

The invention relates to a building element for erecting buildings, parts of buildings or the like.

German laid-open application (DE-OS) No 24 27 568 discloses a building element for erecting buildings, which comprises a concrete-filled sheet metal profile structure and which is in the form of a table and which has a panel, two longitudinal side portions and four or more upright columns. Building elements of that kind can be used to erect individual storeys of a building, by the building elements being fitted on to a row of finished cells which form the ground floor. As the panel of the table-like building elements simultaneously forms on the underside the ceiling and on the top side the floor for the storey thereabove, those building elements are substantially lighter than known finished cells and also require less material.

With building elements of that kind, there is the problem that, for static reasons, to prevent the panels from sagging, beam members or similar support elements must be provided. With the known building element, the beam members are formed by longitudinal side portions. Furthermore it is difficult in relation to a building which is erected from building elements of that kind to arrange the required supply conduits for example for water, waste water, electricity, heating or the like, in such a way that on the one hand the construction is not weakened and on the other hand expensive and cost-intensive labour operations are avoided. In the known building element, it is not possible to dispose supply conduits within the building element.

German laid-open application (DE-OS) No 24 38 376 discloses a latticework panel with upper and lower flange plates and struts connecting same. For the purposes of supporting a ceiling which is formed from a plurality of such latticework panels which are laterally connected together, on supports, the edge latticework panels each include a solid block at their outer ends. It is not possible for supply conduits or the like to be passed through the supports into the space between the upper and lower flange plates.

The invention is essentially based on the problem of so designing a building element of the kind set forth in the opening part of this specification that no sagging which is relevant in practice occurs, even when the panel is of relatively large dimensions, so that there is therefore no need for any beam members or the like. Another problem is that of so designing the building element that conduits of any kind can be incorporated or arranged in an inexpensive fashion and without difficulties.

The building element according to the invention for the production of buildings, parts of buildings or the like has at least one panel which is horizontal in the position of use and which has a

reinforcement. The reinforcement is in the form of a space frame structure. A portion of the reinforcement is embedded into an upper embedding region. Provided in the corner regions of the panel are support elements which extend transversely to the plane of the panel.

5 For the purposes of connecting the panel to the support elements, arranged in the corner regions of the panel are stiffening shoes which are connected to the reinforcement. The stiffening shoes each have a top plate which is disposed parallel to the panel and a bottom plate which is disposed parallel to the panel, as well as a plurality of web plates

10 which space the top and bottom plates. Provided in the stiffening shoes is at least one respective passage which is open to the interior region of the reinforcement and to the corner.

The fact that the reinforcement is in the form of a space frame

15 structure means that no sagging which is relevant in a practical context occurs, even when the panel is of relatively large dimensions, so that, in a building structure which is erected using such building elements, no beam members or the like are required. That therefore affords a very high level of planning options in regard to completion of the interior

20 of a building erected from building elements of that kind. By virtue of the embedding region which is preferably made of concrete, the panel has a surface which is closed throughout. The cavity in the panel which is only interrupted by the space frame structure, beneath the upper embedding region, can serve to accommodate horizontally extending

25 conduits of any kind. After the supply conduits have been introduced, that space can be closed off downwardly by means of panel-like cladding elements which bear against the underside of the space frame structure.

The forces, for example the forces caused by the weight of a

30 building erected from building elements according to the invention, are carried by the stiffening shoes and transmitted by way of the respective support elements therebeneath to the lowermost building element. The at least one passage provided in the stiffening shoes serves to provide a communication between the cavity in the plane of the panel or the

35 interior of the panel and the corner region. In that way supply conduits or the like can be passed through the support elements into the region of the space frame structure.

In a further configuration according to the invention, it can be

40 provided that the portion of the reinforcement which is towards the underside of the panel in the position of use is also embedded in a lower embedding region which extends over the plane of the panel so that a substantially continuous cavity is formed in the panel between the upper and the lower embedding regions. That cavity is available for

45 carrying or receiving conduits, for example heating conduits.

The fact that the reinforcement is only embedded in an upper and possibly a lower embedding region of concrete or the like means that the

building element is low in weight, which has a particularly advantageous effect in regard to transportation and assembly.

5 In an advantageous configuration according to the invention, it can be further provided that the reinforcement which is in the form of a space frame structure is designed in the form of a bearer grid comprising lattice bearers with intersection points which are force-lockingly connected together, preferably welded. In that respect it is advantageous that a space frame structure of that kind can be produced without involving a high level of expenditure from components which are 10 available on the market as mass-produced items. That means that the space frame structure can be produced inexpensively.

15 In accordance with a further feature of the invention it is provided that the building element has recesses at the respective corners. The recesses are for example in the form of bevels in the corners of the panel. At their outer regions which are towards the corners, the support elements also have recesses which are continuous in the longitudinal direction, preferably in the form of bevels.

20 If for example four building elements are arranged in side-by-side relationship and therefore four support elements are facing towards each other, the recesses provide between the support elements and the panel corners a vertically extending passage which opens in the region of the respective panels into the cavities in the panels so that the assembly 25 in that way has vertical passages and horizontal cavities communicated therewith. These vertical passages and horizontal cavities can serve to accommodate conduits which are not visible either from the outside or from the inside of the building. The term conduits is not only used to denote supply conduits, but the conduits may also be for example floor 30 heating, parts of an air conditioning installation or the like.

It can further be provided that the reinforcement has edge ribs extending along the panel edges and mutually intersecting diagonal ribs. That cross-wise reinforcement with edge stiffening effect gives rise to 35 a considerable reduction in regard to material expenditure, and a high level of stiffness in regard to sagging of the building element.

In accordance with a further feature of the invention it is provided that the edge ribs and the diagonal ribs have lattice bearers 40 which are embedded in concrete or the like and the lattice bearers are fixedly connected to each other and to the stiffening shoes respectively at the points of intersection of the diagonal ribs and at the points of connection with stiffening shoes which are provided in the corner regions of the panel, by embedding of the points of intersection and the 45 points of connection in concrete or the like.

Desirably the stiffening shoes have hook-like suspension devices for suspending loop-like end portions of the lattice bearers. As a result there is no need to make a fixed connection in respect of the diagonal ribs at the points of intersection and the edge ribs and the diagonal ribs with the stiffening shoes provided in the corner regions of the panel, for example by welding, as the fixed connection is easily achieved by virtue of the fact that the reinforcement of the diagonal ribs, which initially lies loosely against each other at the points of intersection, and the ends of the reinforcement of the edge ribs and the diagonal ribs, which ends are initially loosely fitted into the suspension devices of the stiffening shoes, are firmly connected by being embedded in concrete or the like. That makes it possible easily to make the connections of the diagonal ribs with each other and the connections of the edge ribs and the diagonal ribs to the reinforcing shoes which are provided in the corner regions, so that the building element is inexpensive to produce.

Embodiments of the invention are described hereinafter with reference to the drawings in which:

Figure 1 is a diagrammatic view of a number of building elements which are arranged in side-by-side and superposed relationship,

Figure 2 is a plan view of an embodiment of a building element,

Figure 3 is a view in section along line III-III in Figure 2, wherein the support elements are not shown for the sake of enhanced clarity,

Figure 4 is a view in section along line IV-IV in Figure 3, wherein the support elements are not shown for the sake of improved clarity,

Figure 5 is a sectional view along line IV-IV in Figure 2 through a building element having an upper panel and a lower panel and support elements,

Figure 6 is a view corresponding to Figure 5 for a further embodiment in which the space frame structure forming the reinforcement is embedded only in an upper embedding region,

Figure 7 is a diagrammatic plan view of four building elements which are arranged in side-by-side relationship,

Figure 8 is a view on an enlarged scale of the middle region of the view shown in Figure 7,

Figure 9 is a partial view of Figure 8 taken along line IX-IX on an enlarged scale,

Figure 10 is a diagrammatic perspective view of a stiffening shoe,

Figure 11 is a diagrammatic perspective view of the stiffening shoe shown in Figure 10, which is embedded in an upper and a lower embedding region of the panel,

5 Figure 12 is a diagrammatic plan view of the panel of a building element in section approximately along line XII-XII in Figure 13,

10 Figure 13 is a diagrammatic view in section approximately along line XIII-XIII in Figure 12, although the stiffening shoes in the corner regions are not shown, and

15 Figure 14 is a diagrammatic plan view of the junction point formed by the connection of four building elements as shown in Figure 12 at the middle, wherein the respective top plates of the stiffening shoes are not shown, and the connections of the edge ribs and the diagonal ribs are diagrammatically illustrated only for one stiffening shoe.

20 In Figure 1, a plurality of building elements 1 and 2 are arranged in side-by-side and superposed relationship. The building elements 1 each comprise an (upper) panel 3 and support elements 4 which extend transversely with respect to the plane of the panel. In addition to an upper panel 3 the building elements 2 also have a lower panel 5.

25 Figure 2 shows a plan view of one of the panels 3. The corners of the panel are provided with bevels 6. The panel 3 has an interior reinforcement 7 which is constituted as a space frame structure in the form of a bearer grid consisting of lattice bearers with welded points of intersection. The reinforcement in the form of the space frame structure is embedded in its portion which faces towards the top side of the panel, in an upper embedding region 8 of concrete, which extends
30 over the plane of the panel. The portion of the reinforcement 7, which faces towards the underside of the panel in the position of use, is embedded in a lower embedding region 9 of concrete, which extends over the plane of the panel. In that way, formed in the panel 3 is a cavity
35 10 which extends in the plane of the panel and which is continuous, apart from the reinforcement. The support elements 4 are not shown in Figures 3 and 4, for the sake of improved clarity.

40 Figure 5 is a view in cross-section through one of the building elements 2 illustrated in Figure 1. The building elements 1 and 2 differ from each other in that the building elements 1 only have an (upper) panel 3 with support elements 4 extending downwardly thereon, while in the case of the building elements 2, there is a further panel 5 disposed at the lower end of the supports 4, the structure of the panel 5
45 corresponding to that of the panel 3.

The building element shown in Figure 6 and generally identified by 2a differs from the building element 2 shown in Figure 5 in that the

upper panel which in this case is identified by 3a has only an upper embedding region 8 but no lower embedding region 9. The downwardly open space 10a can serve, like the space 10, for accommodating horizontal conduits or the like. The absence of the lower embedding region 9 is found to be particularly advantageous in regard to fitting the conduits. The open underside of the space 10a can be readily closed by cover plates or the like after conduits have been fitted in position.

It can also be provided that the panels 3 of the building elements 1 only have an upper embedding region 8.

Embedded in the corner regions of the panels 3, 3a and 5 respectively are stiffening shoes 11 which are shown on an enlarged scale in Figure 10.

In the case of building elements which adjoin each other, the bevels 6 which are provided in the corners of the panels form passages 12, as can be seen from Figures 7 and 8. It should also be mentioned that the support elements 4 also have bevels at their corners. In that way the passages 12 are of a continuous nature in a vertical direction and can accommodate vertically extending conduits or the like.

The stiffening shoes 11 each comprise a top plate 13 and a bottom plate 14 which are connected together by way of web plates 15, 16, 17, 18, 19 and 20. In that way a continuous passage 21 is formed between the web plates 17 and 18 and the top plate 13 and the bottom plate 14.

By way of that passage 21, the cavity 10 which is horizontal in the position of use or the space 10a and the vertical passages 12 are connected together. For the sake of enhanced clarity Figure 10 does not show any fixing means for the support elements 4, on the stiffening shoes 11. As can be seen from Figure 11, the stiffening shoes 11 are each embedded in the upper embedding region 8 and the lower embedding region 9 of a respective panel 3. For the sake of enhanced clarity Figure 11 does not show the reinforcement in the form of the space frame structure, but in contrast it is diagrammatically indicated that a support element 4 is joined thereto in a downward direction. Fixing elements for the support element 4 are also not shown in Figure 11.

Figure 9 diagrammatically shows the connection of upwardly and downwardly facing support elements 4 to the corner regions of a panel 3. A stiffening shoe 11 is embedded in the corner region of the panel 3. The upper embedding region 8 and the lower embedding region 9 each have conical recesses 22 which open into openings in the top plate 13 and the bottom plate 14. Extending through the openings are screw bolts 23 which are fixedly let into the ends of the support elements 4. Nuts (not shown) are screwed for fixing purposes on to the ends of the screw bolts 23, which project into the interior of the stiffening shoes 11.

A building element which is generally identified by 101 in Figures 12 and 13 comprises a panel 102 which is arranged horizontally in the position of use. Provided in the corner regions of the panel are support elements which extend transversely with respect to the plane of the panel. The support elements are diagrammatically shown in Figure 13 and are identified therein by 103, 104 and 105. At the corners the building element has respective recesses in the form of bevels 106 to 109.

The panel 102 has an upper embedding region 110 and a lower embedding region 111. The embedding regions 110 and 111 comprise concrete or the like.

The panel is further provided with a reinforcement. That reinforcement comprises edge ribs 113, 114, 115 and 116 extending along the edges of the panel and mutually intersecting diagonal ribs 117 and 118. Embedded in the ribs 113 to 118 are lattice bearers which at least at the ends have loop-like end portions 119 to 130 which extend substantially horizontally in the position of use. Moreover the lattice bearers have per se known lattices 131 (see Figure 13). The point of intersection of the lattice bearers of the diagonal ribs 117 and 118 is identified by 132. The lattice bearers are each embedded in concrete and in that way form the edge ribs 113, 114, 115 and 116, and the diagonal ribs 117 and 118. In addition the edge ribs and the diagonal ribs are connected to the upper embedding region 110 and the lower embedding region 111, more specifically by virtue of that connection being made during production by pouring and compacting of the concrete.

In the corner regions the building element has stiffening shoes 133, 134, 135 and 136 of metal. Figure 14 shows the corner illustrated at top right in Figure 12, with the stiffening shoe 133 which has the bevel 106. For connecting individual building elements 101 together with further building elements, the stiffening shoes provided at the respective corners are screwed at angle members 137 and 138 to corresponding angle members of adjoining stiffening shoes of adjoining building elements. The screws are diagrammatically indicated at 139 and 140 in Figure 14. The stiffening shoes also each have a top plate (not shown in Figure 14) which is substantially horizontal in the position of use and a bottom plate 141. The top plate and the bottom plate each have openings 142, 143, 144 and 145 for mounting one of the support elements 103, 104 and 105. The stiffening shoes also have suspension devices for suspension of the loop-like end portions of the edge ribs of the diagonal ribs. In Figure 14 the loop-like end portions 120 and 121 of the edge ribs 113 and 114 and the loop-like end portion 128 of the diagonal rib 118 are shown in diagrammatic form. The loop-like end portions 120, 121 and 118 respectively are suspended in suspension devices 146, 147 and 148 on the stiffening shoe 133. Then, the suspension regions were embedded in concrete in production of the building element 101 so that a fixed connection was produced in that way.



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CLAIMS

1. A building element for erecting buildings, parts of buildings or the like comprising at least one panel which is horizontal in the position of use and which has a reinforcement (7), wherein the reinforcement (7) is in the form of a space frame structure and a portion of the reinforcement (7) is embedded into an upper embedding region (8) and provided in the corner regions of the panel are support elements (4) which extend transversely with respect to the plane of the panel, and stiffening shoes (11) which are connected to the reinforcement (7) are arranged in the corner regions of the panel for connecting the panel to the support elements, wherein the stiffening shoes each comprise a top plate (13) arranged parallel to the panel and a bottom plate (14) arranged parallel to the panel and a plurality of web plates (15, 16, 17, 18, 19, 20) which space the top and bottom plates, and wherein provided in the stiffening shoes (11) is at least one respective passage (21) which is open to the interior region of the reinforcement (7) and to the corner.

2. A building element according to claim 1 characterised in that the portion of the reinforcement (7) which is towards the underside of the panel in the position of use is also embedded into a lower embedding region (9) which extends over the plane of the panel.

3. A building element according to claim 1 or claim 2 characterised in that the reinforcement (7) which is a space frame structure is in the form of a bearer grid comprising lattice bearers with force-lockingly connected intersection points.

4. A building element according to claim 3 characterised in that the intersection points are welded.



5. A building element according to one of claims 1 to 4 characterised in that the building element has recesses at the respective corners.

6. A building element according to claim 5 characterised in that the recesses are in the form of bevels (6) in the corners of the panel (3, 3a, 5).

7. A building element according to claim 5 or claim 6 characterised in that the support elements (4) have recesses which are continuous in the longitudinal direction at their outer regions which are towards the corners.

8. A building element according to claim 7 characterised in that the recesses are in the form of bevels.

9. A building element according to claim 7 or claim 8 characterised in that the support elements (4) are arranged to butt force-lockingly against each other in a storey-wise manner at their ends.

10. A building element according to one of claims 1 to 9 characterised in that the reinforcement has edge ribs (113, 114, 115, 116) extending along the edges of the panel and mutually intersecting diagonal ribs (117, 118).

11. A building element according to claim 10 characterised in that the edge ribs (113, 114, 115, 116) and the diagonal ribs have lattice bearers which are embedded in concrete or the like and the lattice bearers are fixedly connected to each other and to the stiffening shoes respectively at the intersection points (132) of the



diagonal ribs (117, 118) and at the points of connection with stiffening shoes (134, 134, 135, 136) provided in the corner regions of the panel (102), by embedding of the intersection points and the connecting points in concrete or the like.

12. A building element according to claim 11 characterised in that the stiffening shoes have hook-like suspension devices (146, 147, 148) for the suspension of loop-like end portions (119 to 130) of the lattice bearers.