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(54) **Method for the production of a steel plate concrete floor**

Verfahren zur Herstellung einer Stahlblechbetondecke

Procédé pour la fabrication d'un plancher en béton et tôle d'acier

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Description

The invention relates to a method for the production of a steel plate concrete floor, comprising: placing tensioning elements made of steel or other elastic material in the lengthwise direction of a steel plate, pouring concrete mortar onto the steel plate such that such tensioning elements are embedded in the concrete mortar, and placing the tensioning elements under a tensile load.

Such a method is disclosed in US-A-4809474.

As a consequence of the presence of the tensioning elements, the steel plate concrete floor produced by such a method can span a considerable length without the concrete being subjected to too great a tensile load under the influence of weight.

The object of the present invention is to may give the tensioning elements such an accurately determined position in the concrete that the tensioning elements have an optimal effect.

For this purpose, the method mentioned in the preamble is characterised in,

- that before the concrete mortar is poured pipes for recessing channels in the concrete are placed over the steel plate in the lengthwise direction thereof,
- that before or after pouring of the concrete mortar, tensioning elements are guided through said channels,
- that after setting of the concrete the tensioning elements are placed under a tensile load,
- that the ends of the tensioning elements, after being placed under a tension load, are anchored in the concrete so that the pressure load is transmitted from the anchoring places of the tensioning elements into the concrete and the steel plate,
- that for the purpose of increasing the adhesion between concrete and steel, the steel plate is provided beforehand with anchoring elements projecting from the plane of the steel plate.

If tensile forces are to be expected near certain positions at the lower surface of the floor the tensioning elements extend near the lower surface whereas if tensioning elements are to be expected near certain positions at the upper surface of the floor the tensioning elements extend near the upper surface. The pipes for recessing channels make this accurate positioning possible.

The tensioning elements can be, for example, bars, wires or bunches of wires which can be made of steel or glas such as fibres which may or may not be embedded in epoxy resin, plastic such as aromatic polyamide filaments which may or may not be embedded in epoxy resin, or carbon fibres which may or may not be embedded in epoxy resin.

Parallel rectilinear tensioning elements which are pre-tensioned can be fitted at different levels in the thickness of the concrete. The same or better results can, however, be achieved with fewer tensioning elements if the pipes and the tensioning elements guided through these pipes extend in a wavy form through the concrete, the wave valleys being situated approximately halfway between the places where the floor is to be supported permanently in a building.

The steel plate can also be subjected to a tensile load in the lengthwise direction before the concrete mortar is poured by, for example, applying tensile forces to the ends. After setting of the concrete, the forces are removed from the ends.

The method according to the invention could be applied to the production of prefab floor elements, but it is pre-eminently suitable for application to construction itself for the production of extended floors, for example with a total length of 40 meters and spans of, for example, 10 meters. For this, the steel plate is supported at at least two opposite-lying edges by supporting elements of a building and between them by a number of temporary additional bearing elements such as screw jacks, the concrete mortar is poured onto the steel plate serving as the formwork element, and the above-mentioned additional bearing elements are removed after setting and pre-stressing of the concrete.

The anchoring elements are preferably made of studs rolled into the steel plate. These studs prevent the steel plate and the concrete from shifting relative to each other. The inside of the studs can be used at the bottom side of the floors for suspending ceilings, lines of cables and pipes and the like.

It is remarked that FR-A-2233464 discloses a beam comprising concrete and pre-tensioned tensioning elements. The ends of the tensioning elements are anchored in the set concrete. However, there is no talk of the tensioning elements being guided through pipes for recessing channels in the concrete.

The invention will now be explained with reference to the figures.

Figure 1 shows a perspective view of a floor produced according to the invention, in which the concrete is shown partially cut away.

Figure 2 shows a longitudinal section through a building under construction with a floor according to the invention.

The floor shown in Figure 1 has a steel plate 1 with a crenellated profile extending at right angles to the lengthwise direction thereof, on which a layer of concrete 2 is poured. In order to improve the adhesion of the concrete to the steel plate, the latter is provided with projecting anchoring elements in the form of studs 3 rolled into the steel plate.

Before the concrete mortar is poured, form-retaining pipes 4 or the like are fitted over the steel plate in the lengthwise direction of the profile, through which tensioning elements 5 are guided before or after pouring of the concrete mortar. After setting of the concrete the tensioning elements 5 are pre-tensioned, and the ends of the tensioning elements are anchored in the concrete

by means of anchoring elements 6. Resin or mortar is injected into the pipes 4 for the purpose of anchoring and/or protection.

Another possibility of pre-tensioning is the use of virtually rectilinear tensioning elements running in the lengthwise direction of the steel plate floor virtually parallel to each other and at different levels in the thickness, which elements are not fitted in pipes. These tensioning elements are pre-tensioned before the concrete is poured by applying temporary forces to the ends, and the pre-tensioning is removed from the ends of the tensioning elements after the setting of the concrete, as a result of which the concrete is pre-stressed through the adhesion of concrete and tensioning elements. It goes without saying that all kinds of pre-tensioning combinations are possible.

The tensioning elements 5 for pre-tensioning run in a wavy form and, as can be seen from Figure 2, the wave parts are situated approximately halfway between the fixed supports 7 of the floor. So long as the concrete has not yet set, temporary bearing elements 8 such as screw jacks are placed under the floor and are removed after the concrete has set.

The method described above is particularly suitable for use in construction for the production of floors of large dimensions, in particular length dimensions. The steel plate 1 forms a formwork element and replaces the main reinforcement consisting of a woven-wire cloth. The pre-tensioned tensioning elements 5 lead to a very great maximum span length, in particular in conjunction with the profiling of the steel plate. As a result of this profiling and as a result of the steel plate being made thicker, less cable is needed.

Use of the principle of the invention for a prefab floor element is not ruled out.

It is also possible within the scope of the invention to place the steel plate 1 itself under pre-tension. In that case fewer or no tensioning elements 5 at all are needed.

If the tensioning elements 5 to be pre-tensioned do not run in a wavy form, they can be fitted at different levels parallel to each other in the concrete. In general, the steel plate 1 will have no side edges, so that for pouring of the concrete mortar temporary formwork boards will have to be fitted at the sides of the plate 1.

It will be clear that the tensioning elements 5 for pre-tensioning and the steel plate 1 can absorb tensile load at the bottom side of the floor.

What is of vital importance is that through the use of the invention reinforced concrete floors can be made for a very great span without woven-wire cloth, with low thickness, a good bearing capacity, good rigidity and low deformation behaviour.

Claims

1. Method for the production of a steel plate concrete floor, comprising: placing tensioning elements (5) made of steel or other elastic material in the lengthwise direction of a steel plate (1), pouring concrete mortar onto the steel plate (1) such that such tensioning elements are embedded in the concrete mortar, and placing the tensioning elements (5) under a tensile load, characterised in,

   - that before the concrete mortar is poured pipes (4) for recessing channels in the concrete are placed over the steel plate (1) in the lengthwise direction thereof,
   - that before or after pouring of the concrete mortar, tensioning elements are guided through said channels,
   - that after setting of the concrete the tensioning elements are placed under a tensile load,
   - that the ends of the tensioning elements (5), after being placed under a tension load, are anchored in the concrete (2) so that the pressure load is transmitted from the anchoring places of the tensioning elements (5) into the concrete (2) and the steel plate (1),
   - that for the purpose of increasing the adhesion between concrete (2) and steel, the steel plate (1) is provided beforehand with anchoring elements (3) projecting from the plane of the steel plate (1).

2. Method according to claim 1, characterised in that said pipes (4) as well as the tensioning elements (5) guided through the pipes (4) extend in a wavy form through the concrete (2), the wave valleys being situated approximately halfway between the places where the floor is to be supported permanently in a building.

3. Method according to claim 1 or 2, characterised in that the steel plate (1) is placed under a tensile load in the lengthwise direction thereof before the concrete mortar is poured, which tensile load is removed after setting of the concrete.

Patentansprüche

1. Verfahren zur Herstellung einer Stahlblechbetondecke mit den folgenden Schritten: Einbringen von Spannelementen (5) aus Stahl oder einem anderen elastischen Material in Längsrichtung eines Stahlblechs (1), Gießen von Betonmörtel auf das Stahlblech (1), so daß die Spannelemente in den Betonmörtel eingebettet werden, und Anlegen einer Zugbelastung an die Spannelemente (5), dadurch gekennzeichnet,

   daß vor dem Gießen des Betonmörtels über dem Stahlblech (1) in dessen Längsrichtung

Röhren (4) zum Aussparen von Kanälen im Beton verlegt werden,
daß vor oder nach dem Gießen des Betonmörtels Spannelemente durch die Kanäle geführt werden,
daß nach dem Abbinden des Betons die Spannelemente einer Zugbelastung ausgesetzt werden,
daß die Enden der Spannelemente (5) nach dem Anlegen einer Zugbelastung im Beton (2) verankert werden, so daß die Druckbelastung von den Verankerungsstellen der Spannelemente (5) in den Beton (2) und das Stahlblech (1) übertragen wird,
daß zum Zweck einer Erhöhung der Haftung zwischen dem Beton (2) und dem Stahl das Stahlblech (1) vorher mit Verankerungselementen (3) versehen wird, die aus der Ebene des Stahlblechs (1) hervorstehen.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Röhren (4) sowie die durch die Röhren (4) geführten Spannelemente (5) sich wellenförmig durch den Beton (2) erstrecken, wobei die Wellentäler annähernd in der Mitte zwischen den Stellen liegen, wo die Decke in einem Gebäude permanent abgestützt werden soll.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Stahlblech (1) vor dem Gießen des Betonmörtels in seiner Längsrichtung einer Zugbelastung ausgesetzt wird, die nach dem Abbinden des Betons entfernt wird.

Revendications

1. Procédé de fabrication d'un plancher en béton et tôle d'acier consistant à disposer des éléments de tensionnage (5) réalisés en acier ou en un autre matériau élastique dans la direction longitudinale d'une tôle d'acier (1), à couler du béton sur la tôle d'acier (1) de sorte que les éléments de tensionnage sont noyés dans le béton, et à mettre les éléments de tensionnage (5) sous tension, caractérisé en ce que :

   . avant de couler le béton, des tuyaux (4) servant à ménager des canaux dans le béton sont déposés sur la tôle d'acier (1) dans la direction longitudinale de celle-ci,
   . avant ou après avoir coulé le béton, des éléments de tensionnage sont passés à travers lesdits canaux,
   . après durcissement du béton, les éléments de tensionnage sont mis sous tension,
   . après mise sous tension, les extrémités des éléments de tensionnage (5) sont ancrées dans le béton, de sorte que la force de traction est transmise des points d'ancrage des éléments de tensionnage (5) au béton (2) et à la tôle d'acier (1),
   . dans le but d'améliorer l'adhérence entre le béton (2) et l'acier, la tôle d'acier (1) est préalablement munie d'éléments d'ancrage (3) en saillie du plan de la tôle d'acier (1).

2. Procédé selon la revendication 1, caractérisé en ce que les tuyaux (4) de même que les éléments de tensionnage (5) s'étendent de manière ondulée à travers le béton (2), les creux de l'ondulation étant situés approximativement à midi stance des points où le plancher doit être soutenu de façon permanente dans une construction.

3. Procédé selon l'une quelconque des revendications 1 ou 2, caractérisé en ce qu'avant de couler le béton, la tôle d'acier (1) est mise sous tension selon sa direction longitudinale, ladite force de traction étant supprimée après durcissement du béton.

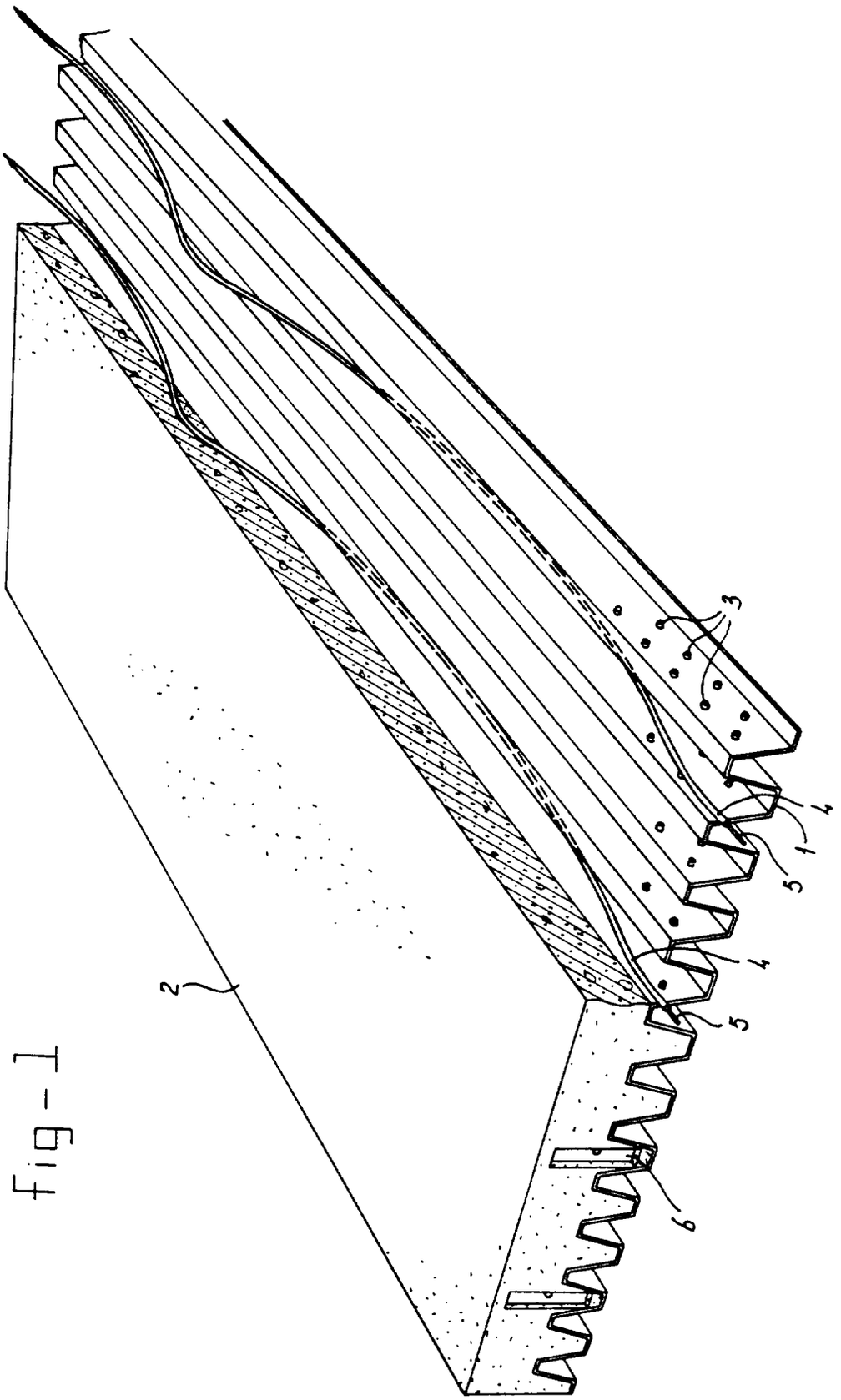

fig-1

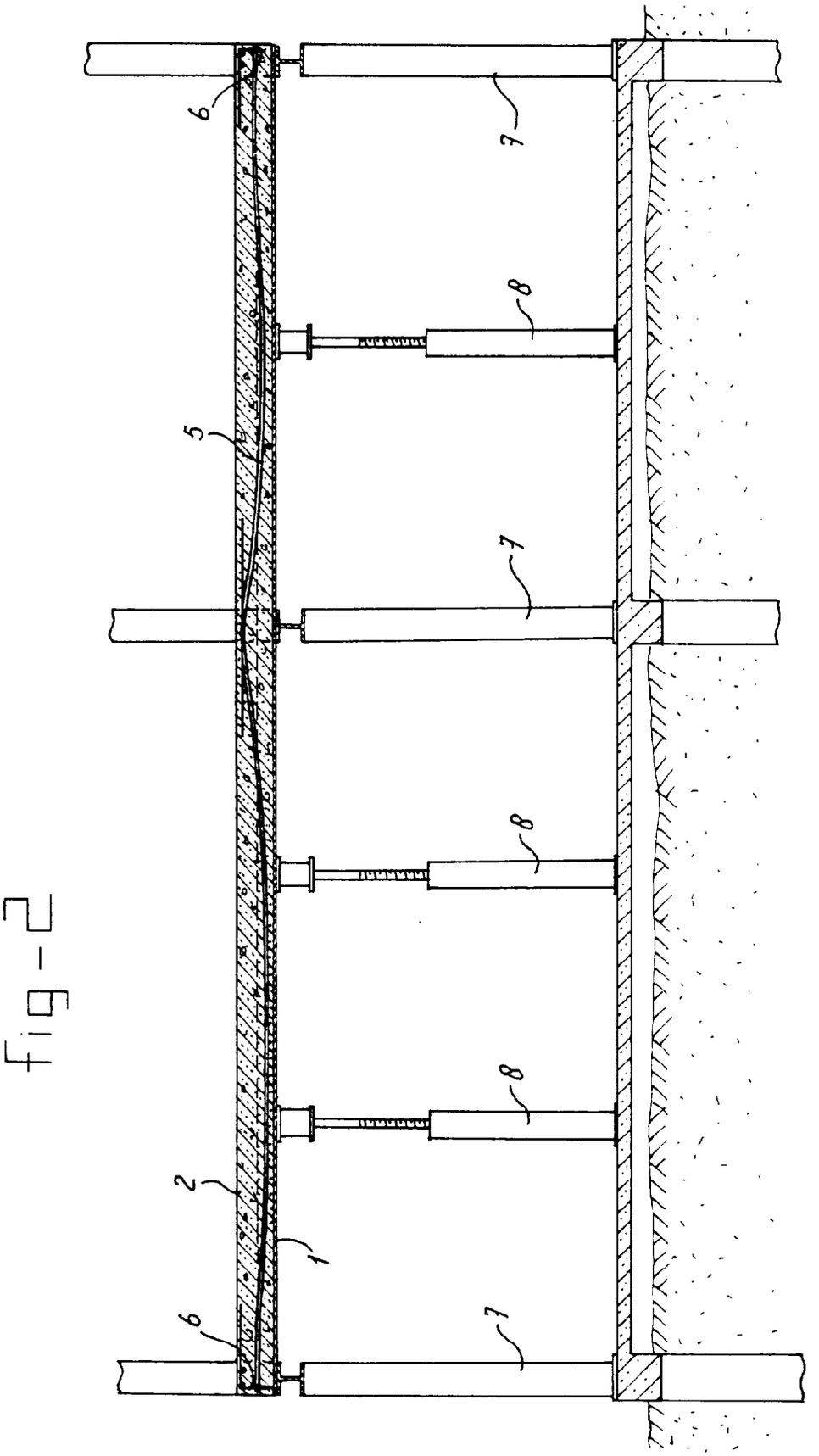

fig-2