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(54) **INTERLOCKING BUILDING PANEL**

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(52) **U.S. Cl.** **52/173.1**; 52/588.1; 52/302.1

(57) **ABSTRACT**

A rigid rectangular construction panel, such as a floor panel, has quick release connections along its edges. The panel is made from composite materials in a single work piece. The base of the panel is made up of pillars to separate the body of the panel from the underlying construction surface, such as a concrete slab or wall. The base defines a fluid flow field to permit drainage and drying of the underlying construction surface. An impermeable moisture barrier may be provided to prevent migration of moisture into or through the panel. The panel may be provided with an added, removable surface layer which may be selectively removed and replaced without removing the underlying panel from an installation area. The core of the panel may be provided with a temperature modification element which may interconnect with similar elements in neighboring panels.

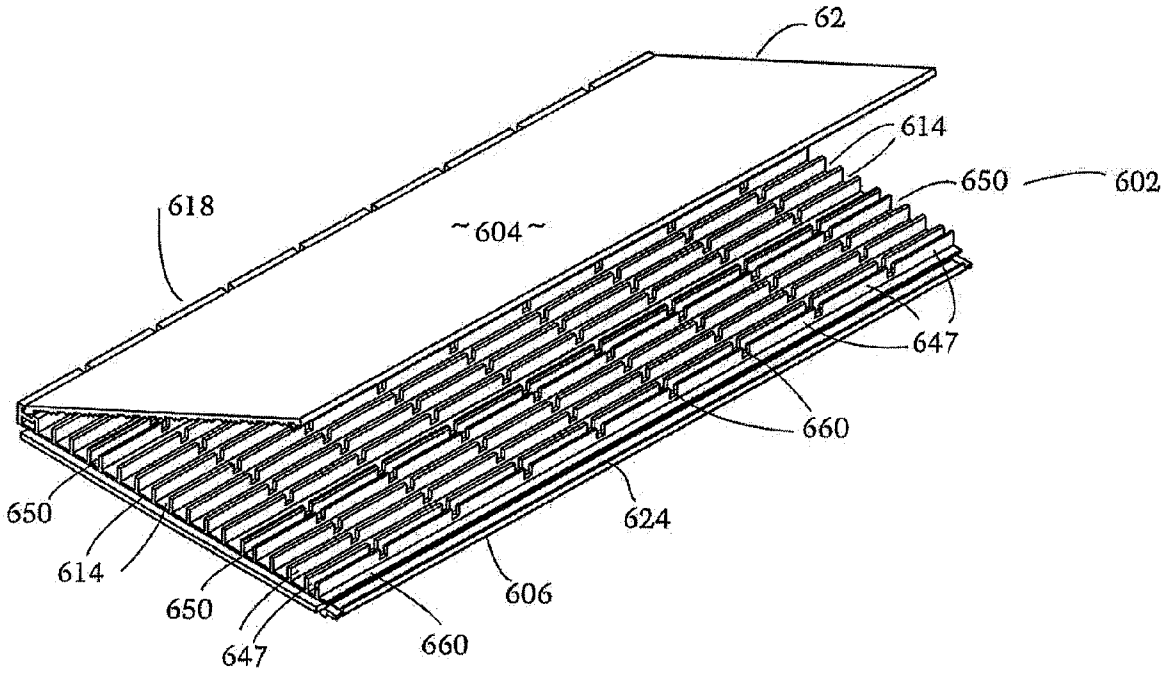

FIG 2.

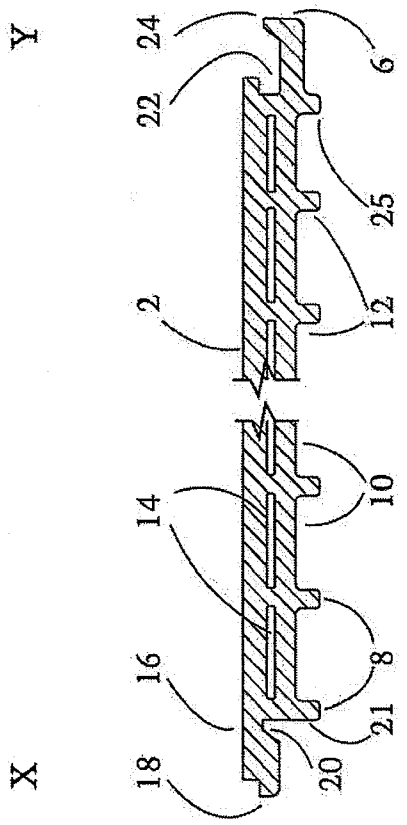
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FIG 1.

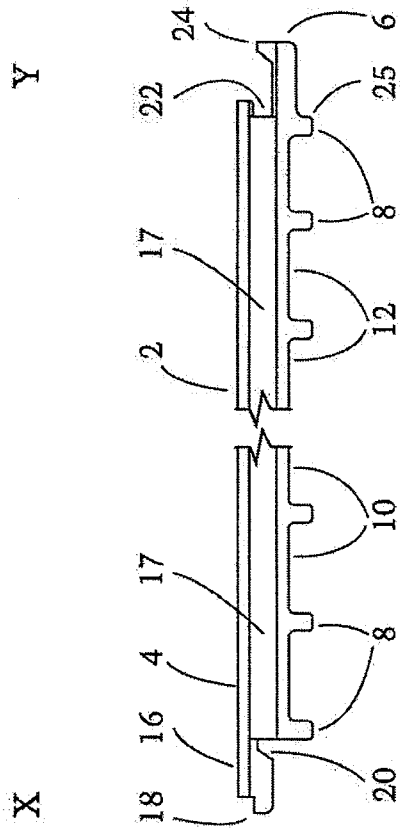
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FIG 4.

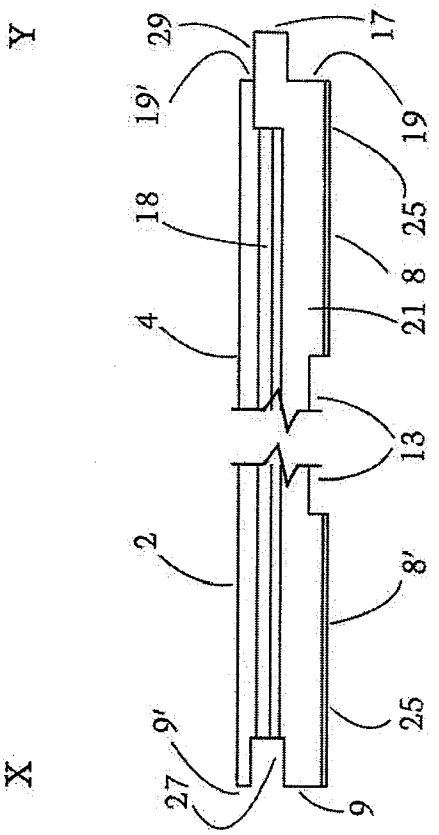
Y
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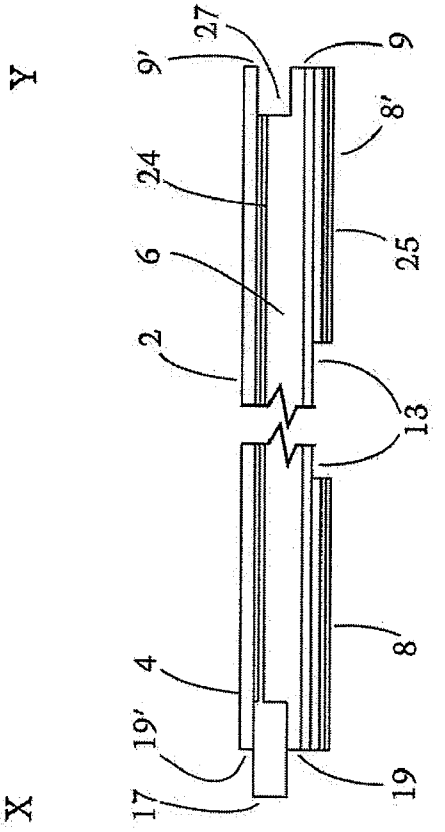
FIG 3.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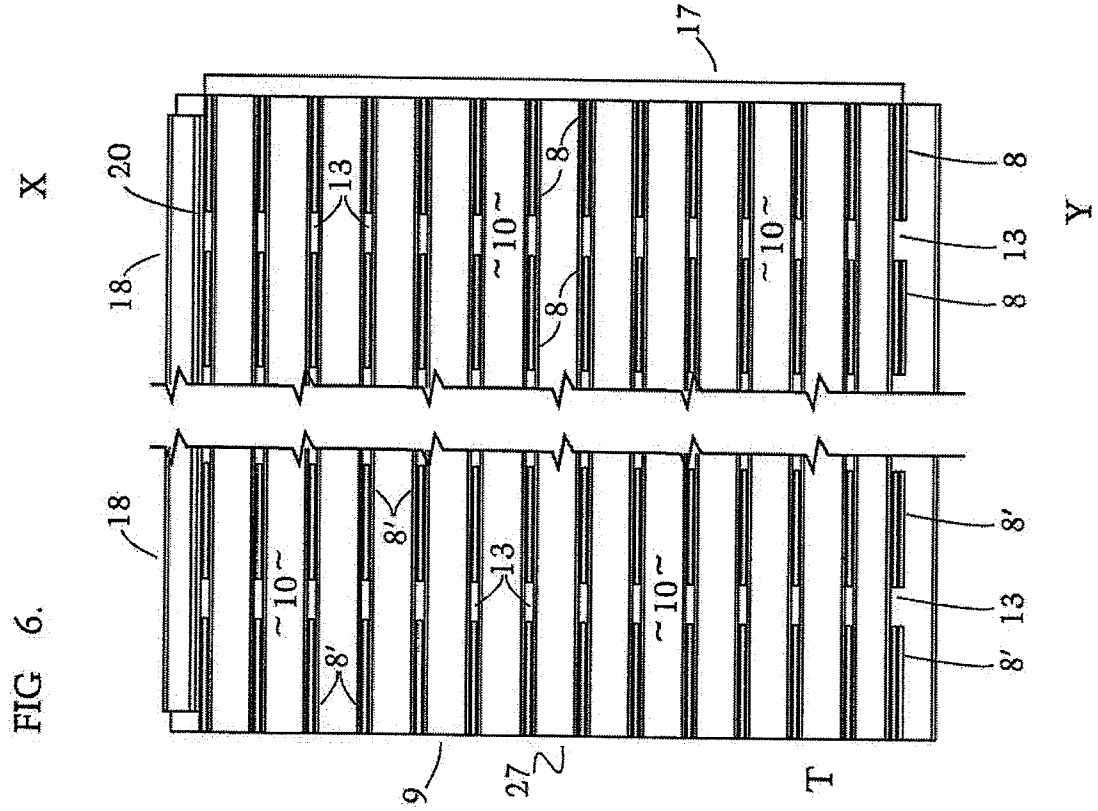


FIG 6.

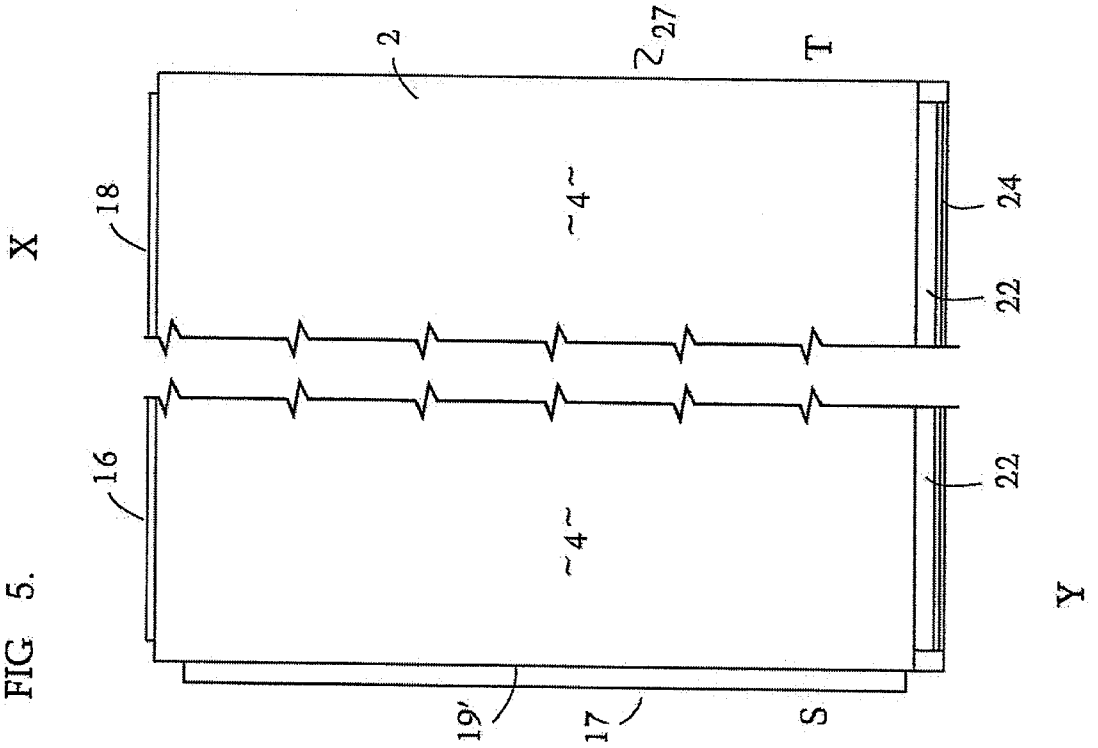


FIG 5.

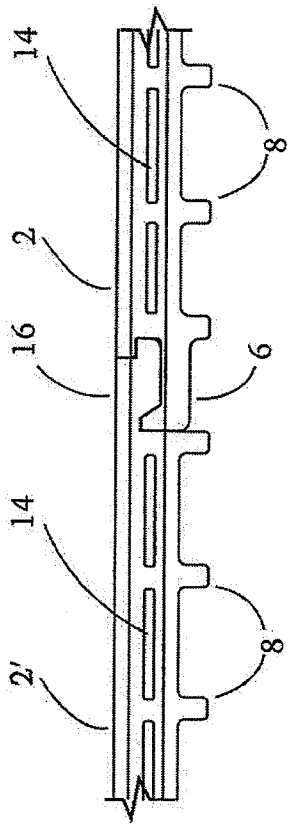
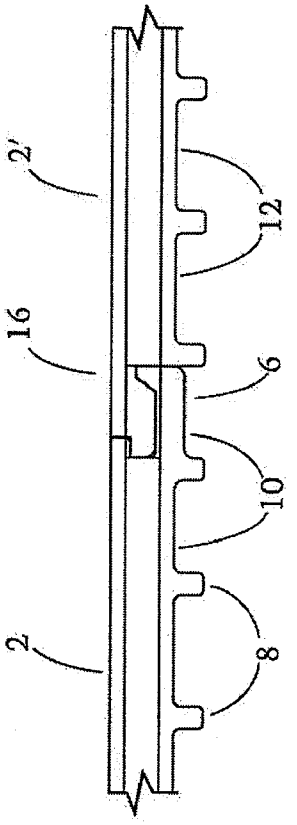


FIG 8.



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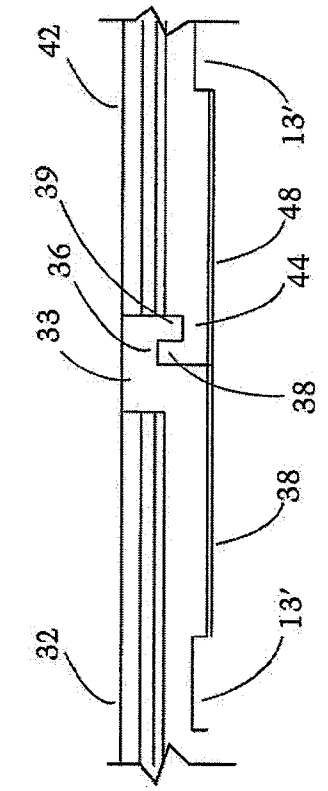


FIG 10.

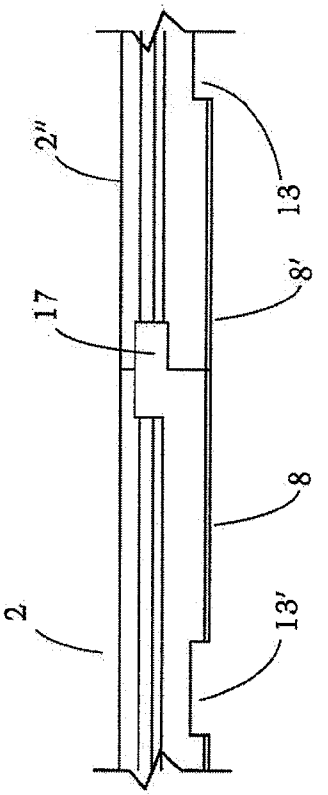


FIG 9.

FIG 12.

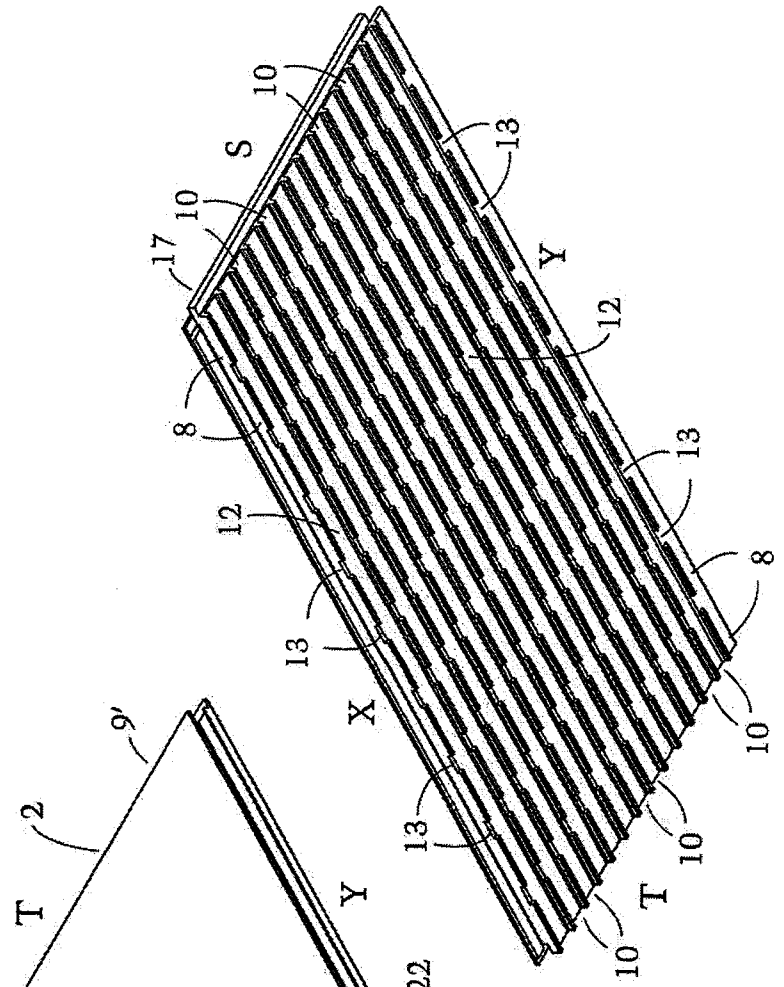


FIG 11.

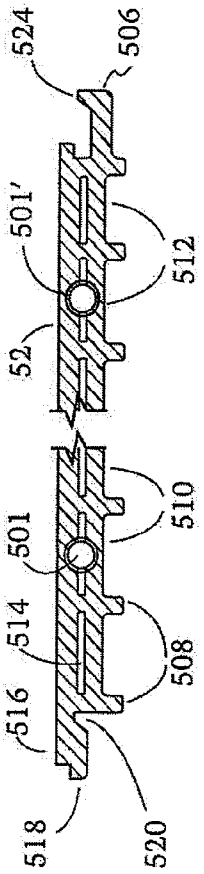


FIG 13.

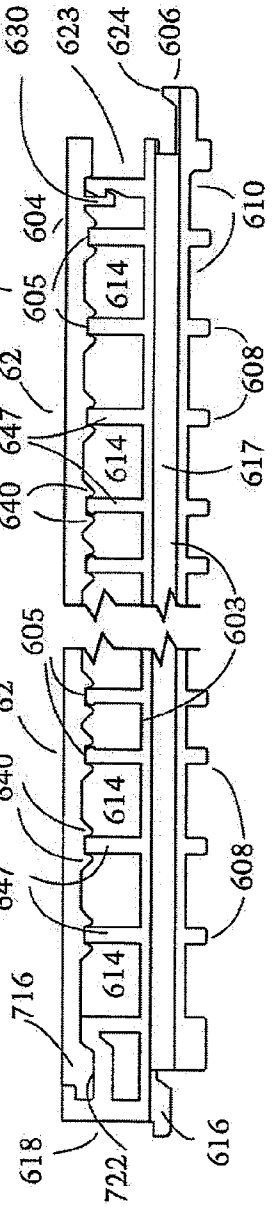


FIG 14.

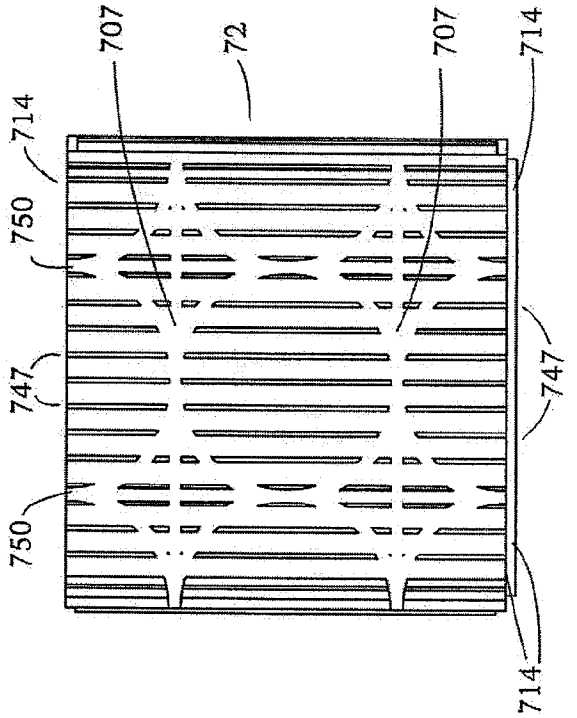
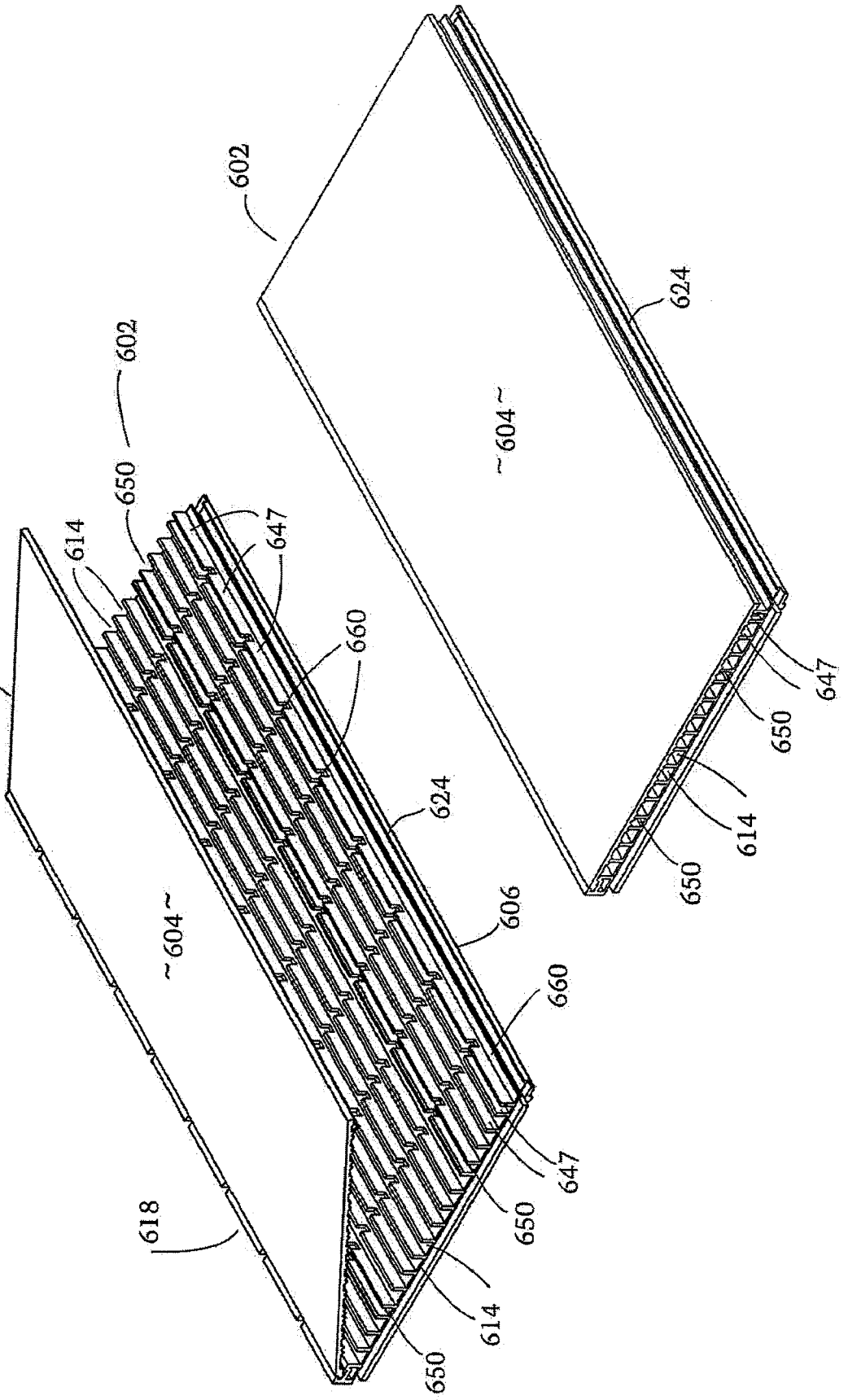


FIG 15.

FIG 16.


618
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614
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FIG 17.

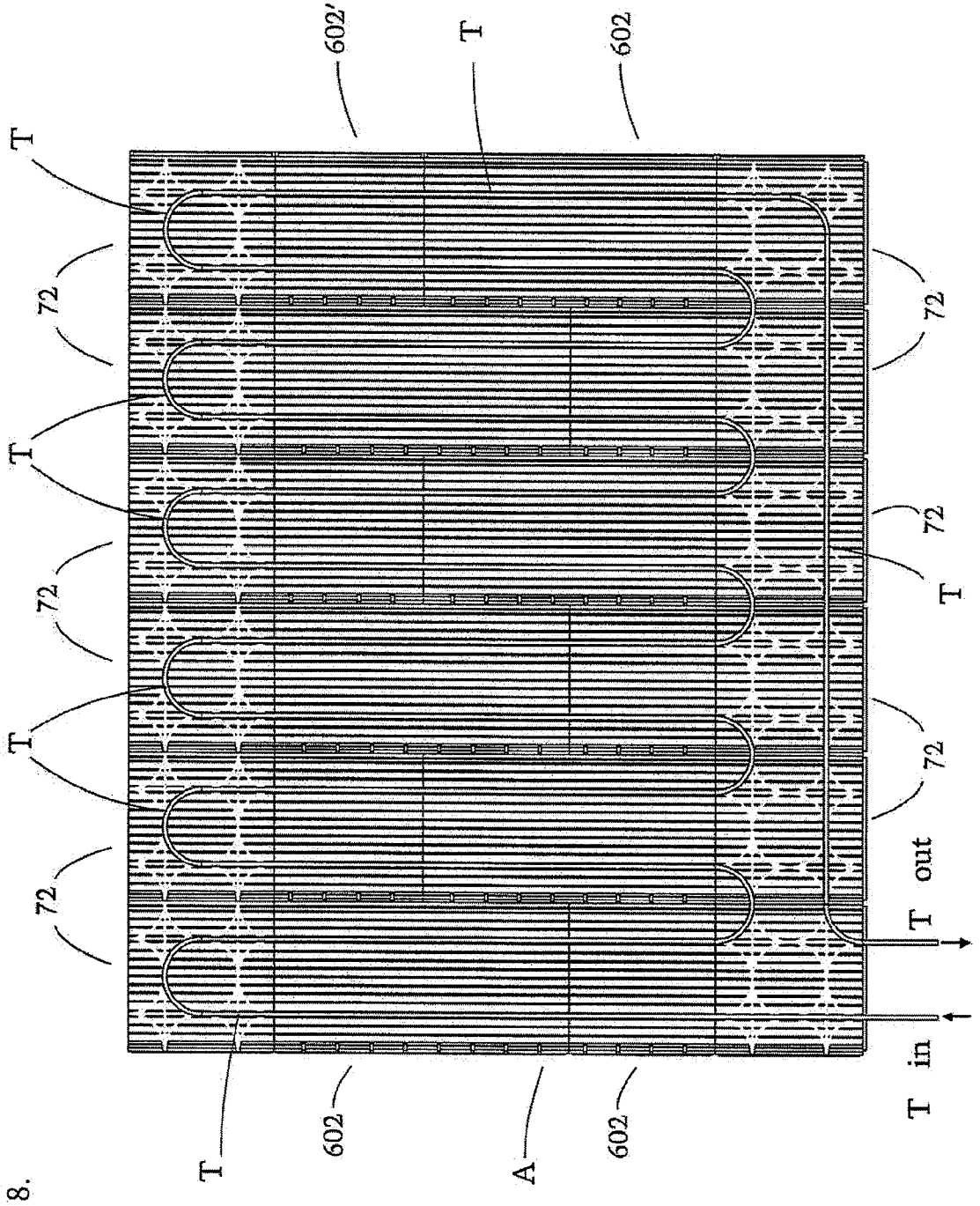

FIG 18.

INTERLOCKING BUILDING PANEL

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This application claims priority from U.S. Provisional Patent Application No. 61/367,783, filed Jul. 26, 2010, which is hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to interlocking building panels, such as, by way of example, flooring panels, subflooring panels, wall panels, and ceiling panels, and the like, often made from composite materials and other man made product formulations suitable for a variety of indoor or outdoor applications.

BACKGROUND

[0003] There are many examples of flooring tiles, ceiling tiles and wall paneling which are used in the construction industry for residential, recreational and commercial buildings. Most of these products are made from naturally occurring materials such as wood and stone, or other conventional materials such as concrete, wood fibers, wood chips and the like.

[0004] Many of these materials are not well suited for uses in damp environments or other surroundings or hostile environments which are subject to, for example, fluctuations in temperature, humidity, wetness or heavy traffic. Many of these materials are not easily adapted to manufacturing construction materials which are easily assembled or disassembled for subsequent removal or, in some cases, recycling, reclamation, or reuse.

SUMMARY OF THE INVENTION

[0005] The present invention is well suited for manufacturing building panels from composite materials which may include recycled or recyclable ingredients such as wood fibers, other naturally occurring plant fibers or man made fibers, thermoplastics and other ingredients which may include additional components such as pigments, stabilizers, foaming agents binding agents, and other components. Many other formulations may be used for manufacturing applications in which the construction building panels will be extruded, molded, cast, or formed using other manufacturing techniques. The present invention is well suited to continuous manufacturing techniques, such as by way of example, extrusion molding.

[0006] In a preferred embodiment, a rigid construction panel made from composite material defines a planar support surface. While the panel may provide for some minor distortion during installation, it is preferable that the panel be a load bearing, non flexible piece formulated to resist deformation including, for example, expansion or shrinkage due to changes in humidity or moisture, temperature, and other environmental variables. The planar support surface extends along a longitudinal axis and a transverse axis, to connect in an interlocking manner with a second construction panel. The preferred construction panel is extruded as a single work piece. The panel comprises a first pair of opposed connector edges which are parallel to the longitudinal axis. The first pair of opposed connector edges are provided along the first and second sides of the panel. A second pair of opposed connector edges are provided along the third and fourth sides of the panel, parallel to the transverse axis of the panel. The core of the panel supports the planar surface. A plurality of pillars project downwardly away from the core, to define a base to separate the core of the panel from an underlying construction surface.

[0007] The underlying pillars may be load bearing walls, track segments, posts, or other suitable structures.

[0008] The base defines a fluid flow field which may be a drainage field, an airflow field, and a combined drainage field and an airflow field. The base may be configured so that any underlying fluid will flow in a preferred direction to a desired location, or to direct airflow to dry accumulated moisture from the underlying construction surface.

[0009] The construction panel of this invention may be used on a variety of construction surfaces such as concrete slabs, concrete steps, gravel beds and other construction surface materials.

[0010] The base or other surface of the construction panel may include a moisture barrier to inhibit moisture migration into or through the construction panel. The moisture barrier may be incorporated into all or a substantial portion of the panel. The entire panel may be impermeable to moisture. For example, the panel may be made from a water repellant composite formulation. Where a barrier is incorporated into the panel, the installer may avoid the cost and inconvenience of installing a separate vapor or moisture barrier, for example, a thermoplastic film commonly used in construction applications.

[0011] The pillars of the base may be arranged in a variety of patterns. In a preferred embodiment, the pillars provide an array of a first set of fluid flow channels which are parallel to the longitudinal axis of the panel and a second set of parallel fluid flow channels which cut across the longitudinal axis of the panel.

[0012] The core of the panel may be a load bearing, low density zone. The low density zone may define a plurality of empty cavities, a foamed core or a plurality of filled cavities. The cavities may also be arranged or configured to house heating or cooling elements, including heating tubes or cooling tubes. In other embodiments, the cavities may be filled with other materials, such as for example, insulation.

[0013] The core may also define a plurality of channels which extend along a second plane, parallel to the planar support surface of the construction panel. In some embodiments, the core may define a plurality of internal arcuate channels which provide alternative pathways for fluid conduits secured within some of the arcuate channels. The tubular conduit may continue through a number of neighboring panels, to provide a temperature controlled grid or covered area. The channels may be configured to snugly retain, for example, securely clamping the tubular fluid conduit (or other temperature control element) within the core of the panel. In other instances, the fluid conduit may loosely nest within the channels.

[0014] The construction panel may also house an optional temperature modification element which may be interconnected with a second temperature modification element in a second construction panel.

[0015] The first or second pairs of connector edges, or both pairs, may be configured as quick connect-quick release slide fit features or drop-fit features, such as for example, matching tongue and groove edges. In other embodiments, one or both pairs of connector edges may be designed to interconnect in locking, snap fit arrangements. Some panels may be config-

ured for installation with few or no glue, nails or other fasteners, allowing for little or no damage to the panels, especially if some or all of the panels are removed for replacement or relocation. This portability feature may be an important benefit for users who may wish to reclaim and relocate their floor assemblies.

[0016] In another embodiment, the construction panel may be included in a decorative construction panel provided with a separate surface layer applied to the planar support surface of the panel. In other examples, of decorative floor panels the decorative appearance of the product may be provided with an embedded pigment, embossed or molded surface texture, or other integral feature incorporated into the single work piece of the panel.

[0017] In another embodiment, the construction panel made from a single work piece as previously described, such as a floor panel, may be configured for assembly with other components, to form an assembled panel. The floor panel may define a major body portion which is formed as a single work piece. The major body of the panel may have a plurality of supports which extend upwardly away from the base of the panel, to form a first planar surface. The first planar surface may be defined by a number of aligned planar segments at the terminal ends of the supports. The supports may also define a plurality of parallel channels (or an alternative array of channels) extending along the longitudinal axis. The supports may be configured as load bearing walls, posts, track segments or other internal structures extending within the main body of the panel. A second, distinct piece forming a second planar support surface may be secured to a latch defined by the main body of the panel. The latch may be incorporated in one or more of the supports.

[0018] The second planar support piece may be removable and interchangeable with other similar pieces with differing textures, colors, patterns, and finishes. An interchangeable second planar support piece may be replaced, as needed or desired, without disassembling a substantial section of an underlying subfloor. For example, the second planar support piece, if discolored or damaged, may be selectively replaced with a substitute second planar support piece with a matching finish, without disturbing the underlying subfloor panel or the surrounding panels of the covered floor area. This easy replacement feature may provide convenience and ease of selective replacement and installation for do it yourself users.

[0019] A temperature control element may be nested or placed within one or more of the channels within the panel, and the piece forming the second planar support surface may be locked in place, upon activation of the latch, to secure the temperature control element.

[0020] However, those skilled in the art will appreciate that many other modifications, variations and embodiments of this invention will be apparent upon a review of this specification including the following drawings, the preferred examples described below, and the appended claims.

DRAWINGS

[0021] The preferred embodiments and other specific examples of the invention are shown herein in which:

[0022] FIG. **1** is an extrusion view of a preferred embodiment of this invention in the form of a subfloor panel;

[0023] FIG. **2** is a section of the extrusion view of the subfloor panel in FIG. **1**;

[0024] FIG. **3** is a side view of the left side of the subfloor panel in FIG. **1**;

[0025] FIG. **4** is a side view of the right side of the subfloor panel in FIG. **1**;

[0026] FIG. **5** is a top view of the subfloor panel in FIG. **1**;

[0027] FIG. **6** is a bottom view of the subfloor panel in FIG. **1**;

[0028] FIG. **7** is an extrusion view of two connected panels, in the orientation shown in FIG. **1**;

[0029] FIG. **8** is a section extrusion view of the two identical connected panels, in the orientation shown in FIGS. **1** and **2**;

[0030] FIG. **9** is a side view of two identical panels with a tongue and groove connection, in the orientation as shown in FIGS. **3** and **4**;

[0031] FIG. **10** is a side view of two panels of an alternative embodiment, with an optional drop lock joint;

[0032] FIG. **11** is a top, isometric view of the first embodiment, namely, the panel of FIG. **1**;

[0033] FIG. **12** is a bottom isometric view of the panel of FIG. **1**;

[0034] FIG. **13** is a section of an extrusion view of a third embodiment, namely, a subfloor panel including embedded tubing;

[0035] FIG. **14** is an extrusion view of a fourth embodiment, namely, a flooring panel having a snap-in top surface panel element;

[0036] FIG. **15** is a top view of a horizontal section of a preferred flooring panel for use along a border of an installation area;

[0037] FIG. **16** is a top isometric view of a partially assembled flooring panel shown in FIG. **14**;

[0038] FIG. **17** is a top isometric view of the fully assembled flooring panel shown in FIG. **14**; and

[0039] FIG. **18** is a top view of a horizontal section of an installation area, comprising a plurality of rectangular and square panel members of the type shown in FIGS. **14**, **16** and **17**, including a plurality of the preferred panel shown in FIG. **15** installed along the top and bottom borders of the illustrated installation area.

DETAILED DESCRIPTION

[0040] A preferred example of a subfloor panel **2** is illustrated in FIGS. **1-6**, **11** and **12**. In a preferred embodiment, the subfloor panel is extruded, molded or cast from a composite material including thermoplastic materials mixed with other compatible ingredients selected to satisfy the requirements for the particular installation. Typically, the product formulations will be engineered to support expected loadings, minimize flexibility or deformation, withstand prolonged wear, fluctuations in environmental conditions and satisfy other criteria.

[0041] FIG. **1** is an extrusion view (or frontal view) of the subfloor panel **2**, viewed as if the panel is exiting from an extrusion mold, upon manufacture. The panel **2** has a core **3** which corresponds to the central region of the panel **2**. Preferably, the core **2** is configured to provide a relatively low density zone within the panel, to among other things, minimize total weight and material costs. The core **3** may be provided with discrete, enclosed chambers **14** which may extend along portions of the core **3**, within panel **2** as shown in FIG. **2**.

[0042] The subfloor panel extends along a longitudinal axis ST and a transverse axis XY.

[0043] In the illustrated subfloor panel **2**, the surface **4** is unfinished. However, decorative panels (not shown) may

include a finished surface such as, by way of example, an added layer of carpeting, or another laminate covering made of natural or manmade materials. In other instances, a decorative panel may incorporate an embossed, colored or other finished surface which has been integrated into the panel, as part of a single work piece, during the manufacturing process.

[0044] In the preferred embodiment, a plurality of track segments **8** project downwardly away from the core **3** of the panel to define intermediate channels **10** and a support base **25**. The bottom surface **12** of the panel **2** includes the contour surface defined by the track segments **8** and the intermediate channels **10**. The support base **25** allows the panel **2** to rest upon a construction surface, for example, a concrete slab or other unfinished surface (not shown). Other configurations such as legs, posts or other projections may be provided, to define a suitable supporting base in other embodiments.

[0045] In a preferred embodiment, the bottom surface **12** may be impregnated or covered with a water repellant material or a water impermeable barrier to inhibit migration of moisture into the panel from the underlying concrete slab or other construction surface. In some instances, an impermeable barrier may be applied to the entire outer surface of the panel **2** to inhibit moisture absorption from any surrounding direction. The panel **2** may also be formulated with ingredients which repel or prevent absorption of water or other liquids.

[0046] The panel may be provided with quick connect features to allow easy assembly and installation of an area of like panels. Some configurations may also be designed for easy disassembly and reuse of an earlier installation. In the illustrated embodiments of FIGS. **1-8** and FIGS. **11-12**, a first tongue **16** extends outwardly from the right (or first) face **21**, along the first side X opposite a left (or second) face along the opposite, second side Y, of the panel **2**. The first tongue **16** is provided with a notched tip **18**. The first tongue **16** and the first face **21** define a beveled recess **20**. As shown in FIGS. **7** and **8**, the first tongue **16** connects in a slide-fit with a groove **22** defined by a jaw **6**, having a beveled ridge **24** on the second face of a like subfloor panel **2'**. The slide-fit connection of the first tongue **16** with the groove **22** occurs via movement in a substantially vertical direction relative to the horizontal plane defined by the planar body of the panel **2**.

[0047] The panel **2** is also provided with a second tongue **17** at a third side S, opposite to a parallel, fourth side T as shown in FIGS. **1-9** and FIGS. **11-12**. The third side S includes an upper wall segment **19**, and a lower wall segment **19'**, the upper wall segment **19** and the lower wall segment **19'**, together providing a third face **29**. The fourth side T includes a fourth face including an upper wall segment **9** and a lower wall segment **9'** having a second groove **27**. In this embodiment, the second tongue **17** having opposing parallel sides, is configured to slide-fit, parallel to the plane defined by the planar body of the panel **2**, into the second groove **27** of a like third panel **2"**.

[0048] The bottom surface **12** of the panel **2**, as shown in FIGS. **6** and **12**, defines a field of track segments **8**, **8'** surrounded by a plurality of linear channels **10** and a plurality of cross channels **13**. The panel **2**, when placed on to a construction surface (not shown), the interconnecting linear channels **10** and the cross channels **13** define a drainage field, along which water or other draining liquids may flow, toward a desired destination, such as a drain. The linear track segments **8**, **8'** may be configured, and subsequently arranged on the construction surface, to enhance the drainage of the water or other liquid in a desired direction.

[0049] FIG. **10** shows a third embodiment of a construction panel, specifically, two like, connected floor panels **32**, **42** with a drop-fit connection between abutting edges. The connected panels **32**,**42** rest on a construction surface (not shown), on corresponding track segments **38**,**48** which define a base **48** with cross channels **13'**. The drop-in connector **33** includes a jaw **37**, with a recess **44**, which receives a tooth **39** projecting downwardly, adjacent channel **36**. In this embodiment, the upwardly projecting jaw **37** engages channel **36** in a drop-fit. Persons skilled in the art will appreciate that other connector configurations may be provided.

[0050] In FIG. **13**, a third embodiment, a subfloor panel **52** with a base **525**, including track segments **508** which separate adjacent linear channels **510**. The panel **52** is shown with a first tongue **516** adjacent a beveled recess **520**, extending along first side X. The tongue **56** is provided with a notched tip **518**. Jaw **506** with a beveled ridge **524** extends along the second side Y, opposite and parallel to the first side X, for engagement with a first tongue **516** of an adjacent, second subfloor panel of like configuration. The core of the illustrated subfloor panel **52** includes hollow chambers **514** which may be, in some instances, air spaces provided for weight saving considerations.

[0051] In this embodiment, embedded fluid tubes **501**, **501'** are provided as heating fluid conduits so that heating fluids may be circulated within a grid of interconnected, similar panels also having similar fluid conduits.

[0052] A fourth embodiment is illustrated in FIGS. **14**, **16** and **17**. The illustrated subfloor panel, namely a panel assembly **602** has a substantially hollow core **603** having upwardly projecting rails **647** and intermediate longitudinal parallel hollow chambers **614**. The terminal ends **605** of upwardly projecting rails **647** define a first planar surface of the main body of the panel assembly **602**. A separate, locking surface layer **62** is provided with downwardly projecting parallel ridges **640** which engage terminal ends **605** of the rails **647**. The main body of the panel assembly includes a first tongue **616** with a notched tip **618** extending along a first side of the panel assembly **602**. A second tongue **617** is provided along a third side of the panel assembly **602**. A third tongue **716** projects outwardly along an edge of the locking surface layer **62**, and engages with a second groove **722** extending, inwardly along the first side of the panel assembly **602**. At the second side, opposite and parallel to the first side, a downwardly projecting latch **630** is in snap-fit engagement with an upwardly projecting notched rail **623**. Jaw **606** includes a beveled ridge **624** along the second side, to removably engage with the first tongue **616** of an adjacent floor panel assembly of similar construction. The base of the assembled floor panel of this embodiment includes downwardly projecting track segments **608** which are provided to allow the assembled panel to rest on a construction surface (not shown) in interlocking assembly with other like panels, to form a subfloor area. Channels **610** are provided between the parallel track segments **608** to provide drainage routes or ventilation pathways to allow drying of the underlying construction surface. The core of the subfloor panel assembly **602** is provided with tubing tracks **650**. Tubing tracks **650** and upwardly projecting rails **647** also define transverse channels **660**. Transverse channels **660** may be configured to provide alternative tracks for serpentine arrangements of heating tubes or electrical heating meshes.

[0053] FIG. **15** illustrates another embodiment of a subfloor panel assembly **72** with a cross sectional view similar to that shown in FIG. **14**. The illustrated panel assembly is configured for use as a boundary panel, in a fully assembled subfloor area. However, panel **72** is shown in horizontal cross section, along the planar body of the panel assembly. The core of the panel **72** is provided with arcuate interior track segment **707** which is stacked in abutting relation to other track segments, to define track returns for tubing T (for example, as shown in FIG. **18**). The core is provided with parallel upwardly projecting track segments **747** extending to define intermediate longitudinal hollow chambers **714**. Track segments **750** are also provided to secure tubing T within the core of the assembled panel.

[0054] In FIG. **18**, a flooring area A is covered with assembled flooring panels including boundary subfloor panels **72**, elongated flooring panels **602** and square flooring panel segments **602'**, in a staggered, offset edge array. The assembled floor panels are illustrated in a cross sectional view, along the horizontal plane, to show certain important interior features of the covered subfloor area. Fluid tubing T is supplied with heating fluid (or cooling fluid in other applications) entering via a fluid inlet T_{in} and exiting via a fluid outlet T_{out}.

[0055] Although the preferred embodiments have been described with reference to subfloor panels and assembled subfloors, alternative embodiments such as decorative floor panels, wall panels, ceiling panels and other construction panels are also contemplated within the scope of this invention. Other variations, modifications and embodiments of the invention will be apparent to those persons who are skilled in the art, upon reading this description, the appended drawings and claims.

1. A composite construction panel made as a single work piece defining a planar support surface extending along a longitudinal axis and a transverse axis, for interlocking connection to a second construction panel, the composite construction panel comprising:
- a first pair of opposed connector edges parallel to the longitudinal axis;
- a second pair of opposed connector edges parallel to the transverse axis;
- a core supporting the planar surface;
- a plurality of pillars projecting away from the core;
- the pillars defining a base to separate the core of the panel from a construction surface; and
- the base defining a fluid flow field selected from the group consisting of a drainage field, an airflow field, and a combined drainage and airflow field.

2. The composite construction panel claimed in claim **1** is selected from the group consisting of a wall panel, a ceiling panel, a subfloor panel, and a decorative flooring panel.

3. The composite construction panel claimed in claim **1**, the panel defining a base surface comprising a moisture barrier to inhibit migration of moisture from the construction surface into the composite construction panel.

4. In the composite construction panel claimed in claim **1**, the core defining a low density load bearing zone selected from the group consisting of a foamed core, a zone comprising a plurality of empty cavities, and a zone comprising a plurality of filled cavities.

5. A decorative construction panel comprising the composite construction panel as claimed in claim **1** and a decorative surface layer applied to the planar support surface.

6. In the composite construction panel claimed in claim **1**, the core defines a plurality of channels extending along a second plane, parallel to the planar support surface.

7. The composite construction panel as claimed in claim **1** housing a temperature modification element for interconnection with a second temperature modification element in the second construction panel.

8. In the composite construction panel as claimed in claim **1**, the base is configured to encourage fluid flow in a preselected direction.

9. In the composite construction panel as claimed in claim **1**, the pillars define a first set of fluid flow channels along the longitudinal axis and a second set of fluid flow channels transverse to the first set of fluid flow channels.

10. The composite construction panel as claimed in claim **1**, connected to the second construction panel, in a flooring area comprising a plurality of like interconnected composite construction panels.

11. The composite construction panel as claimed in claim **4**, comprising an insulating material within the low density core.

12. In the composite construction panel claimed in claim **1**, the core defining a plurality of internal arcuate channels providing alternative pathways for securing a tubular fluid conduit for connecting flow through the second composite construction panel.

13. In the composite construction panel claimed in claim **1**, the first pair of opposed connector edges comprising a first pair of releasable quick-connect elements.

14. In the composite construction panel claimed in claim **13**, the second pair of opposed connector edges comprising a second pair of releasable quick-connect elements.

15. In the composite construction panel claimed in claim **14**, the first pair of opposed connector edges comprising interlocking tongue and groove configurations.

16. In the composite construction panel claimed in claim **15**, the second pair of opposed connector edges defining a slide-fit tongue and groove configuration.

17. The composite construction panel claimed in claim **1** comprising an impermeable barrier to inhibit migration of moisture through the planar support surface, toward the core.

18. An assembled construction panel comprising:
- the composite construction panel as claimed in claim **1**, wherein the planar support surface is a first planar support surface defined by a plurality of supports extending away from the base, the supports defining parallel channels extending along the longitudinal axis; and
- a second planar support surface interlocking with a latch defined by the composite construction panel, adjacent the first planar surface.

19. The assembled construction panel claimed in claim **18**, comprising a temperature modification element selected from the group consisting of a cooling tube, a heating tube, an electrical heating element, and an electrically powered cooling element.

20. In the assembled construction panel claimed in claim **19**, the temperature modification element is nested in at least one of the plurality of parallel channels defined by the plurality of supports.

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