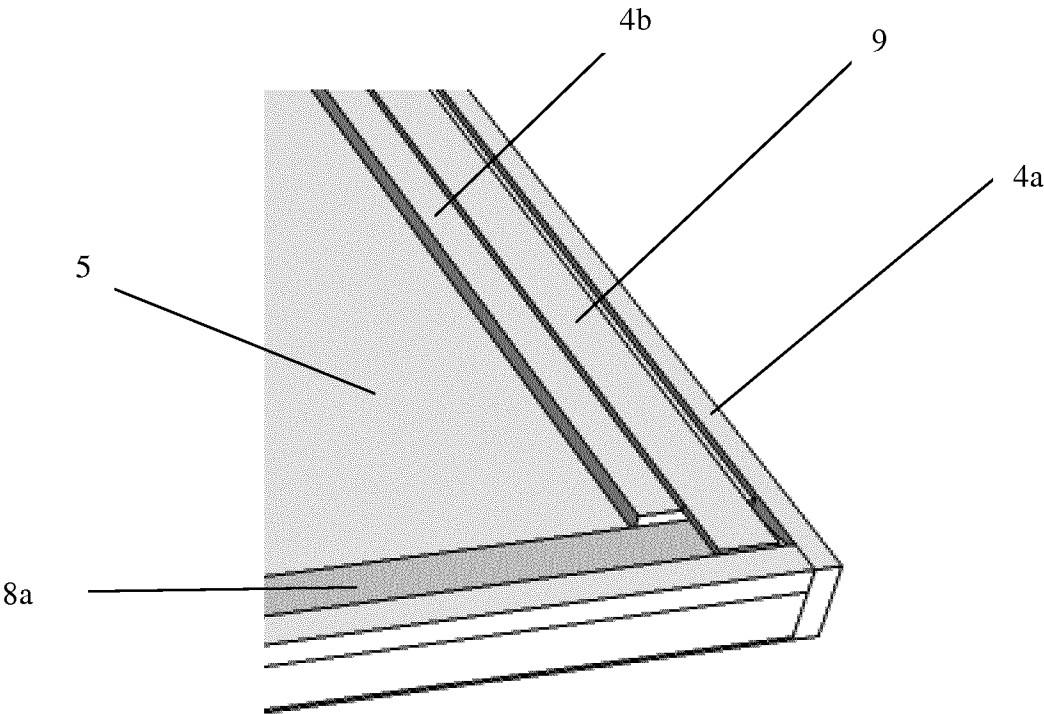


Fig. 7

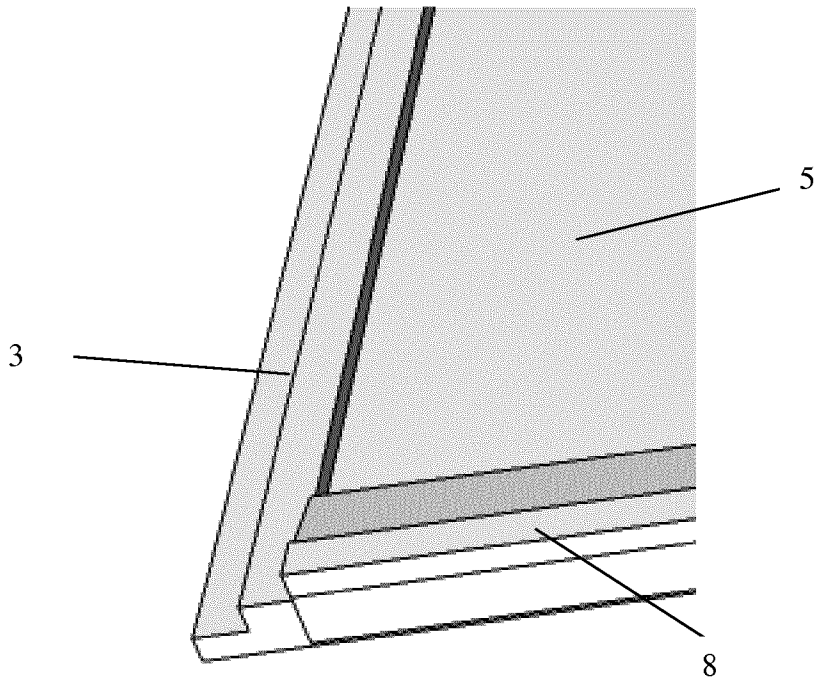


Fig. 8

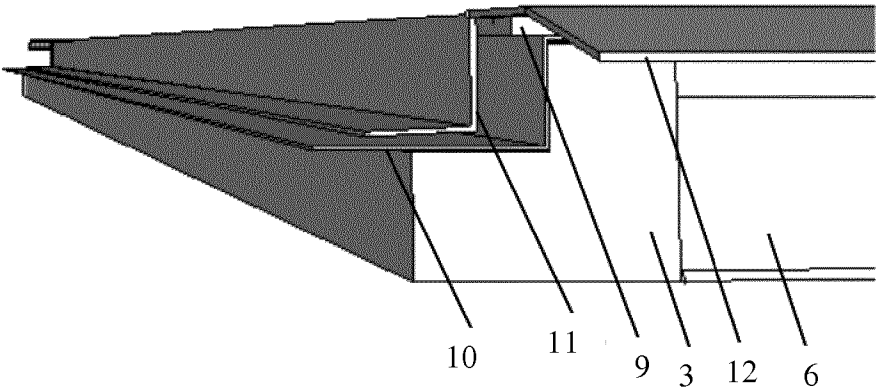


Fig. 9

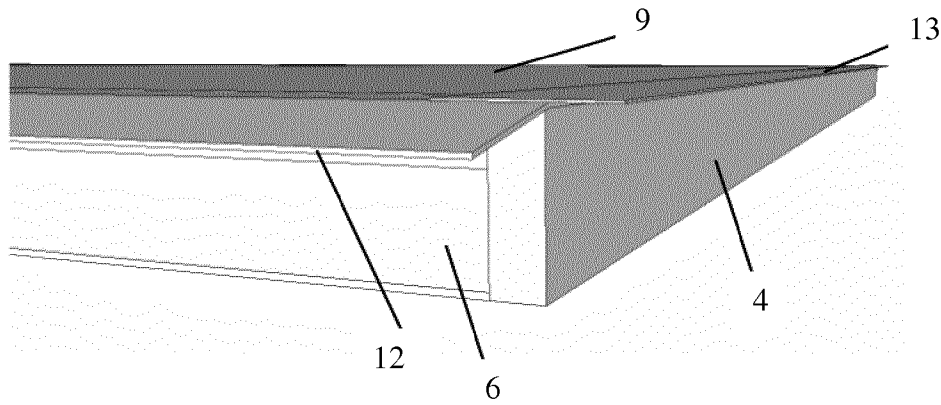


Fig. 10

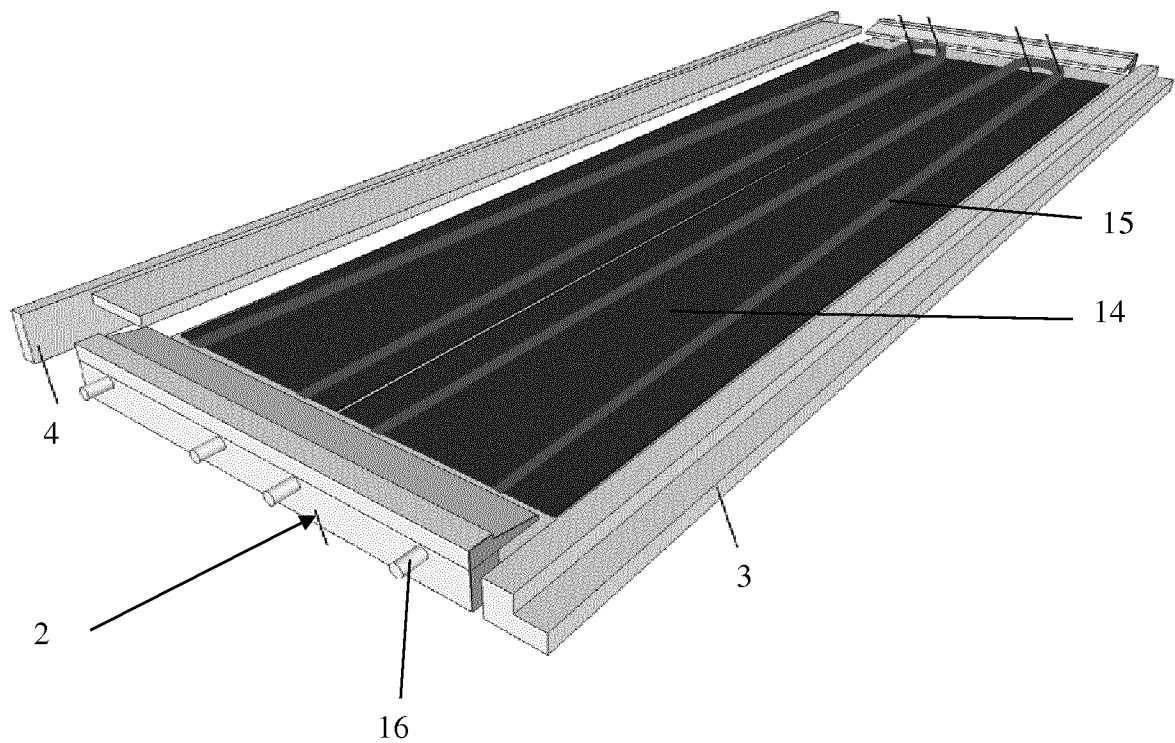


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/052650

A. CLASSIFICATION OF SUBJECT MATTER

INV. F24J2/26 F24J2/46 F24J2/52
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	paragraph [0014] - paragraph [0028]; figures 1-11	6,7,9
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

31 March 2015

Date of mailing of the international search report

10/04/2015

Name and mailing address of the ISA/

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NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Delval, Stéphane

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/052650

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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