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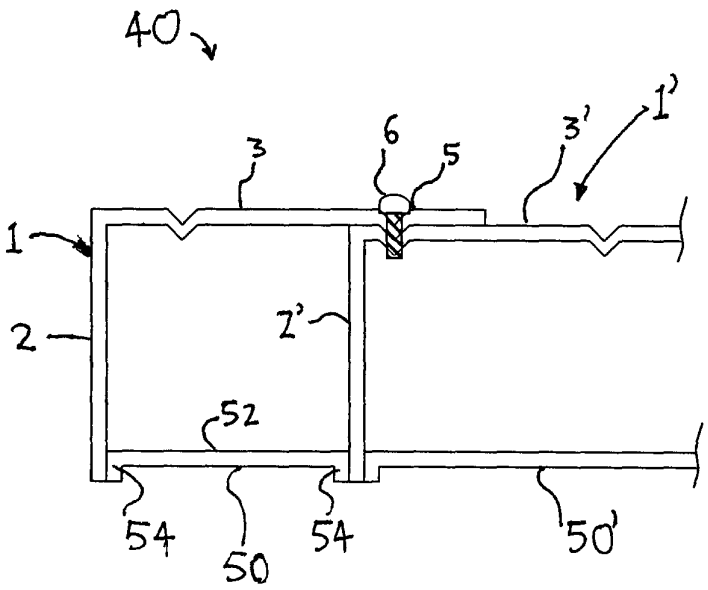
(54) Title: INTEGRATED PLATFORM JOIST SYSTEM



(57) Abstract: A deck assembly uses plurality of joists preferably formed from metal located side by side and each having a web portion and a deck portion integrally formed with the web portion. The deck portion extends laterally from the web portion and the joists are spaced from one another such that the deck portions from a continuous deck surface with the joists being connected to one another.

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INTEGRATED PLATFORM JOIST SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates to an integrated platform joist, an integrated platform joist system, and a method for assembling such a system.

DESCRIPTION OF THE PRIOR ART

[0002] Joist systems are used in the construction industry to span a distance between opposing walls and provide a structural support for a floor, a roof or other platform. The joists are spaced apart and support a decking that forms a sub-floor. Such joists can be manufactured from a variety of materials including softwood, wood based laminates, metals and metal alloys.

[0003] Joists manufactured from a metal, in particular steel, may be fabricated in an open-web configuration or in a roll-formed configuration. Open-web joists consist of spaced-apart upper and lower chord members that are connected with truss members such as steel rods. Typically, open-web joists are coated or finished with a coloured primer. Roll-formed joists are generally shaped from sheet-steel and cold-formed into a shape, such as a C-shape when viewed in cross section. Other configurations may include the assembly of multiple cold-formed sections to form an I-shape section. Roll-formed joists can be made from hot-rolled steel, cold-rolled steel, metallic-coated sheet-steel, and/or painted steel. Such joists are intended to be located at spaced locations and provide point supports for the decking.

[0004] Traditionally, joist systems have required bridging of the upper and lower chord members to brace the joists laterally to resist twisting during, or after installation. Sub-floors, or roofing, or sheathing of various materials is then usually installed on top of the joist system. These joist systems sometimes require multiple fastening means, such as, for example, a tongue and groove joint between the sub-floor components, an adhesive to secure the sub-floor to the joist and a screw to hold the sub-floor in situ and a bolt a rivet or a weld.

[0005] Over the years, the building industry has introduced various types of composite steel concrete and \ non-combustible floor and roof systems in which the upper chord members are

embedded within a concrete slab. The concrete slab has both load bearing and fire resistant properties. Examples of such composite joist can be found in US Patent Nos. 5,941,035; 4,741,138; and 4,454,695 and US Patent Publication Number 2002/0069606 A1. A composite joist design permits the upper chord member of a joist to be designed with less steel in comparison with the non-composite system, since the concrete slab, when properly bonded to the upper chord member, provides additional load support for the floor or roof system.

[0006] One of the major drawbacks of modern joist systems is that they require substantial time to erect. They are also dependent on the availability of skilled labour.

[0007] It is an object of the present invention to obviate or mitigate the above-mentioned drawback.

SUMMARY OF THE INVENTION

[0008] Accordingly, the present invention provides a deck assembly comprising a deck assembly comprising a plurality of joists located side by side and each having a web portion and a deck portion integrally formed with the web portion. The deck portion extending laterally from the web portion and said joists being spaced from one another such that the deck portions from a continuous deck surface with said joists being connected to one another.

[0009] The adjacent joists, once assembled in nested engagement, may be secured together using fastening means. The fastening means may be selected from the group consisting of a screw, a nail, a bolt, an adhesive, a weld, a folded seam and a toggle lock.

[0010] The deck assembly may optionally comprise lower chord bridging to span an open area beneath the platform portion of the joist to provide structural rigidity, and prevent the platform from tortionally deforming.

[0011] According to a further aspect of the present invention there is provided a joist for use in a deck assembly, said joist having a web portion integrally formed with a deck portion that projects laterally to one side of said deck portion and has a distal edge for connection to an adjacent joist, whereby said deck portion maintains said web portions of adjacent joists in spaced relationship and provides a continuous deck surface between said web portions.

[0012] Preferably, the joists of the deck assembly are manufactured from a metal or a metal alloy, or a plastics material. Alternatively, the joists may be manufactured from a composite material.

[0013] The joists, when manufactured from a metal or a metal alloy, may be formed by cold-forming techniques. Alternatively, the joist may be extruded into a desired shape when said joist is manufactured from aluminium, a plastics material, or a composite material.

[0014] Preferred uses of the deck assembly in accordance with the present invention include flooring systems; sub-floor systems; transverse or longitudinal walkways; stairway treads; specialty floors, for example, raised floors for computer rooms, electronic and other manufacturing plants and the like and flat or pitched roof systems.

[0015] The present invention also provides a method for assembling a deck assembly in accordance with the present invention, which method comprises the steps of a) intercalating one or more male and female portions of an adjacent joist in nesting engagement to form a seam and b) closing the seam.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The features of the invention will become more apparent in the following detailed description in which reference is made to the appended drawings wherein:

[0017] Figure 1 is a sectional view of a joist for use in the deck assembly;

[0018] Figure 2 is a sectional view showing a deck assembly comprising two joists of Figure 1;

[0019] Figure 3 is a sectional view of an alternative joist;

[0020] Figure 4 is a sectional view showing a deck assembly comprising two joists of Figure 2;

[0021] Figure 5A to 5C show a sequence of a closure of a seam formed by intercalating male and female portions from adjacent joists;

[0022] Figure 6 is a sectional view of a deck assembly in a stair configuration;

[0023] Figure 7 shows a joist with reinforcing ribs;

[0024] Figure 8 is a sectional view of a further embodiment of joist;

[0025] Figure 9 is a sectional view of a yet further embodiment of joist;

[0026] Figure 10 is an enlarged view of a portion of the joist shown in Figure 8;

[0027] Figure 11 is a view on the line XI-XI of Figure 10;

[0028] Figure 12 is a perspective view of a deck assemble utilizing the joists shown in Figures 1 to 11; and

[0029] Figure 13 shows a deck assembly in accordance with the present invention in a specialty floor configuration.

[0030] In the figures, like numerals denote like parts.

DETAILED DESCRIPTION OF THE INVENTION

[0031] Referring to Figure 1, a joist 1 for use in a deck assembly 40 comprises a web portion 2 and a deck portion 3. It will be appreciated that the joists are of indeterminate length L and may be customized to the length required. The deck portion 3 extends outwardly from the web portion 2 and the included angle between the deck portion 3 and web portion 2 is typically 90°, although other angles may be incorporated. The deck portion 3 is provided with a pair of V-shaped recesses 4, 5 at spaced locations that are proximal to and distal from the web portion 2 respectively. The joist 1 is formed from a rolled steel strip of appropriate gauge and the joists 1 may be pre-finished by painting or powder coating to inhibit corrosion.

[0032] A plurality of joists 1, 1' of Figure 1 are assembled as shown in Figure 2 to form a deck assembly 40. The web portions 2, 2' of each joist are aligned vertically in parallel with the deck portions 2, 2' overlapping. The distal V-shaped recess 5 engages the recess 4 to provide a positive inter-engagement of the decking portions 3, 3". The joists 1, 1'are joined together by fasteners 6, such as self tapping screws or pop rivets to form an integral unit. A lower chord

bridge 50, 50' is located between upstanding portions of adjacent joists spaced from the deck portion to provide additional support and prevent tortional deformation of the deck assembly 40.

[0033] The bridge 50, 50' has a planar body 52 with a pair of flanges 54 that are secured to the webs 2, 2'. The bridges 50 maintain the webs 2, 2" in spaced relationship and provide a box section to enhance the structural rigidity. The bridges 50 may be continuous along substantially the entire length of the joist 1 or may be relatively short lengths spaced apart along the joist 1 to provide rigidity of select locations.

[0034] The joists 1 may be added side by side to the deck assembly 40 to provide a platform of the required width and length. The individual joists are relatively light to handle and assemble but provide high strength and rigidity when in place. The joists 1 may be fastened together with mechanical fasteners, such as screws, bolts, clips or rivets, or may be permanently connected, as for example by welding. In typical applications for a residential deck, the joists 1 are formed from rolled steel strip having a thickness of between 1mm and 3mm with 2mm preferred. The deck portion 3 has a lateral extent of typically 12 inches, although has up to 16'' may be used and the web has a height of between 3½ inches and 8'' with a preferred height of 5½ inches. Fpr such application, a length L of 12 feet has been found appropriate. The dimensions may be varied to suit the loading and the unsupported span as per normal engineering practices.

[0035] The deck assembly 40 may be used as the final platform or may be used to support a non structural decking surface, such as slate, concrete or exotic hardwood. The deck assembly may also be used as a roof deck with a membrane bonded to the deck portions 3 after assembly.

[0036] Referring to Figure 3, an alternative design of a joist 1 of the deck system is shown in which like components will be identified with like reference numbers with a suffix a added for clarity. The joist 1a comprises a web portion 2s and a deck portion 3a. One end of the web portion 2a includes a raised parapet structure 8 where part of the web portion 2a is bent back on itself and projects above the deck portion 3a. The deck portion 3a extends outwardly from the parapet.

[0037] The distal edge of deck portion 3a has an upstanding rib 11 of complimentary configuration to the parapet 8 of an adjacent joist 1a of the deck assembly 40.

[0038] The parapet 8 and rib 11 provide inter-engaging male and female portions that are exaggerated compared with the recesses 4, 5 in Figure 2 but perform a similar function.

[0039] In use, the ribs 11, 11' of a first joist 1a intercalates with the return portion 8 of corresponding configuration on an adjacent joist 1a'. The resulting seam 12 formed by the intercalating male and female portions is then secured together using a suitable fastening means, either mechanical or by welding.

[0040] The joist 1a are arranged, as can be seen at Figure 4 to define a deck assembly 40a. In this embodiment each joist 1a,1a' is interconnected in nested engagement by intercalating the parapet 8 with the rib 11 located on adjacent joists 1, 1'. Such intercalation of male and female portions results in an upstanding seam 12 which can be folded and swaged (see Figure 5) as an alternative to individual mechanical fasteners.

[0041] Figures 5A to 5C show a sequence of a closure of the seam 12. Figure 5A shows the open seam 12 formed by intercalating adjacent joists. A pneumatic seam closing apparatus (not shown) is used to fold the open seam in the direction of arrow A (Figure 5B). This results in a closed seam 13 that is impervious to the environment external of the deck assembly and inclement weather.

[0042] Figure 5C shows that the closed seam 13 of Figure 6B can be swaged to reduce material thickness at the closed seam. The closed seam 13 has been swaged in the direction of arrows B and B'.

[0043] As may be seen in Figure 6 where a suffix b is added for clarity, a plurality of joists 1b, 1b', 1b'' may be assembled in a stair-like configuration. Each joist 1b, 1b', 1b'' has an exaggerated web portion 2b, 2b', 2b'' which is bent back on itself to form a parapet 8b, 8b', 8b''. The deck portion 3b, 3b', 3b'' of the joists 1b extends substantially perpendicularly outwardly from the upstanding portions 2b, 2b', 2b''. The parapet 8b, 8b', 8b'' projects above the deck portion 3b, 3b', 3b''to form the individual steps of the stair-like deck assembly 40b.

[0044] The deck 3b of the joists 1b, 1b', 1b'' are provided with V-shaped recesses 5b as shown in the embodiment of Figure 1. Similarly, the upper end face 10 of the parapet 8b has a V-shaped recess 4b formed to receive the recess 5b of the deck 3b. The height of the web 2b

will vary for each step and bridges may be incorporated between the webs to interconnect them if so required. The joists 1 are connected by fasteners as described above with respect to Figure 1.

[0045] Figure 7 shows a joist 1c with reinforcing ribs in the deck portion 3c. The joist 1c comprises an upstanding portion 2c and a platform portion 3c extending substantially perpendicularly outwardly from the upstanding portion 2c. The platform portion 3c is provided with a plurality of castellations 80. The castellations 80 provide additional structural rigidity to the deck 3c to prevent twisting of the platform 40c. The castellations 80 are arranged parallel to the longitudinal axis of the joist portion 3c, however, the ribs 80 can be positioned perpendicular to longitudinal axis depending on the application the deck assembly is being used for.

[0046] It will be noted that the V-shaped recesses 4c, 5c are provided in the deck portion 3c adjacent the web 2c and distal edge of the deck 3c. The castellations 80 are located between recesses 4.5 to permit the units 1c to be joined side by side.

[0047] A further embodiment is shown in Figure 8 in which like reference numerals will be used to denote like component with a suffix d added for clarity. In the embodiment of Figure 8, each of the joists 1d has a flange 60, 62 formed at the free edge of the web portion 2d and the deck portion 3d respectively. To form a continuous deck, the flange 62 is butted against the web of the adjacent unit 1d with the decks aligned. The flange 62 may then be secured to the adjacent web 2a as described above. The flange 60 at the lower end of the web 2d enhances the bending stiffness of the joist and provides a bearing surface when the deck assembly is located on a support.

[0048] A similar arrangement is shown in Figure 9 in which a pair of webs 2e'. 2e'' extend perpendicularly from opposite edges of deck 3e. Each of the webs 2e', 2e'' terminates in a flange 64. The deck assembly 40e is assembled by abutting the webs 2e', 2e''of adjacent joists 1e against one another and securing the webs 2e', 2e'' by mechanical fasteners or the like.

[0049] The attachment of the adjacent units to one another is shown in greater detail in Figures 10 and 11, as applied to the embodiment shown in Figure 8. It will be appreciated however that a similar arrangement may be utilized in each of the embodiments described above. Referring therefore to Figures 10 and 11, a hole 90 is punched into the web 2e'' and elongate slot

92 punched into the web 2e'. The hole 90 and slot 92 are aligned permitting limited fore and aft adjustment between the two joists. A fastener 94 is inserted through the slot and engages with the hole 90. The fastener 94 is preferably self tapping so as to cut the thread on the hole 90 and pull the web 2e'' up to and in abutment with the web 2e'.

[0050] To assist alignment of the units 1, each of the opposed portions of the joists 1, either the web portions or the deck portions may be formed with a registrar such as a witnessed deformations or dimples 96 that provide for registration of one unit against another. Such an arrangement assists in the rapid assembly and alignment of the deck assembly.

[0051] In each of the embodiments described above, it will be noted that the joists may be assembled to provide a continuous deck surface whilst providing integral support for that surface in the form of the webs. The deck assembly 40 may be used in a variety of environments and under different conditions. As illustrated in Figure 12, the deck assembly 40 may be utilized as an elevated deck in residential or commercial environments. Referring therefore to Figure 12, a pair of posts 100, 102 support a beam 104 that extends generally parallel to the face of a building B to which the deck structure is connected. The beam 104 is dimensioned to support the load imposed upon the deck in the normal use and in accordance with the relevant building standards. It will also be appreciated that whilst a steel beam is preferred, a wooden beam may be used with the span adjusted accordingly.

[0052] The joists 1 are then assembled side by side to run perpendicular to the beams 104. The joists 1 are connected to one another through the fastening and enhanced rigidity provided by the bridges 50 that may extend either continuously along the length of the joist 1 or extend intermittently along the length.

[0053] The webs 2 of the joists 1 are secured to the beams 104 by clips or other fasteners to secure the joists.

[0054] Depending upon the cross section of the joists 1 that is utilized, it may be necessary to support the distal edge of the final unit with an additional web that may be fastened to the distal edge of the joist 1 and may be provided with an inter-engaging formation.

[0055] During assembly of the deck assembly 40, each of the joists is relatively easy to handle due to the light weight construction. The joists 40 may be aligned and interconnected through the use of the inter-engaging formations and secured to one another by fasteners, either mechanical or permanent. Where necessary, the length of the units 1 may be extended by joining two joists end to end with an overlap between the ends of the joists over a beam.

[0056] With the deck assembly 40 assembled, it is possible to utilize a variety of finishes providing increased flexibility in achieving the desired aesthetics. The deck assembly 40 may, for example, support tile, stone, slate, concrete, pavers, wood tiles or the like. These may be free floating on the deck surface or may be attached with adhesive or screws or the like.

[0057] As may be seen in Figure 13, the deck assembly 40 using joists 1a as shown in Figure 3 provides a recessed area into which cement or concrete or other filler or substrate 100, 100' can be poured. This is particularly useful when a raised floor is required in, for example, special equipment rooms. The cement or other filler serves to provide a durable surface and also provides structural support to the deck assembly by preventing twisting of the platform structure. The deck assembly is also provided with lower chord bridging 50, 50' to further support the deck assembly 40.

[0058] Although the joists have been described above in the context of building a deck assembly, it will be appreciated that a similar system may be used to provide a flat roof of a building or as an inclined roof with the rafters integrally formed by the webs. The deck assembly may also be used as a self supporting structural vertical wall.

[0059] Although described principally in a construction environment, the product may also be used in other horizontal application, such as the bed of a trailer, or in a vertical application such as a billboard.

[0060] In each embodiment, the webs 2 may be formed with predefined apertures to accommodate services being provided beneath the deck 3 and to minimize the cutting necessary at final installation. This enables the applied finish to be maintained after installation and inhibit corrosion.

What is claimed is:

1) A deck assembly comprising a plurality of joists located side by side and each having a web portion and a deck portion integrally formed with the web portion, said deck portion extending laterally from the web portion and said joists being spaced from one another such that the deck portions from a continuous deck surface with said joists being connected to one another.

2) A deck assembly according to claim 1 wherein said deck portions overlap and are fastened to one another.

3) A deck assembly according to claim 1 or 2 wherein said joists are connected by inter-engaging formations.

4) A deck assembly according to claim 3 wherein said formations are formed at laterally spaced location on said deck portion.

5) A deck assembly according to any one of claims 1 to 4 wherein mechanical fasteners interconnect said joist.

6) A deck assembly according to any one of claims 1 to 5 wherein bridge members extend between adjacent ones of said web portions and are spaced from said deck portion.

7) A deck assembly according to claim 6 wherein said bridge members include flanges for connection of said bridge members to said webs.

8) A deck assembly according to claim 6 or 7 wherein said bridge members extend along the entire length of said joist.

9) A deck assembly according to claim 6 or 7 wherein said bridge member is discontinuous.

10) A deck assembly according to any one of claims 1 to 9 wherein said formations project above said deck portions.

11) A deck assembly according to any preceding claim wherein registers are provided to align adjacent ones of said joists.

12) A deck assembly according to claim 11 wherein said registers are provided on said web portions.

13) A deck assembly according to claim 1 wherein a web extends from opposite edges of said deck portion and said joists are connected by fasteners extending through abutting ones of said webs.

14) A deck assembly according to claim 13 wherein each of said webs terminates in a flange directed inwardly toward the other web of said joist.

15) A deck assembly according to claim 1 wherein a flange extends from a distal edge of said deck portion parallel to said web and said flange is connected to a web of an adjacent joist.

16) A deck assembly according to any one of claims 13 to 15 wherein a register is provided between abutting faces of adjacent joists.

17) A joist for use in a deck assembly according to any one of claims 1 to 16.

18) A joist for use in a deck assembly, said joist having a web portion integrally formed with a deck portion that projects laterally to one side of said deck portion and has a distal edge for connection to an adjacent joist, whereby said deck portion maintains said web portions of adjacent joists in spaced relationship and provides a continuous deck surface between said web portions.

19) A joist according to claim 18 wherein said deck portion has a formation formed adjacent a distal edge to engage in a complementary formation to an adjacent joist.

20) A joist according to claim 19 wherein said formation is a V-shaped recess.

21) A joint according to claim 19 wherein said formation projects above said deck portion.

22) A joist according to claim 18 wherein said deck portion terminates in a flange depending from said deck portion.

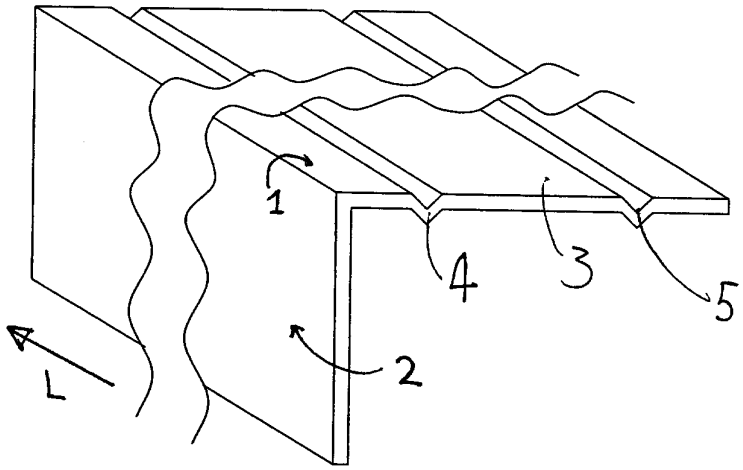

Fig.1

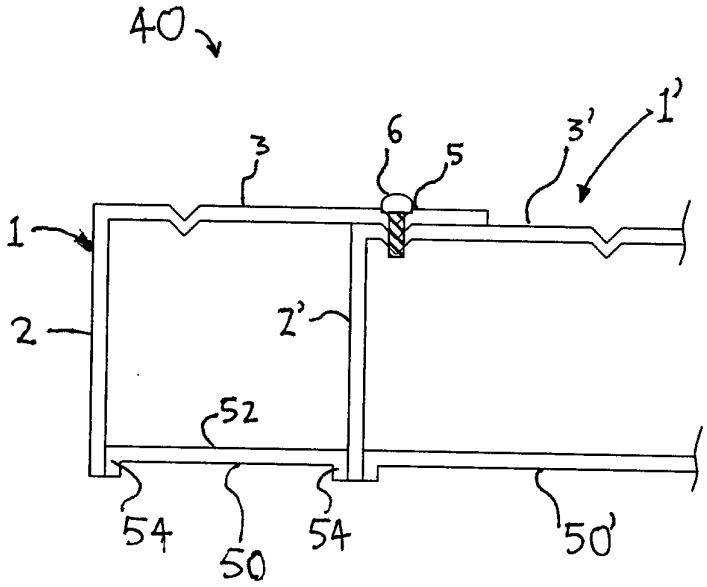

Fig.2

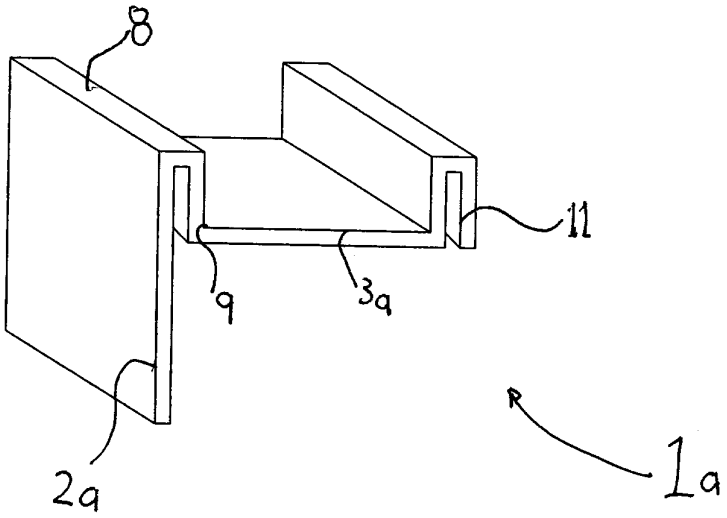

Fig.3

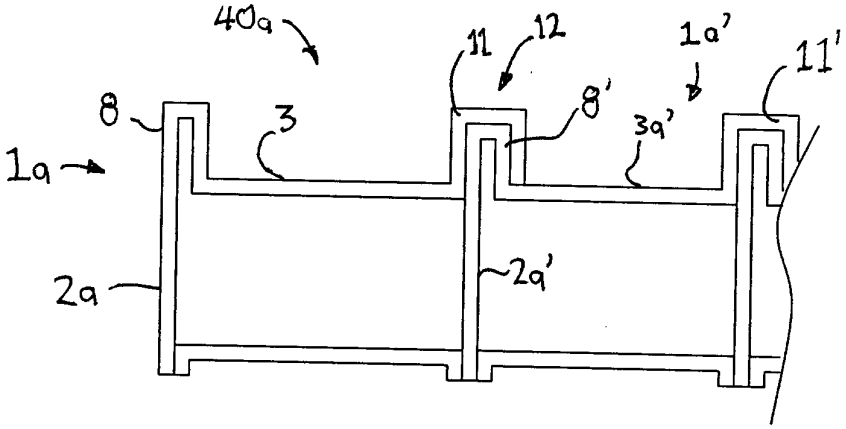

Fig.4

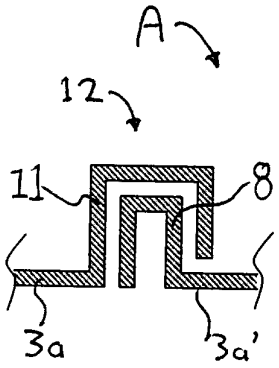

Fig.5A

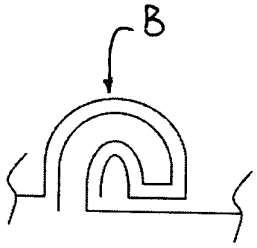

Fig.5B

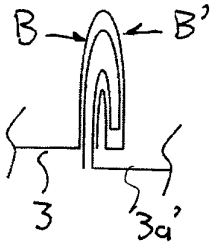

Fig.5C

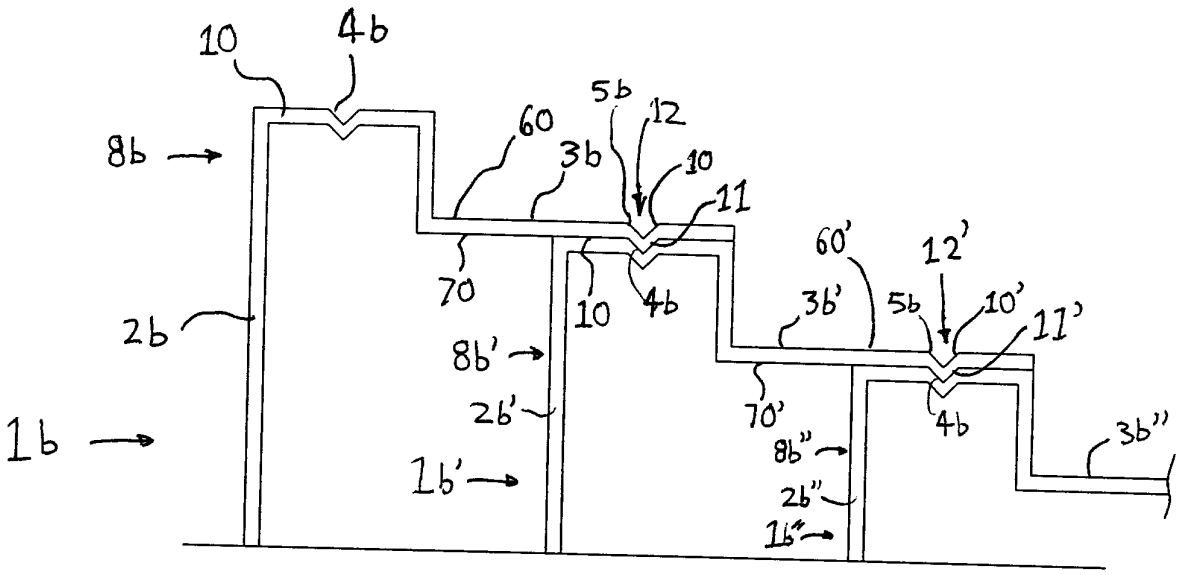
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Fig.6

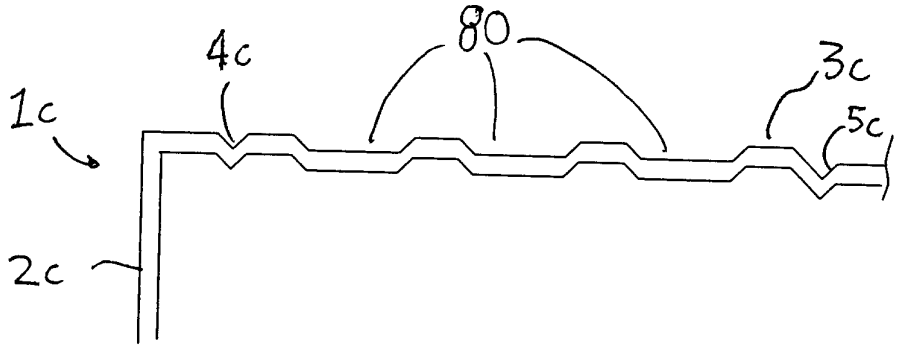
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Fig.7

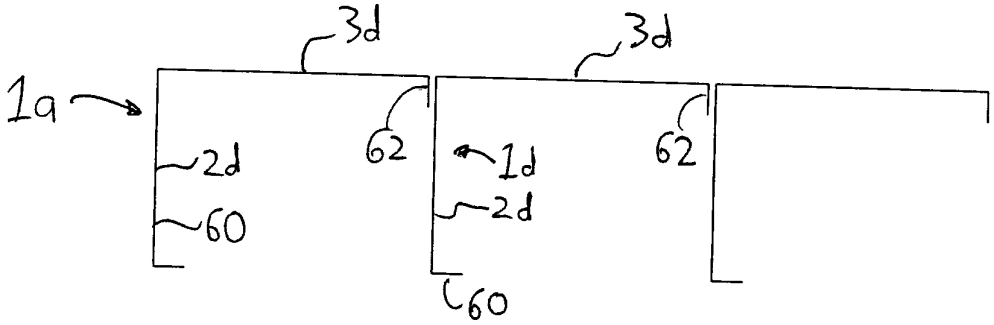

Fig.8

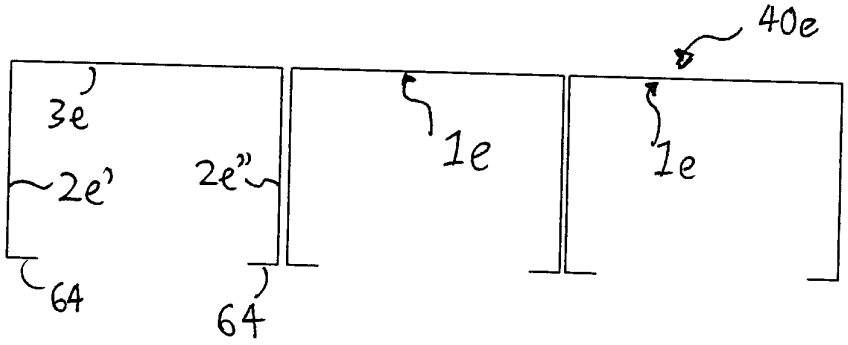

Fig.9

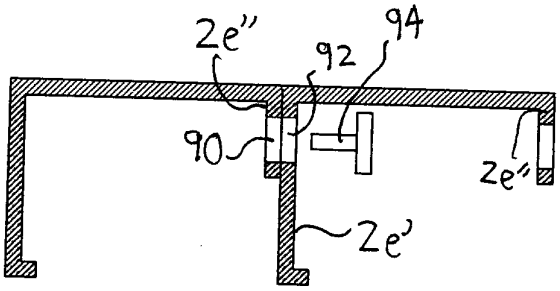

Fig.10

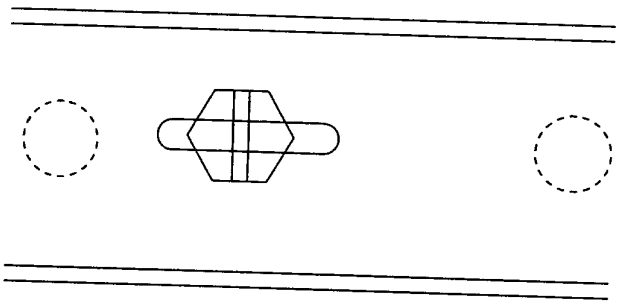

Fig.11

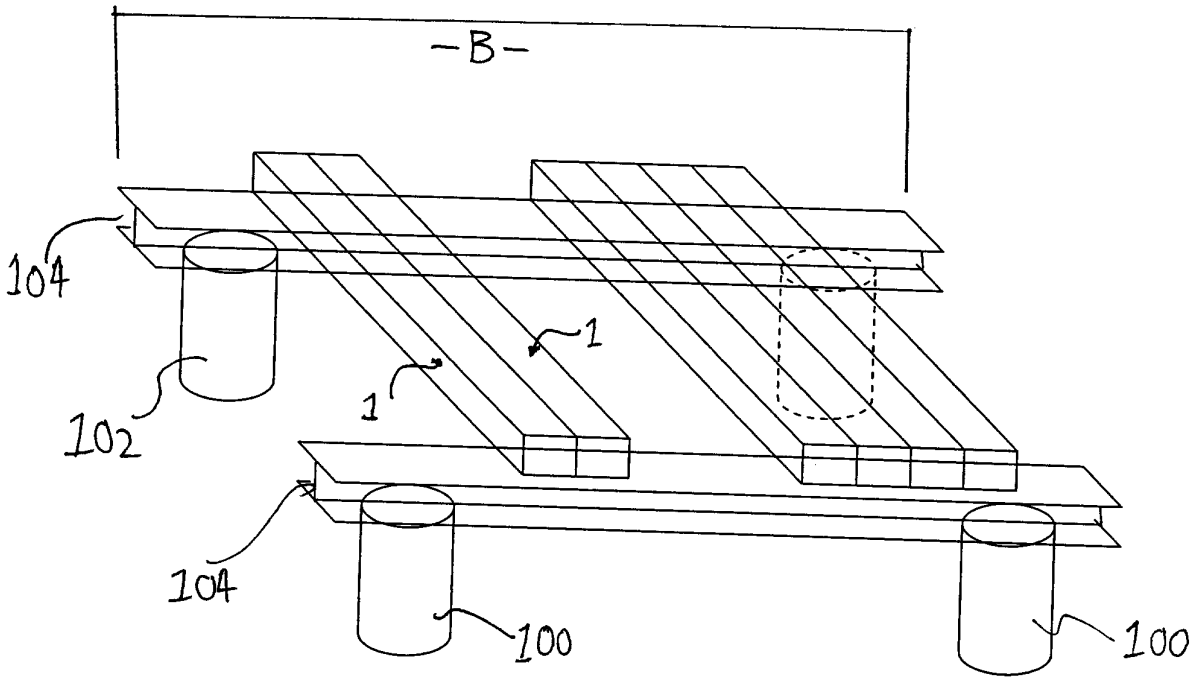

Fig.12

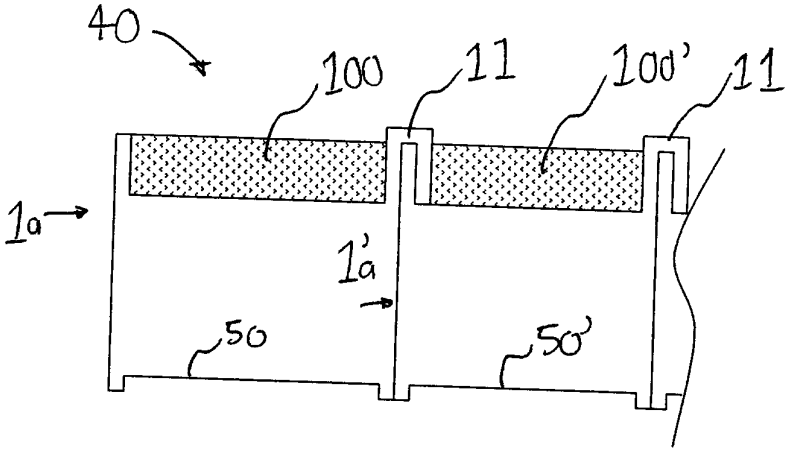

Fig.13