



- (51) **International Patent Classification:**
E04D 1/24 (2006.01)
- (21) **International Application Number:**
PCT/GB2010/051454
- (22) **International Filing Date:**
3 September 2010 (03.09.2010)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
0915776.9 9 September 2009 (09.09.2009) GB
- (72) **Inventor; and**
- (71) **Applicant : GRIBBLE, Meirion** [GB/GB]; 10 Apple-
tree Close, Llanharry, Pontyclun South Wales CF72 9NN
(GB).
- (74) **Agent: DAVIES, Elliott;** Chapman Molony, Cardiff
Business Technology Centre, Senghennydd Road, Cardiff
South Wales CF24 4AY (GB).
- (81) **Designated States** (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, SI, SK, SL,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NI, SN, TD, TG).

Published:

- without international search report and to be republished
upon receipt of that report (Rule 48.2(g))

(54) Title: TILE AND TILE HOLDING DEVICE

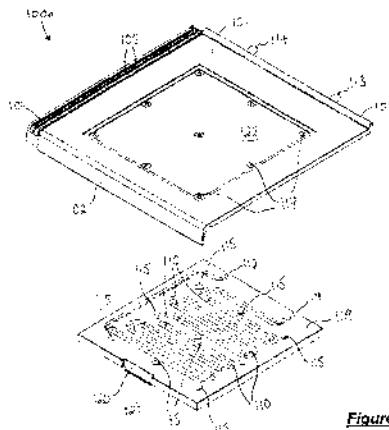


Figure 1

(57) **Abstract:** A tile for a roof, a wall or a floor, is disclosed. The tile comprises a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled. The tile may further comprise a passageway formed therein to provide heated water, and a solar panel or a Peltier device for generating electricity.

WO 2011/030127 A2

Tile and Tile Holding Device

The present invention relates to a tile and a tile holding device and particularly, but not exclusively, to a tile and tile holding device for a roof.

5

When laying tiles or slates upon a roof it is known to first secure a number of lengths of wood or batten upon the roof joists, with the battens being arranged substantially parallel to each other and substantially transverse to the roof joists. The tiles and/or slates are then placed upon the roof such that they bridge two adjacent lengths of batten.

10

Slates are typically nailed to each batten they traverse, while tiles, which may comprise a pedestal arranged on the underside of the rear of the tile, can be placed upon the batten with the pedestal arranged uppermost of the roof and beyond the uppermost batten. Accordingly, the pedestal acts to prevent the tile from sliding over the batten and down the roof. The rear of the tile then becomes held down by the front of a tile arranged further up the roof, while the front of the tile may be nailed to the lower batten.

15

In both cases however, it can be difficult to remove the tiles or slates without damaging the tile or slate and by passing a nail through the slate or tile to secure the slate or tile to the roof, it is possible that the slate or tile could break.

20

In addition when laying tiles to a wall, for example, it is common to use an adhesive. This often leads to excessive waste and requires that any excess adhesive is cleaned from the tile before the adhesive sets. The setting time itself also poses a problem as tiles placed upon the wall often move slightly under gravity, which can lead to a misalignment of the wall tiles. Moreover, once the adhesive has set, the tile cannot be removed and subsequently reused.

25

I have now devised a tile and tile holding device which alleviate the above mentioned problems.

30

In accordance with the present invention as seen from a first aspect there is provided a tile, the tile comprising a substantially planar body and a tile projection which extends

from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled.

5 The at least one tile projection enables the tile of the present invention to be quickly and replaceably secured to a desired area without the requirement for nailing or the use of an adhesive.

10 The tile preferably further comprises a flange which extends along an edge of the tile and which preferably extends out of the plane of the body of the tile. Preferably, the tile comprises a rear flange extending along a rear edge of the tile, which is arranged to engage under a further lip of the tile holding device, and a front flange which extends along a front edge of the tile.

15 The front flange preferably extends downwardly from the front edge of the tile and the rear flange preferably extends upwardly from the rear edge of the tile.

20 The tile preferably further comprises a plurality of ridges disposed on an upper surface thereof, which extend along the length of the tile and which are arranged at one side of the tile. Preferably, the tile further comprises a plurality of depressions disposed on an underside thereof, which extend along the length of the tile substantially opposite the one side. The depressions formed on one tile preferably cooperate with the ridges disposed at the one side on the upper surface of an adjacent tile to minimise any relative lateral movement.

25 Preferably, the ridges and depressions are of complementary shape and preferably further provide a labyrinth seal to minimise any water penetration between adjacent tiles.

30 In a further embodiment, the front flange preferably curves downwardly and then upwardly so as to define a channel or gutter region. When this tile is placed at the eave of a roof for example, the gutters disposed on adjacent tiles cooperate to form a continuous gutter that extends across the full width of the roof to collect rainwater that runs off the roof.

In yet a further embodiment, a side edge of the tile preferably comprises an end face which extends downwardly from the body of the tile and then upwardly, to create a substantially V-shape channel to form a valley in a roof.

- 5 The tile preferably further comprises a passageway which extends substantially within the planar body which is arranged to receive a fluid, such as water. The passageway preferably comprises an inlet and an outlet, which preferably extend through a side edge of the tile and in particular, the rear edge. The tile is preferably formed of a heat
10 and the body of the tile to enable the fluid to become heated by the tile and/or the tile to become heated by the fluid.

Accordingly, in one embodiment, the tile and passageway may be used as water heating system for generating hot water. In this embodiment, the tile is preferably of a
15 dark colour such as grey or black, to maximise the absorption of heat from the sun, for example. In this case, it is envisaged that the tile may be applied to a roof or an external wall of a building, for example. In a further embodiment, the tile and passageway may be used as a heater, with heated water being used to warm the tile. In this case, it is envisaged that the tile may be applied to an internal wall or floor.

20 The passageway preferably further comprises a heater element to prevent to minimise any frost development within the passageway.

The passageway is preferably disposed upon a body section that is removably coupled
25 to the body of the tile using fixing means. Preferably, the body section is received in a body recess disposed at the underside of the tile.

The projection preferably extends from the body section and comprises an elongate
30 barb which preferably extends along the body section.

Preferably, the tile further comprises a recess disposed at an upper surface of the tile, substantially adjacent the body recess, for receiving a solar panel and/or a Peltier device. Accordingly, the tile may be further used to generate electricity. In the case of the solar panel, the electricity would be generated by exposing the panel to sunlight, for

example, whereas, the Peltier device would be configured to generate electricity in dependence on a temperature gradient existing across the device.

5 By positioning the solar panel and/or Peltier device substantially adjacent the passageway, then the fluid within the passageway is found to limit the working temperature of the solar panel and Peltier device to within a suitable temperature range. Moreover, the fluid within the passageway is found to enhance a temperature gradient between an outwardly facing surface and an inwardly facing surface, with respect to the tile, of the Peltier device, and thus improve the generation of electricity
10 therefrom.

The solar panel and/or Peltier device are preferably secured within the recess at the upper surface of the tile using the fixing means. Preferably, the fixing means provides an electrical connection for the solar panel and/or Peltier device to the underside of the
15 tile and an electrical connection to further tiles and/or electrical devices. Preferably, the fixing means comprises a screw and/or a nut and bolt type fastener.

Preferably, recess disposed at the upper surface of the tile comprises a cover which is arranged to seal the solar panel and/or Peltier device within the recess. The cover is
20 preferably transparent to enable sunlight to pass onto the solar panel and/or Peltier device.

Preferably, the tile comprises a tile for a roof or wall or floor.

25 Preferably, the tile is formed from slate and/or stone.

In accordance with the present invention as seen from a second aspect, there is provided a tile holding device, the device comprising an elongate base, and a wall which extends from the base and along the length of the base, the wall further
30 comprising a lip which extends from an upper region of the wall substantially over the base.

The tile holding device thus enables a plurality of tiles of the first aspect to be secured to an area without the requirement for nails or an adhesive.

35

Preferably, the holding device comprises first and second lips, which separately extend to opposite sides of the wall. The first and second lips are preferably curved toward the base.

- 5 The wall preferably comprises a plurality of apertures formed therein which are arranged to align with the inlet and outlet of the passageway on the tile of the first aspect.

Preferably, the base comprises a plurality of apertures through which fastening means,
10 such as screws, may be passed to secure the holding device the area to be tiled.

Preferably, the wall and/or first and second lips are formed of a resiliently deformable material, such as a plastic.

- 15 In accordance with the present invention as seen from a third aspect, there is provided a tiling assembly, the assembly comprising a tile and a tile holding device,

the tile comprising a substantially planar body and a tile projection which extends from an underside thereof,

- 20 the tile holding device comprising an elongate base, and a wall which extends from the base and along the length of the base, the wall further comprising a lip which extends from an upper region of the wall substantially over the base, wherein

the projection is arranged to detachably engage under the lip of a tile holding device to secure the tile to an area being tiled.

- 25 The preferred features of the tiling assembly may comprise one or more of the features of the tile and tile holding device of the first and second aspect, respectively.

In accordance with the present invention as seen from a fourth aspect, there is provided a water heating system, the system comprising a tile and a ducting
30 arrangement,

the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device, to secure the tile to an area being tiled,

- 35 the tile further comprising a passageway which extends substantially within the body, the passageway comprising an inlet and an outlet which are arranged to couple

with the ducting arrangement, the ducting arrangement being arranged to convey cold water to the inlet of the passageway of the tile and to transfer heated water from the tile, through the outlet of the passageway.

- 5 Preferably, the water system further comprises a pump for pumping water around the system.

Further preferred features of the water heating system may comprise one or more of the features of the tile and tile holding device of the first and second aspect,
10 respectively.

In accordance with the present invention as seen from a fifth aspect, there is provided a heating system, the system comprising a tile and a ducting arrangement,

15 the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled

20 the tile further comprising a passageway which extends substantially within the body, the passageway comprising an inlet and an outlet, which are arranged to couple with the ducting arrangement, the ducting arrangement being arranged to convey heated fluid to the inlet of the passageway of the tile and to transfer cooled fluid from the tile, through the outlet of the passageway.

Preferably, the heating system further comprises a pump for pumping fluid around the system.

25 Further preferred features of the heating system may comprise one or more of the features of the tile and tile holding device of the first and second aspect, respectively.

In accordance with the present invention as seen from a sixth aspect, there is provided
30 an electricity generating system, the system comprising a tile and circuit means,

the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled,

35 the tile further comprising electricity generation means disposed on the body of the tile for generating electricity, the electricity generation means being electrically

connectable to the circuit means for communicating an electrical current to an electrical device.

5 Preferably, the electricity generation means comprises a solar panel and/or a Peltier device.

Further preferred features of the electricity generation system may comprise one or more of the features of the tile and tile holding device of the first and second aspect, respectively.

10

In accordance with the present invention as seen from a seventh aspect, there is provided a method of applying tiles to an area, the method comprising the steps of:

15

1. securing at least two tile holding devices of the second aspect to the area to be tiled in a substantially parallel arrangement and spaced from each other a distance that substantially corresponds to the length of a tile of the first aspect;
2. positioning a rear of the tile adjacent of one of the tile holding devices; and,
3. lowering a front of the tile such that the tile projection engages under the lip of the other of the at least two tile holding devices.

20

The rear of the tile is held adjacent one of the holding devices and the projection is secured under the lip of the other holding device to secured the front of the tile thereto. Accordingly, there is no requirement to nail the tiles or use an adhesive and so the tiles can be easily removed and replaced if required.

25

Preferably, the tile holding devices are secured to the area to be covered using fastening means such as screw and nails.

Preferably, the area to be covered comprises a roof, a wall or floor.

30

Further preferred features of the method of applying tiles to an area may comprise one or more of the features of the tile and tile holding device of the first and second aspect, respectively.

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings, in which:

5 Figure 1 is a perspective view of a tile and body section according to a first embodiment of the present invention, from above;

Figure 2 is perspective view of the tile and body section of figure 1, from below;

10 Figure 3a is a plan view of the tile of figure 1;

Figure 3b is a sectional view of the tile of figure 3a, taken across line A-A

15 Figure 4 is a perspective view of a tile according to a second embodiment of the present invention;

Figure 5 is a perspective view of a tile according to a third embodiment of the present invention;

20 Figure 6a is a perspective view of the tile holding device according to an embodiment of the present invention;

Figure 6b is a sectional view of the tile holding device of figure 6a, taken across line B-B;

25 Figure 7 is a perspective view of a water heating and electricity generating system according to an embodiment of the present invention; and,

Figure 8 is a sectional view of the system of figure 7, taken across line C-C.

30 Referring to figures 1 to 3 of the drawings there is illustrated a tile 100a according to a first embodiment of the present invention. The tile 100a may be formed of stone or slate for example and comprises a substantially planar rectangular body 101. The front edge of the tile 100a is turned downwardly to form a downwardly extending flange 102, while the rear edge of the tile is turned upwardly to form an upwardly extending flange
35 103.

At one side of the tile 100a on the upper side thereof, there is provided a region 104 which is depressed into the upper surface 101. The depressed region 104 comprises a series of ridges 105 which extend longitudinally of the tile 100a, between the front and rear flange 102, 103. The ridges 105 are illustrated as being of a square cross-section, however, it is to be appreciated that ridges 105 having other cross-sectional shapes could also be used.

At the opposite side of the tile on the underside thereof, there is provided a region 106 which is depressed into the underside of the tile 100a. The region 106 comprises a plurality of depressions 107 (only one of which is illustrated in figure 2) formed within the depressed region 106, which extend longitudinally of the tile 100a on the underside thereof, from the front flange 102 to the rear flange 103, and which extend below the surface of the underside tile 100a. When two tiles 100a are placed together in a side-by-side arrangement, the depressions 107 formed in the depressed region 106 on the underside of the one tile 100a locate with the ridges 105 formed in the depressed region 104 on the upper surface of the other tile 100a. The ridges 105 and depressions 107 are of a complimentary shape so that when the tiles 100a are placed together, the interlocking nature of the ridges 105 and depressions 107 minimise any lateral movement of the tiles with respect to each other. In addition, the ridges 105 and depressions 107 provide a labyrinth seal which minimises the ingress of rainwater, for example, between the adjoining tiles. The combined thickness of the tile 100a in the depressed region 104 at the one side of the tile and the depressed region 106 at the opposite side of the tile substantially corresponds to the thickness of the tile 100a at the centre thereof. Accordingly, when adjacent tiles are placed together, the upper surface of each tile 100a extends in substantially the same plane.

The tile 100a further comprises a body recess 108 formed on the underside thereof, within the body 101 of the tile 100. The recess 108 is arranged to receive a body section 109 which comprises a convoluted channel 110 formed therein. The channel 110 extends through an upper surface of the body section 109 and comprises an inlet 111 and an outlet 112 for separately allowing water or similar to enter and leave the channel 110, respectively. The inlet 111 and outlet 112 are arranged to separately align with an inlet 113 and an outlet aperture 114 formed in the tile 100a, which extend out through a rear edge of the tile 100.

The body section 109 further comprises a plurality of cavities 115 which extend partially within the body section 109 and are arranged to locate with protuberances 116, which extend from the underside of the tile body 101 within the body recess 108.

5

The protuberances 116 comprise an aperture 117 formed substantially at a central position thereof, which extend from an upper side of the tile body 101 to the underside of the body recess 108. Similarly, each cavity 115 comprises an aperture 118 formed therein, substantially at a centre thereof, which are of a reduced diameter compared with the respective cavity 115.

10

The body section 109 is secured within the body recess 108 by a plurality of nut and bolt type fasteners 119 which are arranged to extend within the apertures 118 formed within the cavities 115 and the protuberances 116 and which thus extend from an upper side of the tile 100a to the underside thereof. Once the body section 109 is secured within the body recess 108, the upper region of the channel 110 becomes closed by the underside of the body recess 108 and the inlet 111 and outlet 112 of the channel 110 becomes aligned with the inlet 113 and outlet aperture 114 at the rear of the tile 100a.

15

20

The body section 109 further comprises a projection 120 disposed along the edge thereof, which is arranged substantially adjacent the front flange 102 of the tile 100a. The projection 120 extends substantially parallel to the front flange 102 and comprises a forward facing barb 121. It is to be appreciated however, that the projection 120 may be disposed upon the body 101 of the tile 100a.

25

The tile 100a further comprises a recess 122 formed at an upper region of the tile 100a, substantially opposite the body recess 108. The recess 122 is arranged to receive a solar panel 123 and/or a Peltier device 124, which is/are secured within the recess 122 by the nut and bolt type fasteners 119 which further provide an electrical connection of the solar panel 123 and/or the Peltier device 124 to the underside of the tile 100a. If required a transparent cover (not shown) may be provided over the solar panel 123 and/or Peltier device 124 to seal the recess 122.

30

Referring to figure 4 of the drawings, there is illustrated a tile 100b according to a second embodiment of the present invention. In this embodiment, the front flange 102 of the tile 100a of the first embodiment is formed into a substantially U-shaped gutter 125 that extends from the front edge of the tile 100b. The depressed region 104 on the upper surface at one side of the tile 100 extends into the gutter 125. Similarly, the depressed region 106 formed on the underside at the opposite side of the tile 100b extends around the underside of the gutter 125. The ridges 105 and depressions 107 formed within the depressed regions 104, 106, respectively, extend around the gutter 125 at the respective sides thereof such that when adjacent tiles 100b are placed together the ridges 105 and depressions 107 cooperate to minimise any relative lateral movement.

The tile 100b illustrated in figure 4 is arranged for fitting along the eaves (not shown) of a roof (not shown) such that the gutter 125 of adjacent tiles 100b partially overlay one another at the side edges thereof to form a continuous gutter along the eave (not shown) of a roof (not shown). Each tile gutter 125 is arranged at a slight decline to the surface 101 of the tile 100b, such that the resulting continuous gutter that extends along the eave (not shown) of a roof (not shown) can collect water which runs off the roof (not shown) and subsequently directs the water to one side thereof for transfer to a downpipe (not shown) or similar.

Referring to figure 5 of the drawings, there is illustrated a tile 100c according to a third embodiment of the present invention. In this embodiment, one of the side edges of the tile 100a of the first embodiment is replaced with a substantially V-shaped channel 126 that extends at an angle to the opposite side edge of the tile 100c. The V-shaped channel 126 is suited for creating valleys in a roof (not shown) where, for example, two roofs (not shown) meet at an angle. The valley tile 100c illustrated in figure 5 exhibits a V-shaped channel 126 wherein the V-shaped channel 126 comprises a first face 126a which extends down from the upper surface 101 of the tile 100c and a second face 126b which extends upwardly from the distal end of the first face 126a; a neighbouring valley tile (not shown) which adjoins the valley tile 100c illustrated in figure 5 comprises a V-shaped channel 126 at the opposite side of the tile compared to the tile illustrated in figure 5, such that the channels 126 become inserted into each other when placed upon the roof (not shown). Alternatively, one of the tiles 100c of the pair forming the

valley may only comprise a downwardly extending face 126a which extends within the V-shaped channel 126 disposed on the neighbouring tile 100c.

Referring to figure 6 of the drawings, there is illustrated a tile holding device 200 according to an embodiment of the present invention. The tile holding device 200 may be formed of plastic material and comprises a substantially planar elongate base 201 that is substantially rectangular in shape when viewed from above. A wall 202 is disposed upon the base 201 and extends substantially along the length of the base 201. The wall 202 extends from the base 201 and is resiliently biased in a plane that extends substantially perpendicularly to the plane of the base 201. The wall 202 may be formed integrally with the base 201 and comprises first and second lips 203, 204 which separately extend to either side of the wall 202 from an upper region thereof. The lips 203, 204 extend substantially over the base 201, along the length of the wall 202 and curve from the wall 202 toward the base 201.

The base 201 comprises a plurality of apertures (not shown) which extend along the length of the device 200 such that screws or nails (not shown) for example, can be passed through the apertures (not shown) to secure the holding device 200 to the area to be tiled. The wall 202 similarly comprises a plurality of apertures 205 disposed along the length thereof which are arranged to align with the apertures 113, 114 formed at the rear of the tile 100a, 100b, 100c.

Referring to figures 7 and 8 of the drawings, there is illustrated a system 300 for heating water. The tiles, for example the tiles 100a of the first embodiment, are secured upon a roof (not shown, or an external wall) of a building (not shown) using the tile holding device 200 described above. The tile holding devices 200 are secured across roof joists (not shown) in a substantially parallel configuration and spaced apart a distance substantially corresponding to the length of the tile 100a. In order to secure the tiles 100a in place, the rear flange 103 of each tile 100a is secured under a first lip 203 on one tile holding device 200 and the tile 100a then lowered so that the barb 121 on the projection 120 snap engages under the second lip 204 of an adjacent holding device arranged lower down the roof (not shown).

Once all of the tiles 100a have been secured in place over the roof (not shown), the inlet 113 to the channel 110 of each tile 100a is coupled to a common "flow" duct 301

via a coupling connection 302 which is arranged to pass through an aperture 205 formed within the wall 202 of the holding device 200 into the inlet 113. The outlet 114 from the channel 110 of each tile 100a is coupled to a common "return" duct 303 using similar coupling connections 302, which also extend through an aperture 205 formed within the wall 202 of the holding device 200 into the outlet 114, thereby providing the typical "flow and return" system. A pump (not shown) is then switched on to pump water for example, from the flow duct 301, around the channel 110 within each tile 100a and then back to the return duct 303. The exposure of the tile 102 to the sun (not shown), by positioning the tile 100a upon a roof (not shown) or external wall (not shown), coupled with the heat conductive nature of the tile 100a is found to cause the water within the channels 110 to become heated. This heated water may then be transferred to hot water outlets (not shown) within the building (not shown) or a heating system (not shown). In the latter case, it is envisaged that the heated water could be transferred to a similar arrangement of tiles 100a embedded within a floor (not shown) of a building (not shown) or upon an internal wall (not shown) of the building (not shown), for example. The heated water can then give up the heat associated therewith to the tiles 100a embedded within the floor (not shown) and/or positioned upon the internal wall (not shown) to heat the building (not shown). Alternatively, it is envisaged that a similar arrangement of tiles 100a arranged within a building (not shown) may take heated water direct from a conventional boiler (not shown).

The tiles 100a of the system disclosed in figures 7 and 8 further comprise a solar panel 123 and a Peltier device 124 secured thereon. The electrical connections, namely the nut and bolt type fasteners 119 to the solar panel 123 and the Peltier device 124, disposed at the underside of the tile 100a are then connected, such that the electrical connections 119 having a first polarity are connected to a common first power rail (not shown) and the electrical connections 119 having a second polarity are connected to a common second power rail (not shown).

On exposure to sunlight, the solar panel 123 will generate electricity which can be extracted from the first and second power rails (not shown) to power electrical devices (not shown). Similarly, the side of the Peltier device 124 which faces the sun (not shown) will become heated with respect to the underside thereof and therefore, a temperature gradient will become established between the upper and lower surfaces of the device 124 which can be used to generate electricity. The close proximity of the

channel 110 of each tile 100a to the respective solar panel 123 and the Peltier device 124 enables the water within the channel 110 to effectively cool the panel 123 and the device 124 and thus maintain the panel 123 and device 124 to within a suitable temperature range. In addition, the cooling of the underside of the Peltier device 124 is
5 found to further enhance the temperature gradient for an improved electrical generation therefrom.

From the foregoing therefore, it is evident that the tile and tile holding device of the present invention provide for a simple yet effective means of coupling tiles to an area,
10 such as a roof, a wall or a floor. The tile further facilitates an environmentally friendly generation of electricity and heating of water.

Claims

1. A tile, the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage
5 with a tile holding device to secure the tile to an area being tiled.
2. A tile according to claim 1, further comprising a flange which extends along an edge of the tile.
- 10 3. A tile according to claim 2, wherein the flange extends out of the plane of the body of the tile.
4. A tile according to any preceding claim comprising a rear flange extending along a rear edge of the tile, which is arranged to engage under a lip of a tile holding
15 device and a front flange which extends along a front edge of the tile.
5. A tile according to claim 4, wherein the front flange extends downwardly from the front edge of the tile and the rear flange extends upwardly from the rear edge of the tile.
20
6. A tile according to any preceding claim, wherein the tile further comprises a plurality of ridges disposed on an upper surface thereof, which extend along the length of the tile and which are arranged at one side of the tile.
- 25 7. A tile according to claim 6, further comprising a plurality of depressions disposed on an underside thereof, which extend along the length of the tile substantially opposite the one side.
8. A tile according to claim 7, wherein the depressions formed on one tile
30 cooperate with the ridges disposed at the one side on the upper surface of an adjacent tile to minimise any relative lateral movement.
9. A tile according to claim 7 and 8, wherein the ridges and depressions are of complementary shape.
35

10. A tile according to claim 9 wherein the ridges and depressions further provide a labyrinth seal to minimise any water penetration between adjacent tiles.

5 11. A tile according to claim 5, wherein the front flange curves downwardly and then upwardly so as to define a channel or gutter region.

12. A tile according to claim 6 or 7, wherein a side edge of the tile comprises an end face which extends downwardly from the body of the tile and then upwardly, to create a substantially V-shape channel to form a valley in a roof.

10

13. A tile according to any preceding claim, further comprising a passageway which extends substantially within the planar body which is arranged to receive a fluid, such as water.

15

14. A tile according to claim 13, wherein the passageway comprises an inlet and an outlet, which extend through a side edge of the tile.

20

15. A tile according to claim 13 or 14, wherein the tile is formed of a heat conductive material so that heat can transfer between the fluid within the passageway and the body of the tile to enable the fluid to become heated by the tile and/or the tile to become heated by the fluid.

25

16. A tile according to any of claims 13 to 15, wherein the tile and passageway may be used as water heating system for generating hot water.

17. A tile according to any of claims 13 to 16, wherein the tile is of a dark colour such as grey or black.

30

18. A tile according to any of claims 13 to 17, wherein the passageway further comprises a heater element to prevent to minimise any frost development within the passageway.

35

19. A tile according to any of claims 13 to 18, wherein the passageway is disposed upon a body section that is removably coupled to the body of the tile using fixing means.

20. A tile according to any of claims 13 to 19, wherein the body section is received in a body recess disposed at the underside of the tile.
- 5 21. A tile according to claim 19 or 20, wherein the projection extends from the body section and comprises an elongate barb.
22. A tile according to claim 21, wherein the barb extends along the body section.
- 10 23. A tile according to claim 20, further comprising a recess disposed at an upper surface of the tile, substantially adjacent the body recess, for receiving a solar panel and/or a Peltier device.
24. A tile according to claim 23, wherein the solar panel and/or Peltier device are
15 secured within the recess at the upper surface of the tile using the fixing means.
25. A tile according to claim 24, wherein the fixing means provides an electrical connection for the solar panel and/or Peltier device to the underside of the tile and an electrical connection to further tiles and/or electrical devices.
20
26. A tile according to claim 24 or 25, wherein the fixing means comprises a screw and/or a nut and bolt type fastener.
27. A tile according to claim 23, wherein recess disposed at the upper surface of
25 the tile comprises a cover which is arranged to seal the solar panel and/or Peltier device within the recess.
28. A tile according to claim 27, wherein the cover substantially transparent to enable sunlight to pass onto the solar panel and/or Peltier device.
30
29. A tile according to any preceding claim, wherein the tile comprises a tile for a roof or wall or floor.
30. A tile according to any preceding claim, wherein the tile is formed from slate
35 and/or stone.

31. A tile holding device, the device comprising an elongate base, and a wall which extends from the base and along the length of the base, the wall further comprising a lip which extends from an upper region of the wall substantially over the base.

5

32. A tile holding device according to claim 31, comprising first and second lips, which separately extend to opposite sides of the wall.

10

33. A tile holding device according to claim 32, wherein the first and second lips are curved toward the base.

34. A tile holding device according to any of claims 31 to 33 as appended to claim 14, wherein the wall comprises a plurality of apertures formed therein which are arranged to align with the inlet and outlet of the passageway on the tile.

15

35. A tile holding device according to any of claims 31 to 34, wherein the base comprises a plurality of apertures through which fastening means, such as screws, may be passed to secure the holding device the area to be tiled.

20

36. A tile holding device according to claim 32, wherein the wall and/or first and second lips are formed of a resiliently deformable material.

37. A tiling assembly, the assembly comprising a tile and a tile holding device, the tile comprising a substantially planar body and a tile projection which extends from an underside thereof,

25

the tile holding device comprising an elongate base, and a wall which extends from the base and along the length of the base, the wall further comprising a lip which extends from an upper region of the wall substantially over the base, wherein

the projection is arranged to detachably engage under the lip of a tile holding device to secure the tile to an area being tiled.

30

38. A water heating system, the system comprising a tile and a ducting arrangement,

the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device, to secure the tile to an area being tiled,

5 the tile further comprising a passageway which extends substantially within the body, the passageway comprising an inlet and an outlet which are arranged to couple with the ducting arrangement, the ducting arrangement being arranged to convey cold water to the inlet of the passageway of the tile and to transfer heated water from the tile, through the outlet of the passageway.

10 39. A water heating system according to claim 38, wherein the water system further comprises a pump for pumping water around the system.

40. A heating system, the system comprising a tile and a ducting arrangement,
15 the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled

20 the tile further comprising a passageway which extends substantially within the body, the passageway comprising an inlet and an outlet, which are arranged to couple with the ducting arrangement, the ducting arrangement being arranged to convey heated fluid to the inlet of the passageway of the tile and to transfer cooled fluid from the tile, through the outlet of the passageway.

41. A heating system according to claim 40, further comprising a pump for pumping fluid around the system.

25 42. An electricity generating system, the system comprising a tile and circuit means,

30 the tile comprising a substantially planar body and a tile projection which extends from an underside thereof, the projection being arranged to detachably engage with a tile holding device to secure the tile to an area being tiled,

the tile further comprising electricity generation means disposed on the body of the tile for generating electricity, the electricity generation means being electrically connectable to the circuit means for communicating an electrical current to an electrical device.

35

43. An electricity generating system according to claim 42, wherein the electricity generation means comprises a solar panel and/or a Peltier device.

44. A method of applying tiles to an area, the method comprising the steps of:

- 5 1. securing at least two tile holding devices of the second aspect to the area to be tiled in a substantially parallel arrangement and spaced from each other a distance that substantially corresponds to the length of a tile of the first aspect;
- 10 2. positioning a rear of the tile adjacent of one of the tile holding devices; and
3. lowering a front of the tile such that the tile projection engages under the lip of the other of the at least two tile holding devices.

45. A method of applying tiles to an area according to claim 44, wherein the tile holding devices are secured to the area to be covered using fastening means such as
15 screw and nails.

46. A method of applying tiles to an area, wherein the area to be covered comprises a roof, a wall or floor.

1 / 8

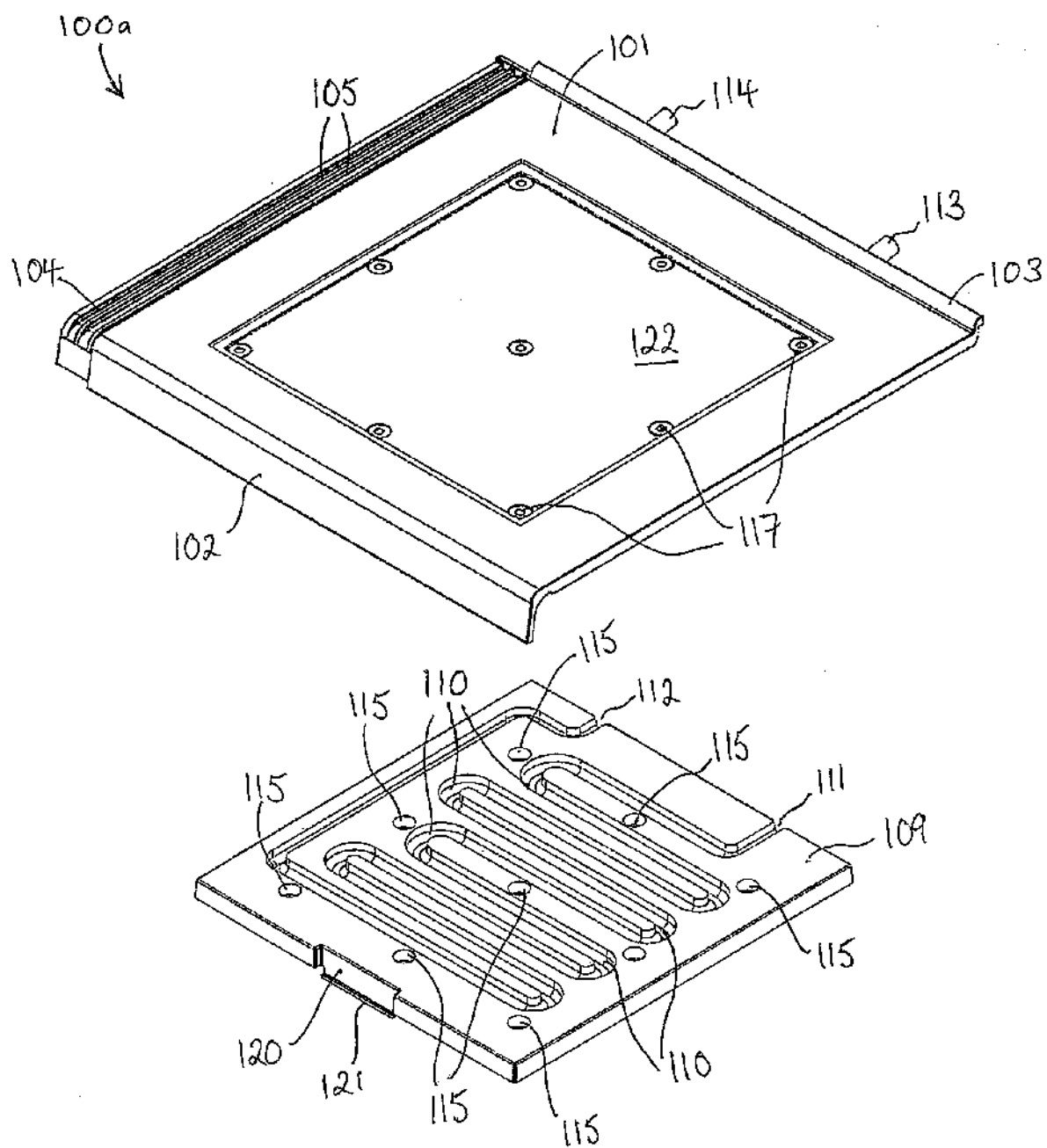


Figure 1

2 / 8

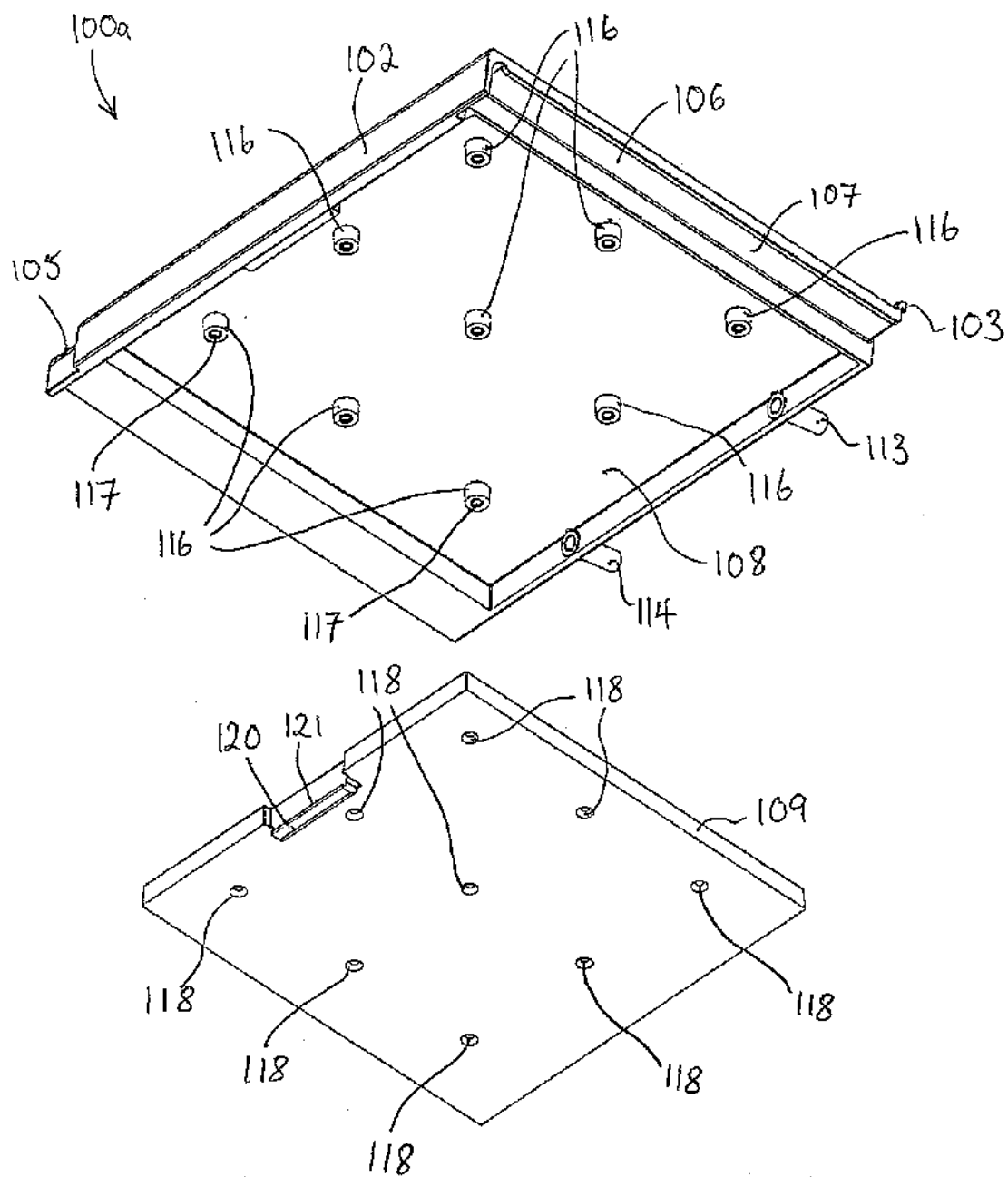


Figure 2

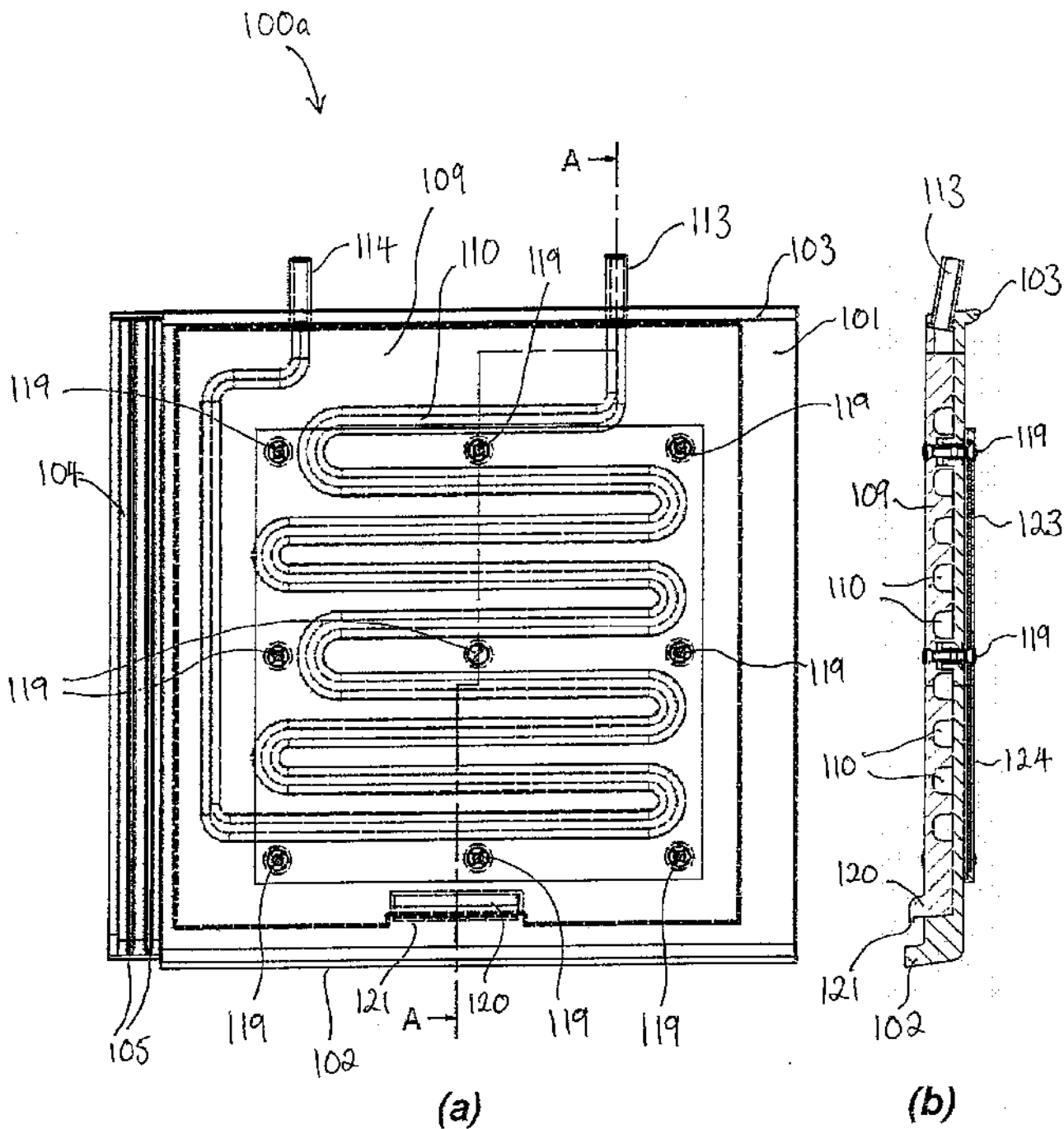


Figure 3

4 / 8

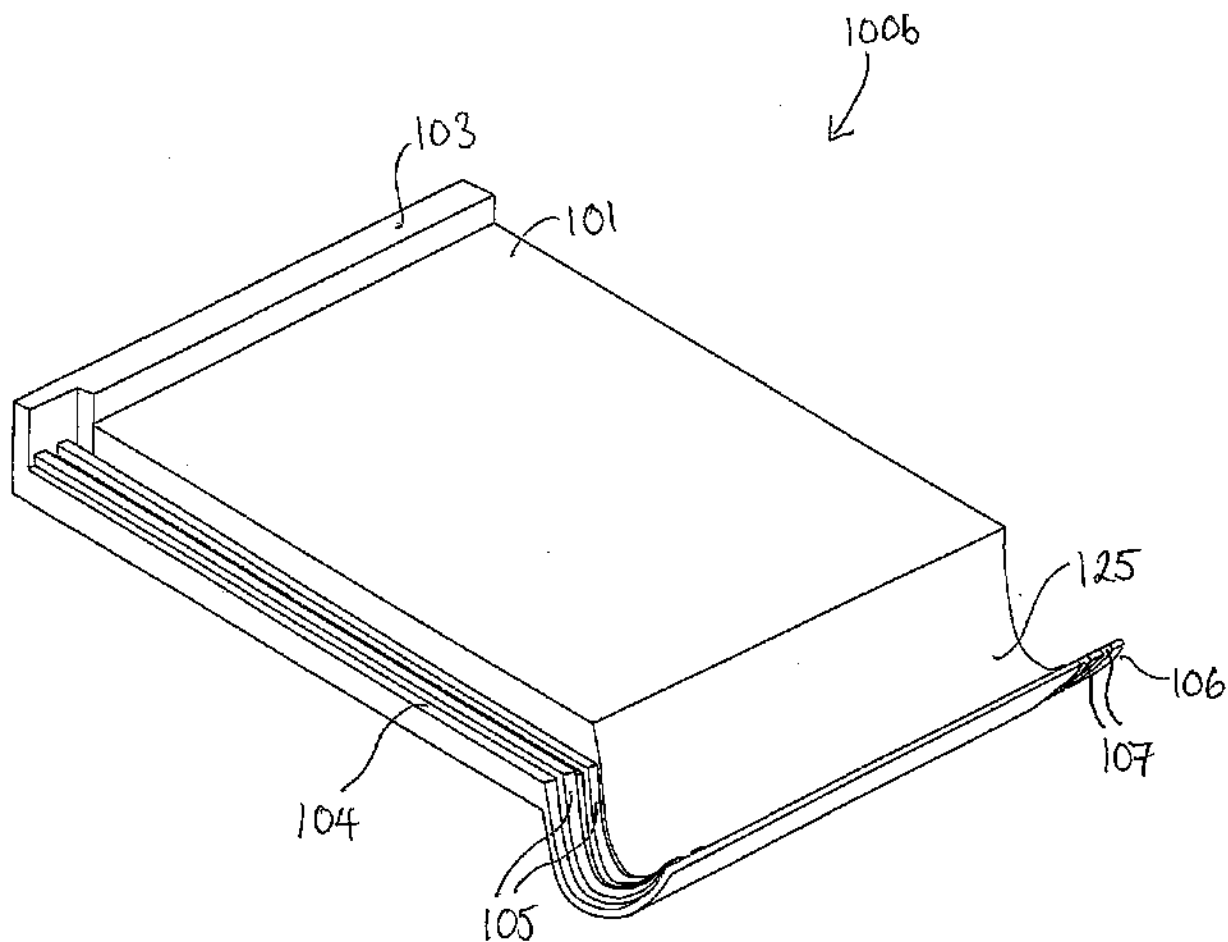


Figure 4

5 / 8

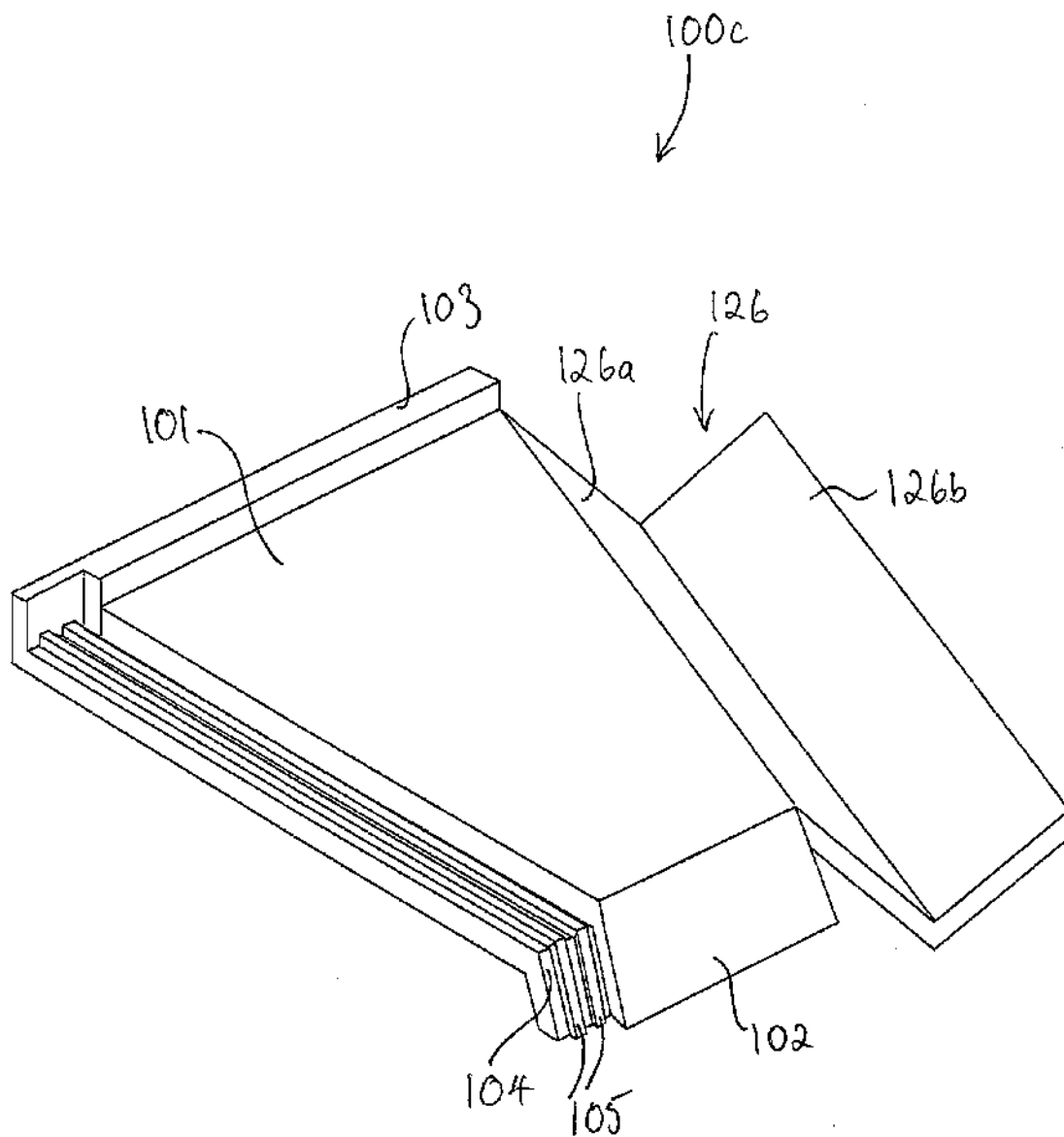


Figure 5

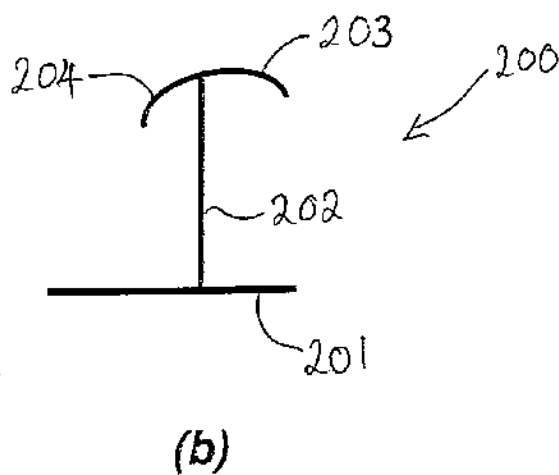
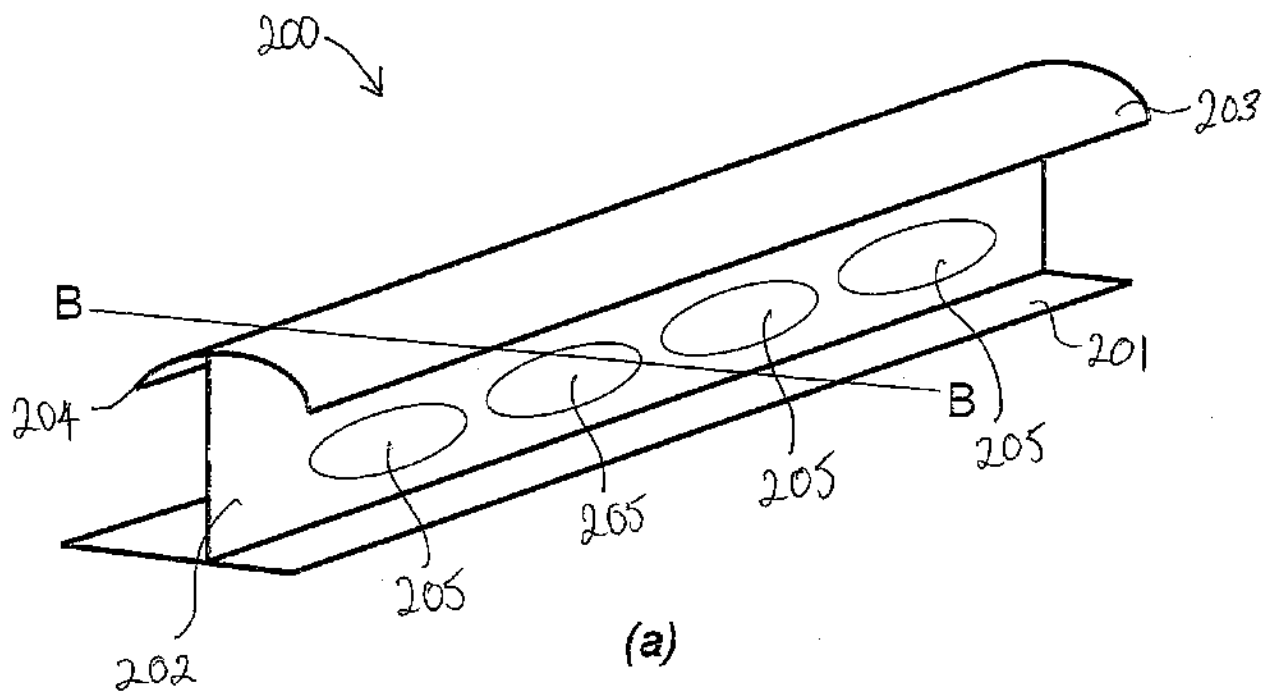


Figure 6

7/8

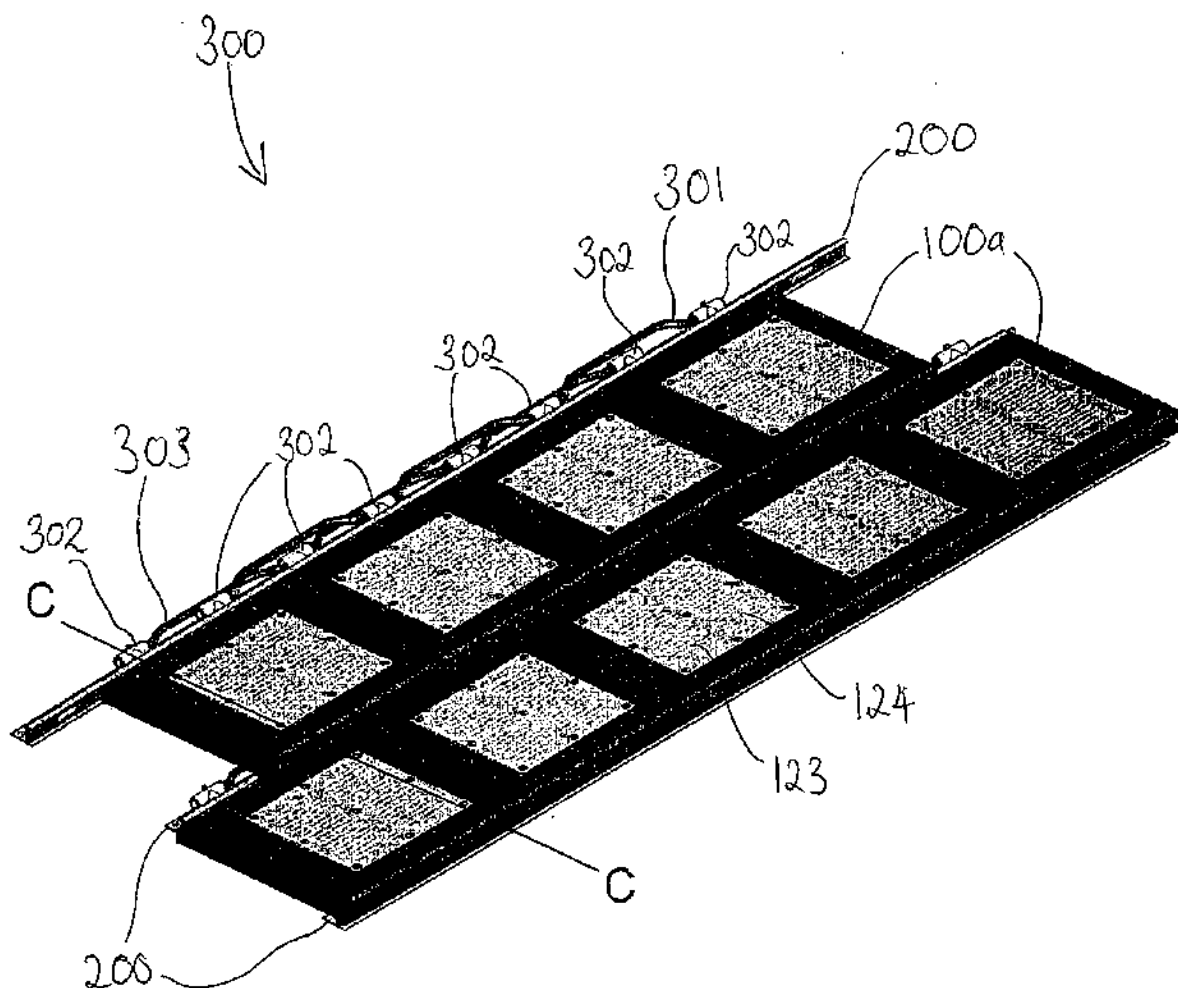


Figure 7

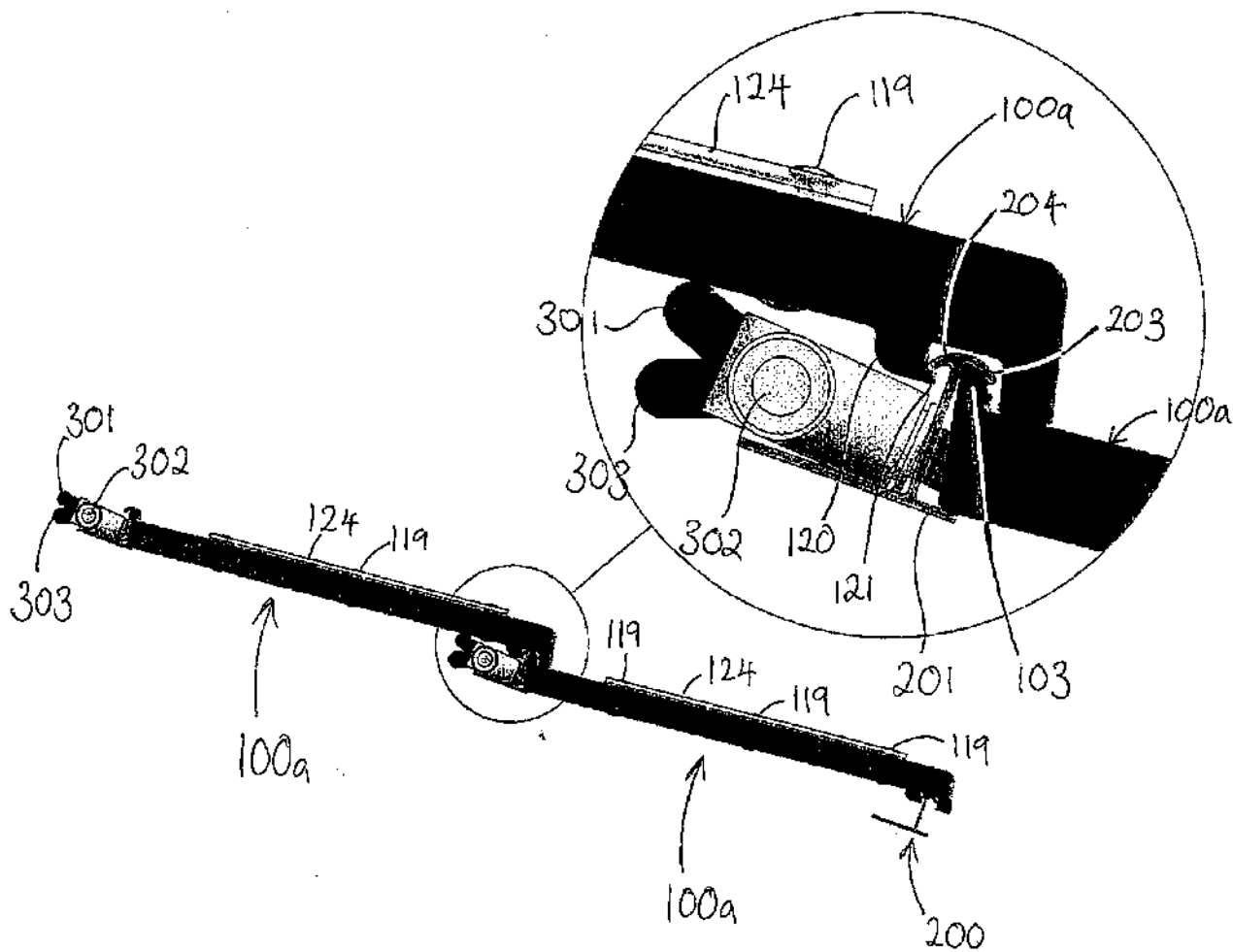


Figure 8