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(54) Composite floor structures

(57) A composite floor structure comprises a profiled steel deck which is bordered on its sides with edge sections to define a framework which is filled *in situ* with concrete. The profiled steel deck comprises upper and lower generally horizontal flange surfaces joined by downwardly and outwardly inclined straight or curvilinear web surfaces and edge laps extending outwardly from sides of the steel deck. The edge sections each comprise an upstanding web from the upper margin of which projects a first flange which assists in determining the level of concrete required to cover the deck. A second flange is provided to which is secured or on which is mounted a longitudinal edge lap or side of the deck.

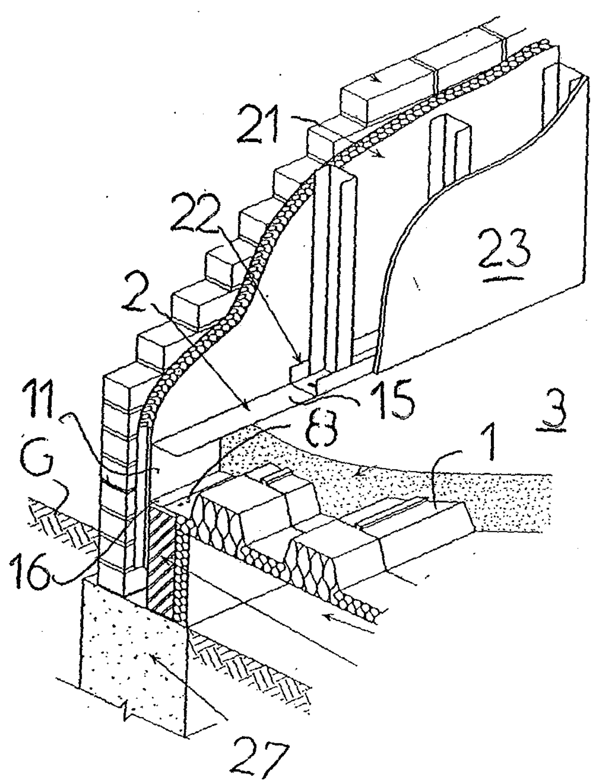

FIG. 1

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Description

[0001] This invention relates to composite floor structures and methods of producing the same. More especially the invention relates to such structures which comprise a profiled steel deck covered *in situ* with a layer of concrete.

[0002] Profiled steel decking comprising steel sheets each including a plurality of crests, troughs and intermediate inclined web sections are well known. The decking is conveniently supported on spaced structural beams or masonry walls and, when assembled, is covered *in situ* with concrete. Shear stud connections secured through the troughs of the decking provide enhanced keying of the decking to the concrete.

[0003] In the house building industry, steel and timber frame wall construction is rapidly gaining favour for reasons *inter alia* of higher quality, ease of assembly and reduced on-site construction time. However, traditional types of foundation and ground floor constructions have proved unsuitable for steel and timber framed housing and it appears over recent years that more structural damage is occurring in houses with traditional foundations and ground floors as a result of increasing amounts of subsidence or heave movements in supporting clay soils due to climatic changes.

[0004] Furthermore, composite floor structures have hitherto only been for use at ground level. To be able to employ the same (or closely similar) structure for flooring above ground level in multi-storey buildings would be highly advantageous in the context of savings in cost and build time.

[0005] Suspended ground floors now dominate the housing market and concrete ground-bearing slabs and timber floors are in decline for both practical and economic reasons. Suspended ground floors are more adaptable to the poorer ground and sloping sites that have now to be used and provide an elevated platform above ground that is subject to periodic flooding from rivers or local inundation. There is, therefore, an increased need for suspended floors when building on brown-field sites of deteriorating quality. In recent years the swings in climate have become more extreme creating a greater awareness of the need to build house levels at a higher elevation to prevent damage from such flooding.

[0006] Many sites now require significant additional fill to raise ground level and thereby create sufficient fall in the drainage and sewage systems to prevent flooding. Such fill of course causes foundation levels to be lower and ground floor levels to be elevated during construction so the suspended ground floor has to be stronger and better tied together on elevated piers or piles.

[0007] There is a current domination of precast concrete beam and block type of suspended ground floor. However, as stated before, this type of floor has problems when attaching wall frames, since the precast concrete components are damaged when drilled for the required fixing bolts. Also, poor accuracy in line and level of these floors leads to the need for packing, wall plates and adjustments to the interface with the frames which are time consuming, unpredictable and costly.

[0008] The cost advantages of composite floor structures are generally seen to be:

- reduced road transport loads, reduced pollution, and environmental nuisance
- eliminating need for site cranes
- faster site preparation and foundation completion up to ground floor level
- reduction in site trades required to ground level
- better line and level to remove interface work for framed wall construction
- enables ground floor to be installed by one ground works contractor.

[0009] One other advantage of a composite floor structure is the ability to prevent the flow of gases present in some sites to a building by applying suitable membranes over the concrete surface of a composite structure prior to the application of a screed. A further advantage is the ability to employ under floor insulation to meet level threshold requirements for *inter alia* disabled access.

[0010] The use of composite flooring also generally removes the need for on-site heaving lifting gear, and provides more adaptability to enable the maximum benefit to be achieved from a given site.

[0011] The present invention sets out to provide a composite floor structure of the type described above which overcomes many of the disadvantages inherent in conventional floor structures. It also provides a composite floor structure which can be employed at different levels in multi-storey buildings. Whereas composite floor structures in accordance with the invention have particular application as suspended ground floors for timber-framed buildings, they can be employed for all species of buildings, including conventional brick-built housing.

[0012] In one aspect the invention provides a composite floor structure which comprises a profiled steel deck and which is bordered on its sides with edge sections to define a framework which is filled *in situ* with concrete, the profiled steel deck comprising upper and lower generally horizontal flange surfaces joined by downwardly and outwardly inclined straight or curvilinear web surfaces and edge laps extending outwardly from sides of the steel deck, and the edge sections each comprising an upstanding web from the upper margin of which projects a first flange which assists in determining the level of concrete required to cover the deck, and a second flange to which is secured or on which is mounted a longitudinal edge lap or side of the deck.

[0013] In another aspect, the invention provides a composite floor structure which comprises a profiled steel deck and which is bordered on its sides with edge sections and covered *in situ* on its upper surface with concrete, the profiled steel deck comprising upper and lower generally horizontal flange surfaces joined by downwardly and outwardly inclined straight or curvilinear web surfaces and edge laps extending outwardly from sides of the steel deck, and the edge sections each comprising an upstanding end web from the upper margin of which projects a first flange which assists in determining the level of concrete required to cover the deck, a base and an upstanding front web of lesser height than that of the first-mentioned web and from the upper margin of which projects a second flange to which is secured or on which is supported an longitudinal edge lap or side of the deck.

[0014] In a further aspect, the invention provides a method of producing a composite floor structure which comprises the steps of producing a framework of one or more profiled steel decks bordered along its sides with edge sections each including a web from which extends an upper flange positioned to overlie an adjoining upper edge surface of the structure, and a lower flange positioned below the upper flange to which is secured or on which is mounted a longitudinal outward extending edge lap or side of the steel deck, and filling the framework *in situ* with concrete to the level of the upper flange.

[0015] The edge sections are preferably edge beams of "G" or "C"shape in cross-section. They may be produced from steel, preferably light gauge galvanised steel, stainless steel, plastics coated steel sheet or indeed any material having the required physical properties.

[0016] The deck may also include one or more intermediate beams which may be generally of "U" shape in cross-section. These beams may be installed immediately onto load bearing internal walls and may include outwardly projecting flanges to which edge laps of adjoining spans of decking are secured. In an alternative embodiment, the intermediate beams comprise "G" or "C" beams positioned back-to-back. The intermediate beams generally span the distance between outer walls of the structure.

[0017] Preferably the deck and the intermediate beams are also produced from light gauge galvanised steel, stainless steel, plastics coated steel sheet or other suitable material. When filled *in situ* with concrete, the structure of the deck and the edge sections forms a stiff monolithic slab having high integrity and bending strength. The high bending strength and the presence of the edge sections enables the composite structure to span between ground beams or discrete pile foundations. The spanning distance between neighbouring ground beams is greater than is the case with conventional structures. Additionally, the composite structure will tolerate a degree of differential settlement in foundations and will provide for the respective house superstructure enhanced protection from cracking caused by subsidence. Props may be provided to support the structure during *in situ* filling with concrete. These props may be removed once the concrete has solidified.

[0018] The deck may comprise a plurality of side by side profiled steel decks spans, each including upper and lower generally horizontal surfaces joined by downwardly and outwardly inclined side surfaces. In use, the spaces defined by the undersurface of the steel deck may be filled with insulation material.

[0019] Alternatively, the spaces may remain as voids. In both situations the underside of the deck may be covered with insulation material.

[0020] Edges of the structure may be lined with insulating material to prevent cold bridging.

[0021] Where two or more lengths of edge sections are required to complete one side of a deck, neighbouring edge sections may be connected together by sleeves whose cross-section complements that of the respective edge sections; the adjoining ends of the neighbouring edge sections may locate around the external surfaces of the sleeves; alternatively, the adjoining ends of the neighbouring edge sections may locate within the open ends of the sleeves.

[0022] External mitred joints each having a cross-section which complements that of the edge sections may be provided to connect the ends of edge sections at the side ends of a steel deck. The joints are configured and dimensioned either to be received within the open ends of adjoining edge sections or to receive the edge sections ends.

[0023] The sleeves and/or the mitred joints may be of box profile which may be perforated or include apertures through which concrete may pass.

[0024] The sleeves and/or the mitred joints may be produced from light gauge galvanised steel, stainless steel, plastics coated steel sheet or plastics.

[0025] The invention will now be described by way of example only with reference to the accompanying diagrammatic drawings in which:-

Figure 1 is a perspective view partly in section of a composite floor structure in accordance with the invention;

Figures 2 and 3 are side views of similar composite structures to that illustrated in Figure 1;

Figures 4 and 5 are respectively plan and side views of steel decking which forms part of a composite structure in accordance with the invention;

Figure 6 is a view to an enlarged scale of a feature of the decking illustrated in Figures 4 and 5 of the drawings;

Figures 7A and 8 are cross-sections to enlarged scales taken respectively along lines VII-VII and VIII-VIII of Figure 4;

Figures 7B is a cross-section of an alternative edge beam to that shown in Figure 7A;

Figures 9A, 9B and 10 are side views of alternative intermediate beams for use with composite floor structures in accordance with the invention;

Figure 11 is a side view of a sleeve of a structure in accordance with the invention;

Figure 12 illustrates an external mitred corner joint which forms part of the decking illustrated in Figures 1 to 3 of the drawings;

Figure 13 is a plan view of a steel sheet blank from which the mitred joint of Figure 12 is produced;

Figure 14 illustrates an internal mitred corner joint which forms part of the decking illustrated in Figures 1 to 3 of the drawings; and

Figures 15 to 17 are side view of edge sections of composite structures in accordance with the invention.

[0026] In each of the embodiments, the same reference numerals have been used for the same integers wherever appropriate.

[0027] The composite structures illustrated in Figures 1 to 3include a profiled steel deck 1 bordered on all sides by galvanised edge sections 2 and covered with a layer of concrete 3. As shown, the edge sections are steel beams and will be described as such below. The deck 1 comprises a plurality of side-by-side profiled deck members each formed with upper flange surfaces 4, lower flange surfaces 5 and inclined side surfaces 6. The profiles extend over the entire length of the deck members and the upper flange surfaces 4 carry projections 7 which assist keying of the decking to the concrete layer 3. Edge laps 8 project outwardly from the outermost members of the deck.

[0028] In the embodiment illustrated in Figure 1, the beam 2 is of "C" section and comprises an end web 11, an upper flange 15 which extends inwardly towards the deck from the uppermost edge of the end web 11 and a lower flange 16 which extends inwardly towards the deck from the lowermost edge of the end web 11.

[0029] In Figures 2 and 3, each edge beam 2 is of G-section and comprises end web 11, a base 12 and a front web 14 of lesser height than that of the end web 11. Upper flange 15 extends inwardly towards the deck from the uppermost edge of its end web 11, and the lower flange 16 extends inwardly towards the deck from the uppermost edge of the front web 14 of each edge beam. In an alternative unillustrated embodiment, the lower flange 16 extends in a direction towards the end web 11. For each of the embodiments of Figures 1 to 3 the flange 16 is secured to the neighbouring edge lap 8 of the deck 1 and the upper flange 15 provides a template for indicating the required level of the concrete layer 3 which is poured in *situ* over the deck 1 to completely fill the troughs defined by the inclined web surfaces 6 of the deck 1 and the interiors of the edge beams 2 effectively to produce a composite slab of steel and concrete. The concrete layer may be applied by any conventional process including a power floating technique. One or more sheets of mesh reinforcement 17 may be embedded within the concrete layer. EPS insulation 18 is secured to the underside of the deck by, for example, bonding, wire hangers or clips (not shown). The insulation 18 may completely fill the underside of the profiled steel deck 1 as shown in Figures 1 and 2, or partially fill the defined spaces as shown in Figure 3.

[0030] A membrane may be applied to the surface of the concrete to prevent the flow of ground gases to the upper surface of the deck. The membrane may be coated by a screed of, for example, sand and cement.

[0031] The edge beams accommodate the use of steel or timber frame constructions and provide an accurate template for line and level and easy connectability. The composite structure can, however, be successfully employed for all types of buildings, including conventional brick-built buildings.

[0032] The end webs 11 of the edge beams 2 abut sheets of cavity insulation 21 supported on wall ties and retained in position by clips. In Figure 1, a base rail 22 of a steel wall frame runs alongside the cavity insulation sheets 21 and over the upper flanges 15 of the edge beams 2. A damp-course is positioned between the surfaces of the rail 22 and the upper flange 15 of the respective edge beam. The base rail 22 is bolted to the concrete layer 3 and receives the lower ends of supporting members to which interior walls 23 of the building are secured. In Figure 2 the cavity insulation sheets 21 are faced with conventional brickwork 24.

[0033] In the embodiments of Figures 1 and 2, the floor structure is supported by ground beams 27 or trench fill. Aerated or other blocks 26A are positioned between the ground beams 27 and the undersurface of the respective edge beam. Similar blocks 26B are supported on the edge beam above ground level.

[0034] In the Figure 3 embodiment, the floor structure is supported again by an in *situ* ground beam 27; in this embodiment, however, the ground beams 27 are themselves supported by piles 28 and pile caps 29. Reinforcing bars are embedded in the ground beam 27. The ground beam is encased within a polystyrene trough which acts as permanent framework for the beam.

[0035] In each of Figures 1 to 3, ground level is indicated by reference "G".

[0036] A ventilation void 25 is provided below the layer of EPS insulation 18.

[0037] The steel decking is illustrated more clearly in Figures 4 and 5. As will be seen from Figure 4 the elongate edge beams 2 comprise either a single length or a plurality of lengths joined together by, for example, welding or by sleeves to be described in greater detail below with reference to Figure 11 of the drawings. The external corners of the deck are defined by external mitred joints to be described in greater detail below with reference to Figure 12 and the internal deck corners are defined by internal mitred joints to be described in greater detail below with reference to Figure 14. As illustrated, the deck comprises two spans 32, 33 and an intermediate beam 34 whose cross-section is generally "U" shaped as shown in Figure 8 of the drawings; alternatively, the intermediate beam may comprise two back-to-back "G" and/or "C" beams as shown in Figures 9 and 10 of the drawings. Continuous horizontal lips 35, 36 project outwardly from the upper margins of the upstanding walls of the intermediate beam 34.

[0038] As will be seen more clearly from Figures 5 and 6 , each deck span 32, 33 comprises a plurality of decking panels each of which comprises the upper and lower generally horizontal flange surfaces 4, 5 separated by inclined web surfaces 6 described above with reference to Figures 1 to 3. The outwardly extending edge lap 8 of the outermost panel of span 32 is secured by screws, bolts, welding or other suitable means to the inwardly extending flange 16 of the respective edge beam 2. As shown in Figure 6, the end of the deck span 32 remote from the edge beam 2 is secured to the horizontally extending lip 35 of the intermediate beam 34 through a filler strip 37. Filler strips 37 are only required in situations where the respective end of the deck span and lip of the intermediate beam do not overlap. In situations where overlap occurs, the overlapping end and lip are secured together directly. Before in *situ* pouring of concrete begins, blocks are positioned within the cavity of the intermediate beam 34 for reference purposes. This greatly assists the construction process following completion of the composite floor structure.

[0039] Blocks need not be positioned within the cavity of the central beam. In such cases, the cavity is completely filled with concrete during in *situ* pouring. Reinforcement rods, bars or the like may be located within the cavity before pouring commences thereby producing a simply supported beam which does not require support from continuous blockwork. In this case the beam acts as a shutter for the concrete beam produced. Props (not shown) may be positioned below the decking to provide support during and following the concrete casting process. These props may be removed once the concrete has gone off.

[0040] As shown, the profiled panels of deck span 33 are positioned normal to those of span 32, the front and rear ends of the decking panels of each span being supported between the lip 36 of the central intermediate beam 34 and the lower flange 16 of the adjoining edge beam. Alternatively, the decking panel spans may lie generally parallel; alternatively, one may be inclined at an angle to the other.

[0041] The connections between the decking panels of the spans and the intermediate beam are illustrated in greater detail in Figure 6 of the drawings. As will be seen from this Figure, the steel filler strip 37 extends between the neighbouring ends of the edge lap 8 of the deck span 32 and the closest lip 35 of the intermediate beam 34. The end of the deck span 33 closest to the intermediate beam 34 is supported and secured to the lip 36 of the intermediate beam 34. The edge and intermediate beams are set at the same level.

[0042] The profiles of the G-section and C-section edge beams 2 are illustrated in Figures 7A and 7B respectively. The profile of the intermediate beam 34 is shown in Figure 8. From Figures 7A and 7B, it will be seen that the upper flanges may be inclined downwardly. The downwards inclination is shown in broken line in Figures 7A and 7B. Other angles of inclination than that illustrated may be adopted. Also, as shown in broken line 31 the lower flange 16 of the G-section beam may extend towards the end web 11 and not away from this web. Furthermore, a lip 30 shown in broken line may project downwardly from the outer margin of the front web 14. Typically the height of the end web 11 of each edge beam of "G" cross-section is between 200 and 230mm (generally 215mm) although the web height may be made to suit any brick block coursing height; the length of the base 12 is between 90 and 150mm (generally 100mm); the height of the front web 14 is typically between 70 and 80mm (generally 75mm); the length of the flange 15 is typically between 35 and 45mm (generally 40mm); and the length of the flange 16 is typically between 40 and 60mm (generally 50mm). The corresponding dimensions for a typical edge beam of "C" cross-section are an end web 14 height of 120 to 160 mm (generally 140 mm), an upper flange length between 35 and 45mm (generally 40mm); and a lower flange length of between 40 and 60mm (generally 50mm). The upper flange dimension provides a stiffening edge to the web and depending on the stiffening requirement the flange dimension can be of any size to meet the requirement.

[0043] As will be described below with reference to Figures 15 to 17, edge beams and intermediate beams are employed to support insulation material. Alternatively, rebated edge insulation may be secured to the edge beam to support underfloor decking insulation.

[0044] As mentioned previously the intermediate beam 34 may comprise two back-to-back "G" or "C" edge beams. These are shown in Figures 9A, 9B and 10. As for the "U" shaped intermediate beam illustrated in Figure 8, the upper flanges 15 may be inclined downwardly and the lower flanges 15 of the "G" beams shown in Figure 9 may be directed towards the respective end web 11 rather than away from this end web as shown in broken line 31 and the outer margin of the flange 16 may carry a lip 30.

[0045] The alternative intermediate beam shown in Figure 9B includes two side extension pieces 30A.

[0046] A sleeve 40 for connecting neighbouring lengths of edge beams is shown in Figure 11. In cross-section, the sleeve replicates the shape of each edge beam and comprises an end web 41, a base 42, an upstanding front web 43 and an upper inwardly extending flange 44. In use, the sleeve locates within the adjoining or spaced ends of neighbouring edge beams, the dimensions of the end web 41, base 42 and front web being marginally less than the respective dimensions of the end web, base and front web of each edge beam. In an alternative arrangement, the adjoining ends of neighbouring edge beams may locate within the open ends of a suitably dimensioned sleeve.

[0047] An external mitred joint 45 for connecting the ends of neighbouring edge beams at the corners of the steel deck is illustrated in Figure 12. The joint functions in a similar way to that of the sleeve excepting that it comprises two side walls 45a, 45b at right angles to one another and is dimensioned to locate within the open ends of the two adjoining or spaced edge beams. The angle between the joint sections need not be a right angle, the required angle being selected depending upon the configuration of the steel deck.

[0048] Advantages accrue by spacing the ends of neighbouring edge beams connected through the sleeves or mitred joints. These include the provision of length tolerances during the construction process. Typically, spacings may be of the order of 5cm.

[0049] The mitred joint may be produced from a blank of steel sheet 46 as shown in Figure 13, the required shape being produced simply by folding the blank along the chain dotted lines 47.

[0050] As shown in Figures 11 and 12, the sleeve 40 and mitred joint 45 are configured to locate within the open ends of adjoining edge beams. Alternatively, a sleeve and/or the mitre joint may be dimensioned so that the adjoining ends of the edge beams are sited within the open ends of the sleeve and/or joint.

[0051] An internal mitred joint is shown in Figure 14. This locates around the ends of adjoining or spaced edge beams and includes two side walls 47a, 47b at right angles to one another and two separable trays 48a, 48b. The joint is dimensioned to locate the neighbouring ends of adjoining or spaced edge beams and may be produced from two pieces of material or may comprise a single tray.

[0052] The sleeve and mitred joint are preferably produced from light gauge galvanised steel sheet, stainless steel or plastics.

[0053] As mentioned previously, whereas the edge beams support traditional masonry constructions, they also facilitate the use of steel or timber frame wall construction and also provide an accurate template for line and level and easy connectability.

[0054] Figures 15 to 17 illustrate edge beams 2 used to support insulation material 18. In Figure 15, an extended G-section beam as illustrated in a back-to-back arrangement in Figure 9B is employed, the insulation material being supported by and between extension pieces 30A. A similar arrangement is illustrated in Figure 16 although here the G-section beam includes a flange 31 which extends towards its web 11 to support a 'Z' section member 50 which in turn supports the insulation 18. At its end remote from the G-section beam, the insulation is supported through a support member 51 by one lip 35 of an intermediate beam 34. In Figure 17, an edge beam of'C' cross-section carries an insulation filled frame 52 which supports the insulation material 18.

[0055] These are only examples of various assemblies for supporting the insulation material.

[0056] Trials have indicated that considerable periods of time can be saved from the total house construction time through use of composite floor structures in accordance with the invention. This is valuable because foundation construction is always on the critical path.

[0057] Because the lightweight components of the floor structure are suppled in 'kit' form, packing, delivery, handling and assembly of these components on site are greatly assisted.

[0058] Trials have also demonstrated safer construction procedures for site personnel, reduction in the site waste and high strength. In this context, suspended floor structures in accordance with the invention can be used with longer spans and piled foundations.

[0059] Further advantages include the fact that steel trimmings can be recycled and no special craft training of the labour force is required, only familiarisation with steel assembly and fixing procedures.

[0060] Composite structures in accordance with the invention can be used at ground level or for upper floors of a building. In the latter case, traditional ceiling finishes can be attached to the underside of the decking.

[0061] Also, existing fabrication processes and building industry supply routes can be employed.

[0062] To prevent the ingress of concrete into the open ends of the decking during the casting process, seals may be provided. These may comprise end caps of plastics or other suitable material, self adhesive tape attached to the surrounding surfaces of the decking before casting or compressible sheets of, for example, an expanded foam material contoured to complement the undersurface of the decking. In this latter case, the decking is positioned over the sheets of contoured sheets to compress the same and therefore provide an effective seal against the ingress of concrete. Alternatively, when edge beams of "C" section are employed, the decking may be positioned sufficiently close to the end webs 11 of the C-section beams to prevent the ingress of concrete.

[0063] It will be appreciated that the foregoing is merely exemplary of composite floor structures in accordance with the invention and that various modifications can be made thereto without departing from the scope of the invention as set out in the appended claims.

Claims

1. A composite floor structure which comprises a profiled steel deck and which is bordered on its sides with edge sections to define a framework which is filled *in situ* with concrete, the profiled steel deck comprising upper and lower generally horizontal flange surfaces joined by downwardly and outwardly inclined straight or curvilinear web surfaces and edge laps extending outwardly from sides of the steel deck, the composite floor structures being **characterised in that** the edge sections each comprising an upstanding web from the upper margin of which projects a first flange which assists in determining the level of concrete required to cover the deck, and a second flange to which is secured or on which is mounted a longitudinal edge lap or side of the deck.

2. A composite floor structure as claimed in claim 1 wherein each edge section further comprises a base and an upstanding front web of lesser height than that of the other web and from the upper margin of which projects a second flange to which is secured or on which is supported an longitudinal edge lap or side of the deck.

3. A structure as claimed in claim 1 or claim 2 wherein the edge sections are produced from steel and/or comprise beams.

4. A structure as claimed in claim 1 or claim 2 in which the edge sections are of "C" or "G" shape in cross-section.

5. A structure as claimed in any one of the preceding claims wherein the edge sections are produced from plastics coated steel or light gauge galvanised steel or stainless steel.

6. A structure as claimed in any one of the preceding claims further including one or more intermediate beams which are generally of "U" shape in cross-section.

7. A structure as claimed in claim 6 wherein the or each intermediate beam includes outwardly projecting flanges to which edge laps of adjoining spans of profiled decking are secured.

8. A structure as claimed in any one of claims 1 to 5 further comprising one or more intermediate beams each including two back-to-back "C" or "G" section beams.

9. A structure as claimed in any one of claims 5 to 8 wherein, before *in situ* pouring of concrete, blocks are positioned within the internal cavity of one or more intermediate beams to a height equal to or above the level of poured concrete.

10. A structure as claimed in any one of the preceding claims in which the deck comprises a plurality of side by side profiled steel deck spans, each including upper and lower generally horizontal flange surfaces joined by downwardly and outwardly straight or curvilinear inclined web surfaces.

11. A structure as claimed in any one of the preceding claims in which two or more lengths of edge section are required to complete one side of a deck, neighbouring edge sections being connected together by sleeves each of whose cross-section complements that of the respective edge sections; the opposed ends of the neighbouring edge sections locating around the external surfaces of the sleeves.

12. A structure as claimed in any one of the preceding claims in which external mitred joints of cross-section which complements that of the edge sections are provided to connect the ends of edge sections at the side ends of a steel deck, the joints being configured and dimensioned either to be received within the open ends of neighbouring edge sections or to receive the edge sections ends.

13. A method of producing a composite floor structure which comprises the steps of producing a framework of one or more profiled steel decks bordered along its sides with edge sections each including a web from which extends an upper flange which overlies an adjoining upper edge surface of the structure and is positioned substantially to coincide with the level of concrete required to cover the deck, and a lower flange positioned below the upper flange to which is secured or on which is mounted a longitudinal outward extending edge lap or side of the steel deck, and filling the framework in *situ* with concrete to the level of the upper flange.

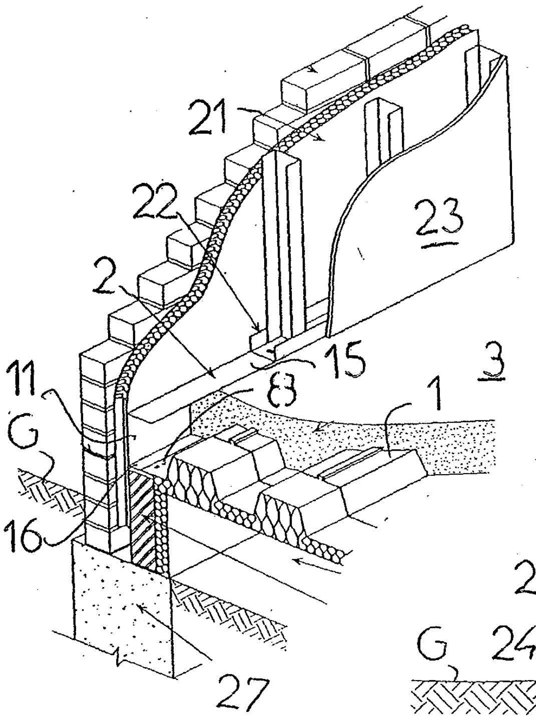

FIG. 1

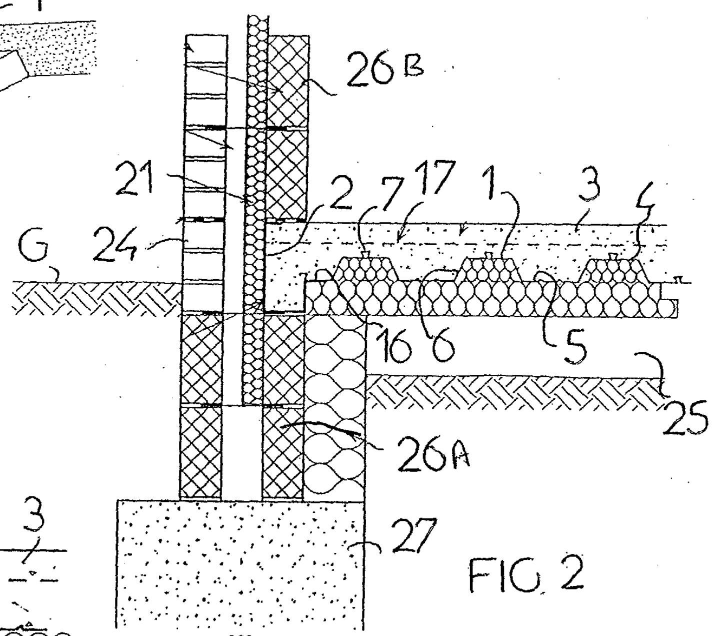

FIG. 2

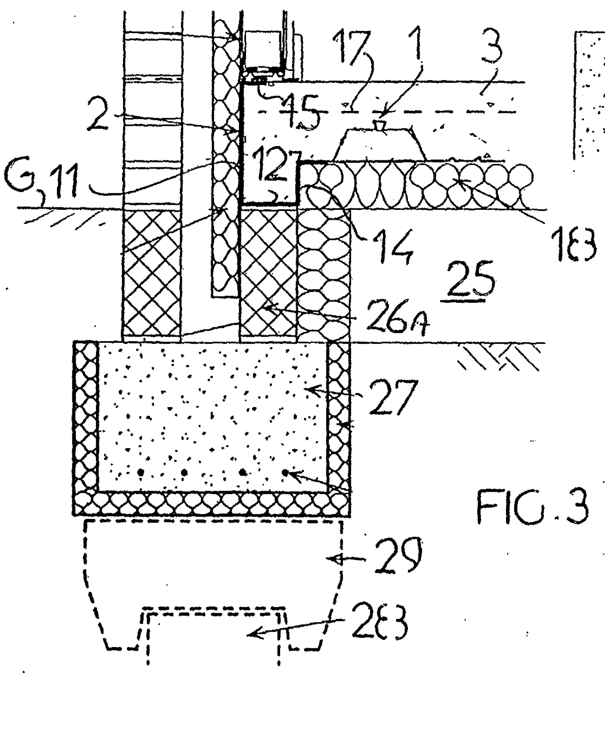

FIG. 3

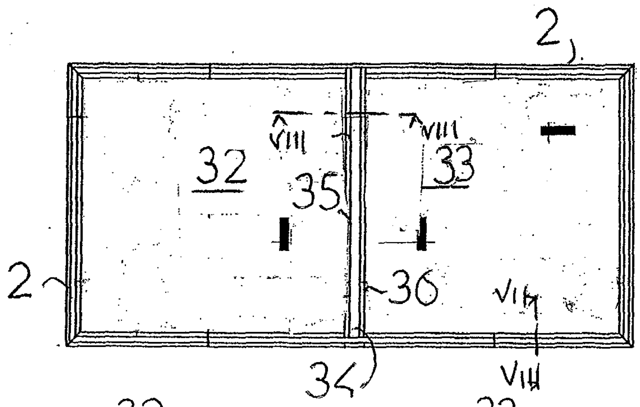

FIG.4

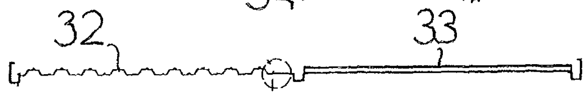

FIG.5

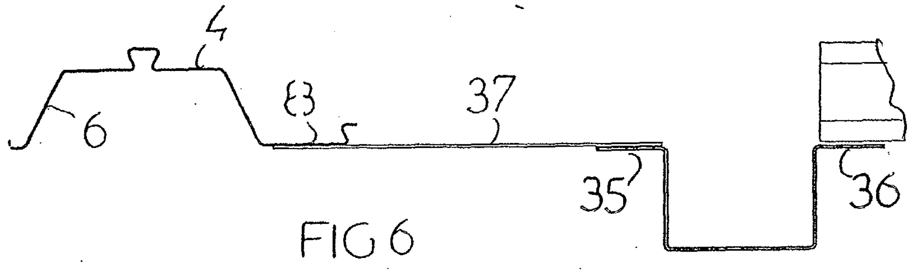

FIG 6

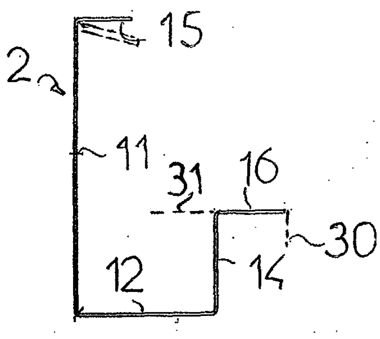

FIG 7A

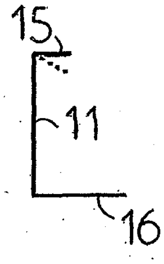

FIG 7B

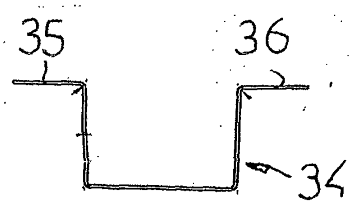

FIG 8

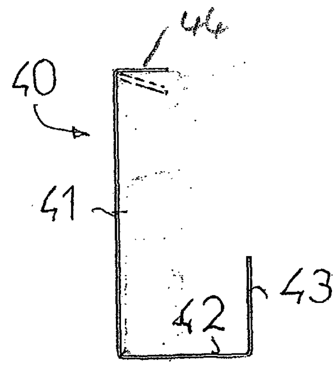

FIG 11

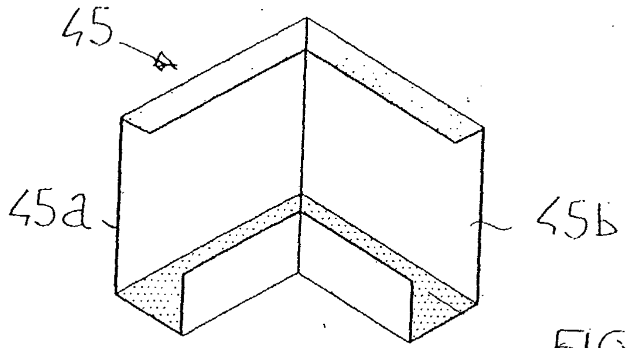

FIG.12

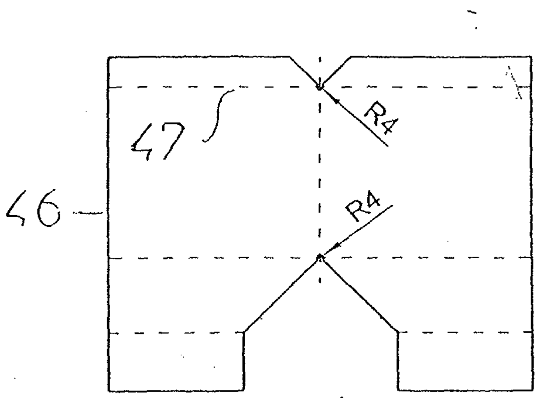

FIG.13

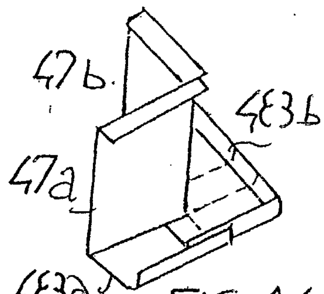

FIG.14

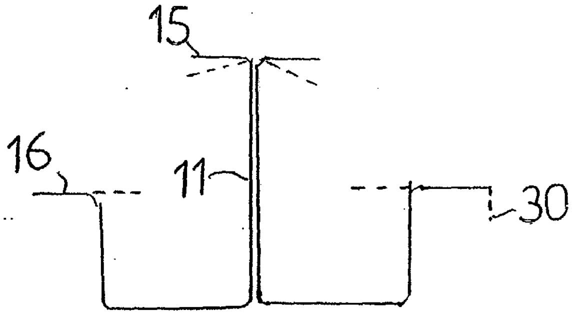

FIG.9A

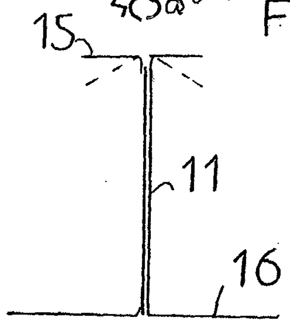

FIG.10

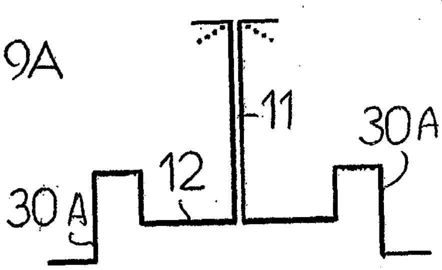

FIG9B

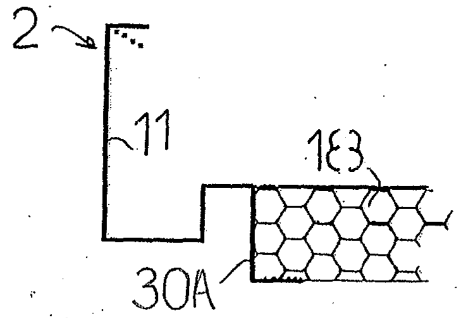

FIG. 15

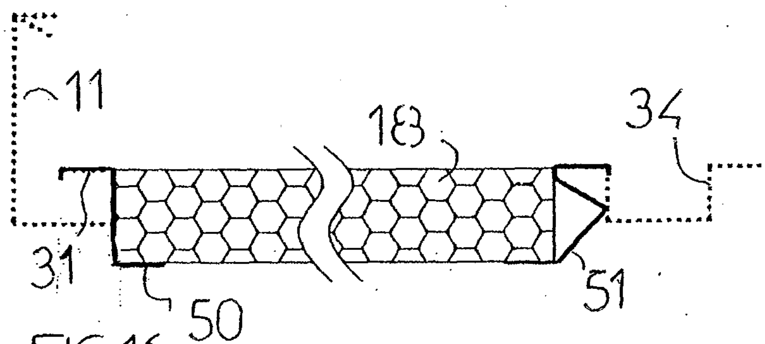

FIG.16

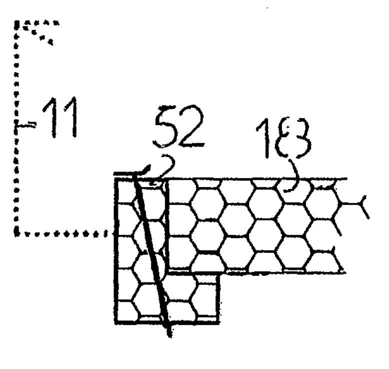

FIG 17

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Application Number
EP 03 25 5121

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 November 2003	Righetti, R

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