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(54) METHOD FOR MANUFACTURING SEMI-FINISHED ELEMENTS AND SEMI-FINISHED ELEMENTS

(57) A method of manufacturing a semi-finished element (6), comprises the steps of:
(a) Producing or providing a grid formwork element (1) wherein the grid formwork element (1) has a central region (Z) between a first grid side (2) and a second grid side (3), the second grid side (3) being arranged opposite the first grid side (1);
(b) Application of a layer of hydraulically settable composition (7), especially settable concrete, from an outside of the grid formwork element to the first grid side (2), in such a way that the first grid side (2) is embedded in the hydraulically settable composition, so that at least the central region of the grid formwork element remains free of the hydraulically settable composition, and, in particular, with the second grid side (3) projecting out of the layer of the hydraulically settable composition (7).

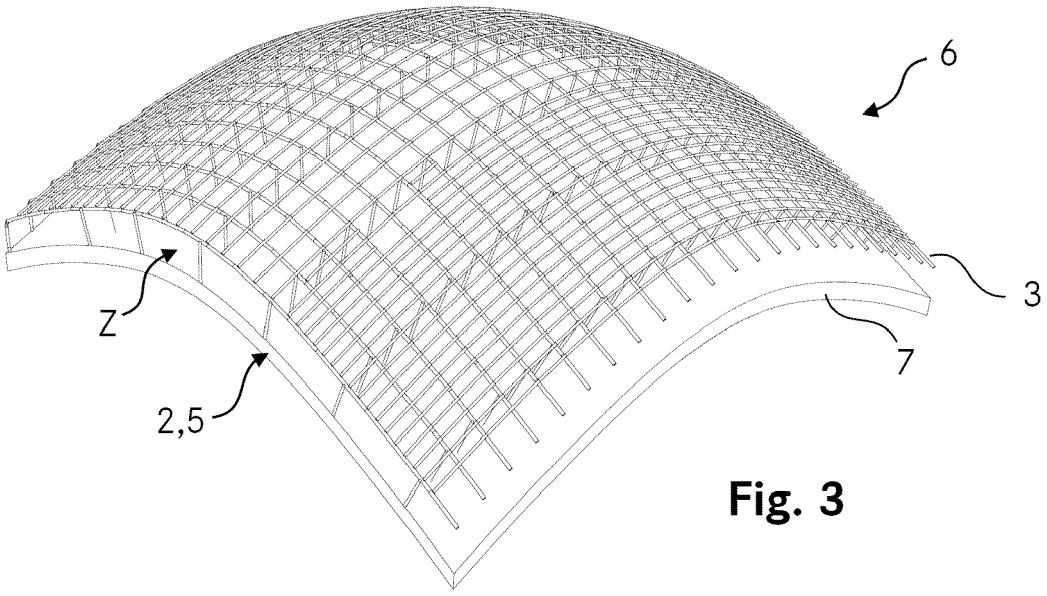

Fig. 3

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Description

Technical field

[0001] The invention relates to a method of manufacturing a semi-finished element, a semi-finished element and the use of a grid formwork element in the production of a semi-finished element.

Prior art

[0002] Semi-finished elements, also called filigree elements, are pre-fabricated elements usually made of concrete and steel reinforcement. Semi-finished elements comprise a first side made of casted concrete and an opposing side with protruding reinforcement elements. The protruding reinforcement elements are provided as connecting reinforcement, which allows for connecting the semi-finished element with other parts of as structure upon installation. Semi-finished elements based on other hydraulically settable compositions than concrete and reinforcement materials different from steel are known as well.

[0003] Semi-finished elements usually are pre-fabricated in a factory and then they are transported to a job site and erected, e.g. on a temporary shoring. Subsequently, at the second side of the semi-finished element with the protruding reinforcement elements, another layer of concrete, optionally with further reinforcement, is poured in order to produce a final structure such as e.g. a floor, a wall or a ceiling of a building.

[0004] Thus, semi-finished elements allow for producing structures from two interconnected concrete placements. This process effectively accelerates the construction of structures by eliminating the need for costly and time-consuming field forming, and the placing of reinforcements.

[0005] DE 38 07 517 A1 describes for example a method for the production of a semi-finished element, in which a first reinforcement is laid on a temporary formwork and a first concrete layer is applied on top of it. The shell formed after hardening is transported to its final position with a temporary stiffening element. Here, a final shell is then produced by laying a second reinforcement and applying a second layer of concrete.

[0006] The disadvantage of this known procedure inter alia is that a dedicated formwork and support structures are required, which makes production costly and inflexible. Furthermore, due to the low stiffness of the semi-finished element, production must take place at the point of use, so that after minimal transport to the final position, the finished element can be completed at the same place immediately.

Disclosure of the invention

[0007] It is therefore an object of the invention to provide an improved solution for manufacturing semi-finished elements. Especially the solution should allow for manufacturing semi-finished elements more efficiently and flexibly. In particular, it is also an object of the invention to provide a semi-finished element which is so stable that it can be prefabricated in a factory and then transported to the construction site, for example by truck.

[0008] The solution to the problem is defined by the features of the independent claims. Especially preferred embodiments are the subject of dependent claims and/or described in the following.

[0009] A first aspect of the invention is directed to a method for manufacturing a semi-finished element, which comprises the following steps:

(a) Producing or providing a grid formwork element wherein the grid formwork element has a central region between a first grid side and a second grid side, the second grid side being arranged opposite the first grid side;

(b) Application of a layer of hydraulically settable composition, especially settable concrete, from an outside of the grid formwork element to the first grid side, in such a way that the first grid side is embedded in the hydraulically settable composition and at least the central region of the grid formwork element remains free of the hydraulically settable composition, and, in particular, with the second grid side projecting out of the layer of the hydraulically settable composition.

[0010] The advantages of the invention lie in particular in the fact that semi-finished elements can be produced without need for additional formwork and lavish removal of formwork. Thus, the grid formwork element can be used both as reinforcement and as lost formwork for the layer of the hydraulically settable composition.

[0011] Moreover, the shape of the semi-finished element can be chosen essentially freely by appropriately designing the grid formwork element. Thus, even curved shapes can be realized without need for elaborate design or formwork support. Thus, the production of semi-finished elements is greatly simplified compared to known techniques for producing semi-finished elements, for which reusable moulds or formwork are required.

[0012] Also, the semi-finished element obtainable by the inventive method can be manufactured as mechanically stable elements, which can be transported more easily and safely to the a construction site.

[0013] Furthermore, the inventive method inter alia allows to produce double walled semi-finished elements with the layer of the hydraulically settable composition at the first grid side and a further layer of a hydraulically settable composition at the second grid side and a free central region. In this case, the hydraulically settable composition can for example be applied simultaneously at the first and the second grid side, which results in a faster manufacturing process. Thereby, the shape of the

first and the second grid side may be the same or different.

[0014] The layer of hydraulically settable composition is applied to the first grid side from the outside in such a way that the central region of the grid formwork element, and optionally the second grid side, remain(s) free of the hydraulically settable composition.

[0015] In the present context, in particular, the expression "application of a layer of hydraulically settable composition from an outside of the grid formwork element to the first grid side" means that the hydraulically settable composition is applied from a region next to the first grid side facing away from the second grid side.

[0016] Especially, a thickness of the layer of hydraulically settable composition applied to the first grid side is about 5 - 60%, in particular 10 - 50%, especially 20 - 40Y, of the overall thickness of the semi-finished element. Thereby, in particular, the thickness is measured in a direction perpendicular to the layer of hydraulically settable composition applied on the first.

[0017] For example, a thickness of the layer of hydraulically settable composition applied to the first grid side is from 1 - 40 cm, in particular from 3 - 20 cm or 4 - 12 cm. An overall thickness of the semi-finished element is for example 7 - 100 cm, in particular 10 - 50 cm, especially 15 - 40 cm.

[0018] According to another preferred embodiment, the layer of hydraulically settable composition is applied to the first grid side and a further layer of a hydraulically settable composition is applied to the second grid side from the outside in such a way that the central region of the grid formwork element remains free of the hydraulically settable composition. With this approach, a double walled semi-finished element can be produced.

[0019] In particular, the grid formwork element has a three-dimensional structure, which functions simultaneously as a reinforcement and as a lost formwork.

[0020] Especially preferred, the grid formwork element is a self-supporting element and/or as an element stable in shape. This in particular means that the grid formwork element, regardless of how it rests on a support, keeps its shape without additional support.

[0021] In particular, the two grid sides are designed as two interconnected grids. In particular, the first grid side and the second grid side are connected to each other at a distance from each other by a plurality of bridging elements and/or webs.

[0022] In an exemplary embodiment, the two grids are connected to each other in such a way that they run substantially parallel to each other. In an exemplary embodiment, the grids are substantially planar or substantially curved or substantially uneven.

[0023] In an exemplary embodiment, a distance between the two grids is between 5 and 100 cm, preferably between 10 and 80 cm, particularly preferably between 15 and 50 cm.

[0024] In an exemplary embodiment, bars forming the grids are aligned substantially horizontally and vertically. In an alternative embodiment, the bars of the grids are oriented substantially diagonally to a horizontal and a vertical direction.

[0025] Especially, openings (meshes) of the first grid side are configured such that the layer of the hydraulically settable composition is prevented from penetrating to the central region and/or the second grid side. Thereby, preferably, openings of the first grid side are adapted to the hydro-static pressure of the hydraulically settable composition or vice versa. Especially such that the hydraulically settable composition accumulates in such a way that the first grid side becomes embedded in the hydraulically settable composition, whereas the central region and/or the second grid side remain free of the hydraulically settable composition.

[0026] In particular, openings (meshes) of the second grid side are adapted to the hydrostatic pressure of a cast-in-place hydraulically setting composition, e.g. used on a job site, in such a way that the cast-in-place hydraulically setting composition does not flow through the openings of the second grid side after filling it into the central area. Thereby, preferably, the second grid side is embedded in the cast-in-place hydraulically setting composition and the latter is reinforced by the steel of the second grid side and optionally bridging element, e.g. webs.

[0027] This allows for example to produce a prefabricated element from a semi-finished element, e.g. on a job site. The cast-in-place hydraulically setting composition may have the same or a different composition than the hydraulically setting composition used in step (b) of the inventive method.

[0028] In particular, the first grid side is more closely meshed than the second grid side. This is a highly beneficial solution for preventing the hydraulically settable composition from penetrating to the central region and the second grid side. Nevertheless, when producing the final structure from the semi-finished element by placing further cast-in-place hydraulically setting composition on a job site, the semi-finished element can be embedded effectively.

[0029] Especially, the grid formwork element is at least partly, especially fully, made of reinforcing steel, especially by welding together reinforcing steel elements, especially bars, e.g. by at least one robot. However, the grid formwork element can also be made at least partly, especially fully, of synthetic material.

[0030] In some embodiments, the grid formwork element is welded together from reinforcing steel, especially by at least one robot.

[0031] In particular, reference is made to European patent application EP 3 042 008 A1, in which a manufacturing process for grid formwork elements are described.

[0032] According to another preferred embodiment, at least one limiting element is provided, in special cases a plurality of limiting elements may be provided, which are arranged adjacent to the first grid side, such that the

hydraulically settable composition is prevented from penetrating to the central region and/or to the second grid side and accumulates in such a way that the first grid side becomes embedded.

[0033] In particular, "adjacent to the first grid side" means that the limiting element is arranged directly on the first side of the grid or at a distance from the first grid side of 1 - 60%, in particular 5 - 50%, especially 20 - 40Y, of the thickness of the grid formwork element.

[0034] Especially, the limiting element is arranged directly on the first grid side or at a distance from the first grid side of no more than 10 cm, especially no more than 6 cm. A minimum distance is for example 0.5 cm, especially 1 cm or 3 cm.

[0035] In particular, the limiting element is arranged between the first grid side and the second grid side. Preferably, the limiting element is arranged adjacent to the first grid side, especially in direct contact with the first grid side.

[0036] In particular, the limiting element is attached to the grid formwork element, especially in a form-fit, force-fit and/or material-fit manner. For example, the limiting element is adhesively bonded, tied, welded and/or otherwise attached to the first grid side and/or to the bridging elements and/or webs.

[0037] In some embodiments, the limiting element is a formwork insert, especially arranged inside the grid formwork element adjacent to the first grid side.

[0038] In particular, the limiting element can be a plate, especially a plate of synthetic and/or insulating material. In this way, the function of local limitation of the layer of the hydraulically settable composition can be combined with an increase in the insulation value.

[0039] In some embodiments, an additional grid is used as a limiting element, which is in particular more closely meshed than the first grid side of the grid formwork element.

[0040] With such grid elements, usually, a rear surface of the layer the hydraulically settable composition becomes relatively rough. This allows for a better bonding with cast-in-place hydraulically settable compositions during installation of the semi-finished element.

[0041] In some embodiments, the additional grid is an expanded mesh. In particular, the expanded mesh can be an expanded metal and/or it can be made of a synthetic material in such a way that it takes the form of an expanded metal.

[0042] In particular, expanded metals are to be understood as a type of sheet metal which has been cut and stretched to form a regular mesh pattern.

[0043] Especially, expanded metals are sheets that are provided in rows with short successive continuous cuts offset from those of the neighboring row and are then pulled apart (stretched) perpendicular to the cuts. When stretched, diamond-shaped holes are created at the intersections, which is why the expanded metal looks like a net with diamond-shaped meshes. The mesh bars turn out of the plane during stretching, so that the thickness of the expanded metal is greater than that of the original sheet. As an alternative to diamond meshes, expanded metal with long bar meshes, hexagon meshes, round meshes, square meshes can also be used.

[0044] In particular, the grid formwork element, optionally comprising the limiting element, is the only formwork present when applying the layer of hydraulically settable composition. Thus, no other formwork is required.

[0045] Especially, the grid formwork element is an uneven and/or curved grid formwork element, whereby, preferably, an outer surface of the first grid side has a concave shape and/or an outer surface of the second grid side has a convex shape or vice versa. With the inventive method, the shape of the semi-finished element can be directly controlled by the shape of the grid formwork element.

[0046] Thus, in particular, the semi-finished element is an uneven and/or curved filigree element, in particular made of the reinforced hydraulically settable composition, especially reinforced concrete, whereby, preferably, an outer surface of the hydraulically settable composition has a concave shape and/or convex shape.

[0047] In particular, however, it can also be a non-curved filigree element, especially a straightsurfaced or stepped filigree element.

[0048] Whether curved or non-curved, the semi-finished element can be a ceiling element, a wall element, a floor element, a stair element or a mixed element consisting of at least two of the aforementioned elements.

[0049] In principle, the hydraulically settable composition can be applied by any know method.

[0050] In particular, the hydraulically settable composition can be applied by a shotcrete application process to the first grid side.

[0051] According to another preferred embodiment, the hydraulically settable composition, especially a concrete, can be applied by a 3D printing robot.

[0052] However, the hydraulically settable composition can also be applied manually.

[0053] Especially, the hydraulically settable composition can be applied, e.g. in the form of a mortar or concrete, from above to the first grid side if the grid formwork element is arranged so that the first grid side faces substantially upwards.

[0054] The invention also relates to a method comprising the steps of (i) producing a semi-finished element by a method according to the description herein, and (ii) after the hardening of the layer of hydraulically settable mixture, filling the central area, and optionally embedding the second grid side, of the produced semi-finished element with a cast-in-place hydraulically setting composition.

[0055] Thereby, in particular, the semi-finished element can be completed and/or assembled into a prefabricated element for a building, e.g. a floor, a ceiling and/or a wall element for a building.

[0056] Also, the semi-finished element can be completed and/or assembled into a building structure, e.g. a

floor, a ceiling and/or a wall of a building or a part thereof.

[0057] A time interval between the hardening and the filling of the central area, and optionally embedding the second grid side, of the produced semi-finished element with a cast-in-place hydraulically setting composition may for example be from 1 minute to 3 years, especially from 5 days to 1 year, in particular from 14 days to 6 months.

[0058] In particular, steps (i) and (ii) mentioned above take place at a different location. In a special embodiment, the semi-finished element in step (i) is produced in a factory hall, whereas step (ii) takes place on a construction site. In this case, the basic shape of the element can be prepared in advance under weather-independent conditions, with only the assembly and completion of the element then taking place later on the construction site. These latter steps are less susceptible to difficult weather conditions. In addition, considerable transport costs are saved compared to preparing the complete precast element.

[0059] In the present context, a "hydraulically settable composition" and "a cast-in-place hydraulically settable composition" is meant to be a composition comprising a mineral binder and optionally aggregates and/or additives.

[0060] The term "mineral binder" refers in particular to a binder, which in the presence of water reacts in a hydration reaction under formation of solid hydrates or hydrate phases. It may be, for example, a hydraulic binder (e.g., cement or hydraulic lime), a latently hydraulic binder (e.g., slag), a pozzolanic binder (e.g., fly ash), or a non-hydraulic binder (e.g., plaster or calcium lime).

[0061] In particular, the mineral binder comprises a hydraulic binder, preferably cement. Preferably, the cement is of the type CEM I, CEM II, CEM III, CEM IV, CEMV (according to standard EN 197-1) or a calcium aluminate cement (according to the standard EN14647:2006-01) or a calcium sulphoaluminate cement or a mixture thereof. Of course, cements produced according to relevant alternative standards, for example ASTM or Chinese standards, are likewise suitable.

[0062] A proportion of the hydraulic binder in the total mineral binder is advantageously at least 5% by weight, in particular at least 20% by weight, preferably at least 50% by weight and especially at least 75% by weight. According to a further advantageous embodiment, the mineral binder is made up of 100% hydraulic binder, in particular cement.

[0063] However, it can also be advantageous if the mineral binder comprises other binders in addition to or instead of a hydraulic binder. These are in particular latent hydraulic binders and/or pozzolanic binders. Suitable latent hydraulic and/or pozzolanic binders are e.g. slag, fly ash and/or silica fume. Likewise, the binder composition may include inert substances such as e.g. limestone powder, quartz powder and/or pigments.

[0064] Additionally, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition may comprise one or more additives, especially chosen from the group consisting of rheology modifiers, viscosity modifiers, thickeners, accelerators, retarders, defoaming agents, plasticizers and superplasticizers.

[0065] The admixture of such additives, especially accelerators, has the advantage that the processing properties of the hydraulically settable composition and/or the cast-in-place hydraulically settable composition can be adjusted to the specific needs for the present inventive method.

[0066] For example, the compositions may be adjusted to set more quickly after application and/or the viscosity of the composition is adjusted such that it does not flow through grid openings.

[0067] In particular, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition may have a mineral binder content, especially a cement content, of from 360 to 510 kg/m^3 , preferably from 400 to 470 kg/m^3 , more preferably from 420 to 450 kg/m^3.

[0068] In another embodiment, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition comprises aggregates, especially with a maximum grain size of 20 mm, especially a maximum grain size of 8 mm, preferably a maximum grain size of 6 mm, particularly preferably a maximum grain size of 4 mm. A minimum grain size of the aggregates is for example 0.1 mm, especially 0.7 mm, or 1 mm.

[0069] In an exemplary further embodiment, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition has a water-cement ratio of 0.25 - 0.60, preferably of 0.27 - 0.55, particularly preferably of 0.3 - 0.50.

[0070] Especially, the hydraulically settable composition and the cast-in-place hydraulically settable composition are different in terms of composition. However, they may have the same composition for special applications.

[0071] In particular, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition can be a shotcrete composition.

[0072] In an exemplary further development, the hydraulically settable composition and/or the cast-in-place hydraulically settable composition is a concrete composition. Thereby, especially, the compositions have an aggregate with a maximum particle size of 20 mm, preferably of 15 mm, particularly preferably of 10 mm. In an exemplary further embodiment, the concrete composition has a water-cement ratio of 0.25 - 0.60, preferably of 0.27 - 0.55, particularly preferably of 0.3 - 0.50.

[0073] In particular, when filling the central region of the grid formwork element, and optionally embedding the second grid side, the cast-in-place hydraulically settable composition is introduced between the second grid side and the hardened layer of the hydraulically settable composition in which the first grid side is embedded. For example, the cast-in-place hydraulically settable composition can be introduced into the central region from above or from one side.

[0074] In an alternative embodiment, the cast-in place hydraulically settable composition is introduced through the second grid side when filling of the grid formwork element. In particular, the filling location can be changed during the filling process.

[0075] The invention further relates to a semi-finished element, in particular manufactured by a method according to the description herein, which comprises:

(a) a grid formwork element with a central region between a first grid side and a second grid side, the second grid side being arranged opposite the first grid side, and

(b) a layer of hydraulically settable composition, especially in hardened state, is arranged such that the first grid side is embedded in the hydraulically settable composition, so that at least the central region of the grid formwork element is free of the hydraulically settable composition, and, in particular, the second grid side projects out of the layer of the hydraulically settable composition.

[0076] In particular, this semi-finished element according to the invention is intended to be manufactured in a factory hall, whereby it is transported to its destination, e.g. to a building construction site, after hardening of the layer of the hydraulically settable composition.

[0077] As previously described, the semi-finished element can then be completed into a prefabricated element by filling the central region, and optionally embedding the second grid side, with a cast-in-place hydraulically settable composition. In this way, the basic shape of the element can be prepared in advance under weather-independent conditions, with only the assembly and completion of the element then taking place later on the construction site.

[0078] Thus, a further aspect of the present invention is directed to a prefabricated element comprising a semi-finished element as described above.

[0079] Likewise, the semi-finished element can be completed and/or assembled into a building structure, e.g. a part of a floor, a ceiling and/or a wall of a building.

[0080] A still further aspect of the invention therefore is related to a building, comprising a semi-finished element and/or prefabricated element as described above.

[0081] Furthermore, the present invention is related to the use of a grid formwork element as described herein as reinforcement and as lost formwork in the production of a semi-finished element as described herein.

[0082] Further advantageous embodiments and combinations of features of the invention result from the following detailed description and the totality of the patent claims.

Brief description of the drawings

[0083] The drawings used to explain the embodiment show:

Fig. 1 an exemplary grid formwork element with a first grid side and a second grid side opposite the first grid side;

Fig. 2 the grid formwork element from Fig. 1 with an inserted limiting element; and

Fig. 3 a semi-finished element made from the grid formwork element with the inserted limiting element shown in Fig. 2.

[0084] In principle, the same parts are given the same reference signs in the figures.

Ways of carrying out the invention

[0085]

Fig. 1 shows an exemplary grid formwork element 1 made of steel with a first grid side 2 and a second grid side 3 opposite the first grid side 2. In this example, the first grid side 2 and the second grid side 3 are curved grids welded together from intersecting steel bars. The first grid side 2 and the second grid side 3 are welded to each other via webs 4 so that a distance is always maintained between the grids, which defines the central area Z, i.e. the interior of the grid formwork element 1.

Fig. 2 shows the grid formwork element from Fig. 1 with an limiting element 5 in the form of an additional grid was inserted (= formwork insert). The additional grid is more closely meshed than the first grid side 2 of the grid formwork element 1. The limiting element 5 has been inserted laterally and is in direct contact with the entire first grid side 2 and are fixed there, e.g. with wires (not shown).

Fig. 3 shows a semi-finished element 6 or curved filigree element, respectively, which was produced from the grid formwork element 1 comprising the limiting element 5 as shown in Fig 2. Thereby shotcrete 7 was applied as a layer of hydraulically settable composition from an outside region (from below in Fig. 2) to the first grid side 2 and was allowed to harden. The consistency of the shotcrete 7 was adjusted such that it did not flow through openings of the additional grid or the limiting element 5, respectively.

[0086] The shotcrete 7 adheres to the limiting element 5 due to its tight mesh and has embedded the first grid side 2. The second grid side 3 as well as the majority of the webs 4 protrude from the concrete layer 7. The semi-finished element 6 is stable as such an can be transported to a construction site for installation or it can be

used to produce a prefabricated element whereby the central area Z and the second grid side 2 is filled and embedded in a cast-in place hydraulically settable composition.

[0087] Thus, the grid formwork element 1 comprising the limiting element 5 functions as a three-dimensional structure functions simultaneously as a reinforcement and as a lost formwork.

[0088] While a particular embodiment of the invention has been described, it is apparent to one skilled in the art that various variations and alternatives to the details described could be developed in the light of the disclosure as a whole. Accordingly, the particular arrangement disclosed herein is intended only as an explanation and not as a limitation of the scope of protection of the invention given by the following claims and all their equivalents.

[0089] For example, instead or in addition of an additional grid, the limiting element 5 can comprise a plate, especially a plate of synthetic and/or insulating material. Also, it is possible to arranged the limiting element 5 at a distance from the first grid side 2 to increase the thickness of the layer of shotcrete layer 7.

[0090] Likewise it is possible to apply another layer of hydraulically settable composition on the second grid side 3 to obtain a double walled semi-finished element. In this case a further limiting element may be attached to the second grid side 3 to prevent the hydraulically settable composition from filling the central region Z.

[0091] Instead of a purely curved shape, the semi-finished element can have any other shape, e.g. a flat shape or a more complex shape with flat, curved and/or step-like regions.

Claims

1. A method of manufacturing a semi-finished element (6), comprising the steps of:

(a) Producing or providing a grid formwork element (1) wherein the grid formwork element (1) has a central region (Z) between a first grid side (2) and a second grid side (3), the second grid side (3) being arranged opposite the first grid side (1);

(b) Application of a layer of hydraulically settable composition (7), especially settable concrete, from an outside of the grid formwork element to the first grid side (2), in such a way that the first grid side (2) is embedded in the hydraulically settable composition, so that at least the central region of the grid formwork element remains free of the hydraulically settable composition, and, in particular, with the second grid side (3) projecting out of the layer of the hydraulically settable composition (7).

2. Method according to claim 1, wherein a limiting element (5) is arranged adjacent to the first grid side (2) and/or a mesh size of the first grid side (2) is configured such that the layer of the hydraulically settable composition (7) is prevented from penetrating to the central region and/or the second grid side (3).

3. Method according to any of preceding claims, wherein the first grid side (2) is more closely meshed than the second grid side (3).

4. The method according to any of claims 2-3, wherein the limiting element (5) is an additional grid, which is in particular more closely meshed than the first grid side of the grid formwork element (1).

5. Method according to any of claims 2-4, wherein the limiting element is a formwork insert arranged inside the grid formwork element adjacent to the first grid side.

6. Method according to any of preceding claims, wherein the grid formwork element, optionally comprising the limiting element, is the only formwork present when applying the layer of hydraulically settable composition.

7. Method according to one of the preceding claims, wherein the grid formwork element is a curved grid formwork element, whereby, preferably, an outer surface of the first grid side has a concave shape and/or an outer surface of the second grid side has a convex shape or vice versa.

8. Method according to one of the preceding claims, wherein the semi-finished element (6) is a curved filigree element, in particular made of reinforced hydraulically settable composition, especially reinforced concrete, whereby, preferably, an outer surface of hydraulically settable composition has a concave shape and/or convex shape.

9. Method according to any one of the preceding claims, wherein the grid formwork element (1) has a three-dimensional structure which functions simultaneously as a reinforcement and as a lost formwork.

10. Method according to one of the preceding claims, wherein the layer of hydraulically settable composition is applied to the first grid side (2) and a further layer of a hydraulically settable composition is applied to the second grid side (3) in such a way that the central region (Z) of the grid formwork element (1) remains free of the hydraulically settable composition to produce a double walled semi-finished element.

11. Method according to one of the preceding claims,

comprising the steps of (i) producing a semi-finished element (6) by a method according to any of preceding claims and (ii), after the hardening of the layer of hydraulically settable mixture, filling the central area (Z), and optionally embedding the second grid side (3), of the produced semi-finished element (6) with a cast-in-place hydraulically setting composition.

12. Method according to claim 11, whereby in step (ii) a prefabricated element for a building, e.g. a floor, a ceiling and/or a wall element for a building, is produced from the semi-finished element (6).

13. Method according to claim 11, whereby in step (ii) the semi-finished element (6) is completed into a building structure, e.g. a floor, a ceiling and/or a wall of a building.

14. Semi-finished element (6), in particular produced by a method according any of preceding claims, having:

(a) a grid formwork element (1) with a central region (Z) between a first grid side (2) and a second grid side (3), the second grid side (3) being arranged opposite the first grid side (1), and
(b) a layer of hydraulically settable composition (7), especially in hardened state, is arranged such that the first grid side (2) is embedded in the hydraulically settable composition, so that at least the central region of the grid formwork element is free of the hydraulically settable composition, and, in particular, the second grid side (3) projects out of the layer of the hydraulically settable composition.

15. Use of a grid formwork element as defined in any of preceding claims as reinforcement and as lost formwork in the production of a semi-finished element.

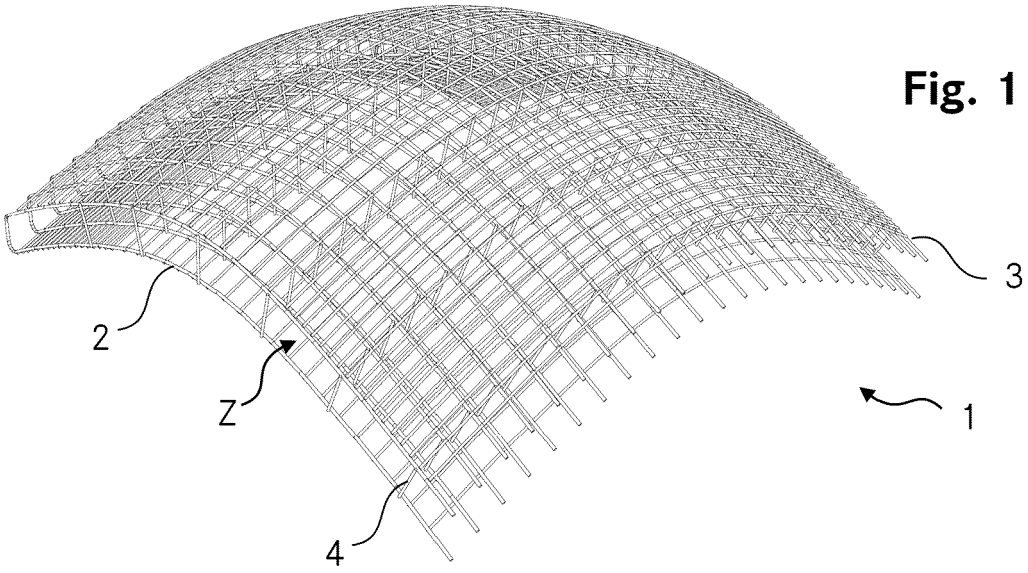

Fig. 1

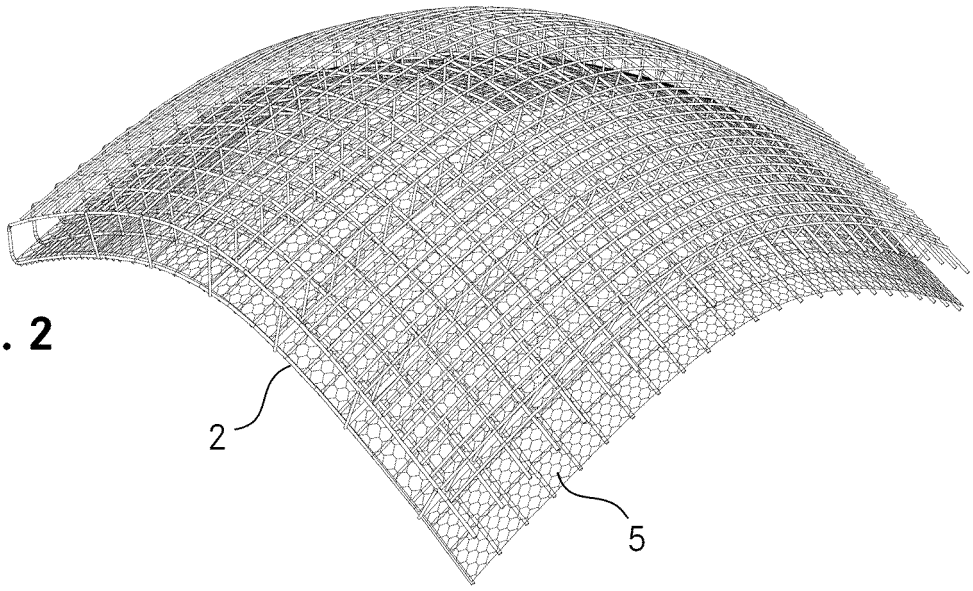

Fig. 2

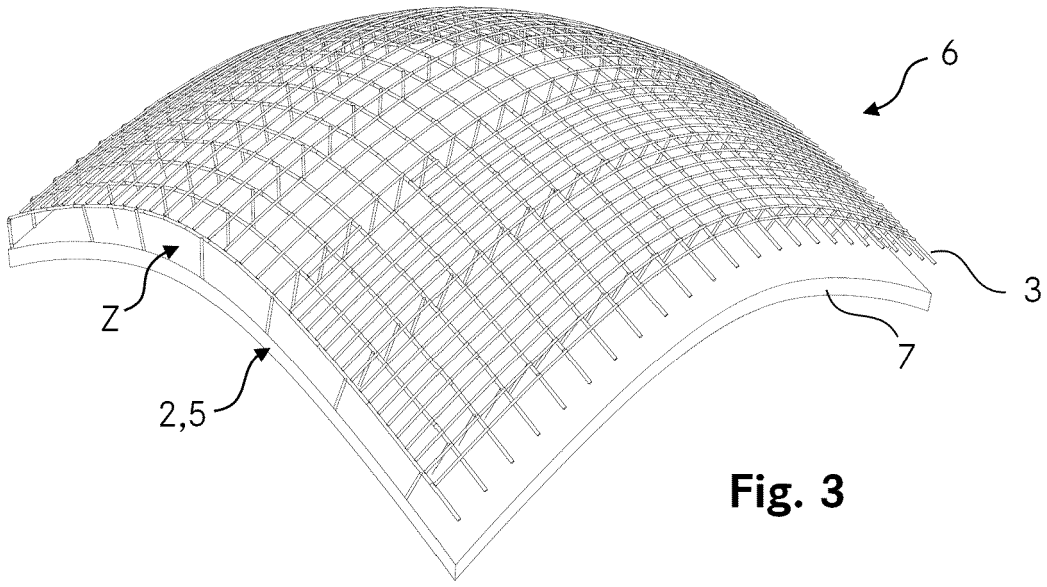

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 4883

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Place of search	Date of completion of the search	Examiner
The Hague	20 October 2023	Orij, Jack

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