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(71) Applicants:
- **Verbrugge, Renaat**
  8530 Harelbeke (BE)
- **Verbrugge, Christiane**
  8700 Tielt (BE)

(72) Inventors:
- **Verbrugge, Renaat**
  8530 Harelbeke (BE)
- **Verbrugge, Christiane**
  8700 Tielt (BE)

(74) Representative: **Leherte, Georges, Dr. et al**
Bureau Vander Haeghen - K.O.B. S.A.,
Pres. Kennedypark 31 c
8500 Kortrijk (BE)

(54) Foundation method and foundation slab made by such a method

(57) The invention relates to a foundation method in which the method comprises providing a first concrete layer (2), provided with distant holders (6), and optionally provided with a first reinforcement (5), on the ground; whereafter lost shuttering (7) which can bear the load of concrete is placed between said distant holders (6); and whereafter a second concrete layer (8), optionally provided with second reinforcement (9), is provided on top of said lost shuttering (7) and in the space created by the distant holders (6). For said lost shuttering (7), preferably polystyrene blocks are used, and for said distant holders (6) zig-zag-meshes are used. The invention further relates to a foundation slab made by such a method.

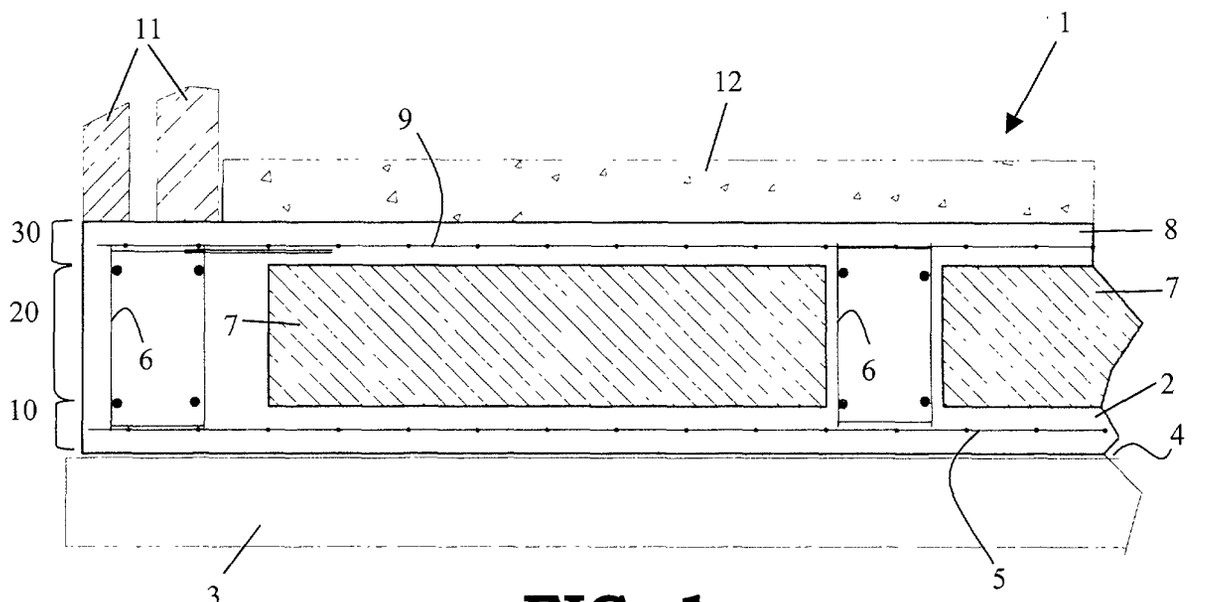

FIG. 1

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Description

[0001] The invention relates to a foundation method and a foundation slab.

[0002] Until now, the generally applied foundation methods comprises following steps:

- removing the soil layer and/or the stirred toplayers of the ground;
- digging trenches with a depth of 800 mm and a width of 600 - 800 mm;
- filling with concrete up to a height of 400 mm;
- laying a layer of full concrete blocks with a width of 300 mm on top of said concrete filled trenches;
- installing sewers;
- filling the space between said full concrete blocks with sand and stabilizer;
- providing on top of said full concrete blocks and the filled space between them a layer of reinforced concrete.

[0003] The disadvantage of this foundation method is that only the trenches bear the full load of the building that is built on top of the foundation. The rest of the concrete serves nothing.

[0004] Another disadvantage of this method is teh stability of the trenches themselves, especially in case of high (ground-)water level. The trenches collapse even before the concrete can be poured in, which results in unverifiable dimensions of the foundation trenches.

[0005] Still another problem that arises with this method is the heavy weight of concrete. Concrete has a weight of 2500 kg/m^3. When such a classic foundation method is exerted on ground with a low supporting capacity, the load that such ground can bear is for a great part already taken up by the load of the foundation slab. This means that the load of the building that has to be build on this foundation slab has to be seriously reduced. When the load of the building is too important, subsidence can occur.

[0006] Till now, this problem is solved by exerting expensive foundation techniques such as piles, or by digging deaper into the ground.

[0007] In JP 07211667, a foundation of building and a method for constructing the same is described for reducing the weight of a foundation and for eliminating the need for ground improvement works, etc.. Therefore, the foundation comprises a foundation base made of concrete, which is installed on the ground, and a foundation beam made of steel, secured to the foundation base. The foundation beam is tightened to the foundation by anchor bolts previously driven into the foundation base, or is tightened by chemical anchors constructed on-site. A connecting piece is welded to the foundation beam in advance. The foundation beams of the adjacent foundations are thereby connected together by a tie member comprising reinforcing braces.

[0008] A first disadvantage of this foundation method is that it is still necessary to dig out to an important depth for the construction of the concrete base, whereby also the risk of collapsing of the ground stays.

[0009] A second disadvantage is that the connection of the concrete base with steel foundation beams and tie members results in a rather high foundation construction, which rises more than 800 mm above the ground level.

[0010] Furthermore, the complexity of execution of this foundation method results in a very expensive method.

[0011] In one respect, the purpose of the invention is to provide a foundation method that resolves the above-mentioned disadvantages.

[0012] To achieve this purpose, a foundation method is provided that comprises the steps:

- providing a first concrete layer, provided with distant holders, and optionally provided with a first reinforcement, on the ground;
- placing lost shuttering which can bear the load of concrete between said distant holders;
- providing a second concrete layer, optionally provided with a second reinforcement, on top of said lost shuttering and in the space created by the distant holders.

In a preferred foundation method according to the invention, polystyrene blocks are used for said lost shuttering.

[0013] This has the advantage that there is a high insulation value. As a result, a warm feeling flour is obtained.

[0014] In another preferred foundation method according to the invention, one or more devices selected from air cushions, recycled PVC-blocks, carton or plastic blocks, etc. are used for said lost shuttering.

[0015] In a specific foundation method according to the invention, zig-zag meshes are used for said distant holders.

[0016] In another specific foundation method according to the invention, bended meshes and/or reinforcement baskets are used for said distant holders.

[0017] In a more specific foundation method of the invention, part of said lost shuttering is replaced by technical supplies such as tanks for rain water, septic tanks, and/or heat exchangers for subfloor heating or cooling.

[0018] The method according to the invention comprises preferably the steps:

- measuring out the external contours of the building;
- removing the soil layer and/or the stirred toplayers of the ground;
- installing sewers in a layer of stabilisator;
- placing of external shuttering according to the external contours of the building;
- optionally, placing a PE-foil on top of said layer of stabilisator;

- laying a first mesh-reinforcement on the ground;
- fixing zig-zag-meshes to said mesh-reinforcement;
- pouring a first layer concrete on said mesh-reinforcement;
- after curing of said first layer concrete until it is passable, placing polystyrene blocks between said zig-zag-meshes;
- optionally, placing extra reinforcement bars;
- laying a second mesh-reinforcement on top of said polystyrene blocks;
- pouring a second layer concrete on said second mesh-reinforcement and in the space between the polystyrene blocks created by the zig-zag-meshes.

[0019] In another respect, the invention relates to a foundation slab which is made by the method as described above.

[0020] In a preferred embodiment of the foundation slab according to the invention, the foundation slab has following sizes:

- a thickness of 50 to 150 mm for said first concrete layer;
- a thickness varying between 200 and 1200 mm, a width of circa 1000 mm and a length of a couple of meters for said polystyrene blocks;
- a height of 200 to 1200 mm for said distant holders.
- a thickness of 50 to 150 mm for said second concrete layer.

[0021] The invention is now further explained on the basis of the following detailed specification of a preferred foundation slab according to this invention and of the foundation method for making such a foundation slab. The purpose of this specification is only to give a clarifying example and can therefore in no way be interpreted as a restriction on the field of application of the invention or on the patent rights claimed in the claims.

[0022] In this specification reference is made by means of reference numbers to the figures attached hereto, of which

- *figure 1* is a cross-section of a foundation slab according to the invention;
- *figure 2* is a perspective view of a foundation slab according to the invention;
- *figure 3* is a view from above of a foundation slab according to the invention.

[0023] A foundation slab (1) according to the invention, as shown in figure 1, comprises three major parts:

- a first part (10), consisting of a first concrete layer (2) that is laid on a layer of stabilisator (3), on which optionally a PE-foil (4) is spread out, and in which the sewers are installed. This first concrete slab (2) has a relatively low thickness varying from 50 to 150 mm. In most cases, the first concrete slab (2) is reinforced by a first mesh-reinforcement (5). Therefore, this first mesh-reinforcement is placed on top of the layer of stabilisator; optionally more reinforcement may be required. Distant holders (6) with a height of 200 to 1200 mm are fixed appropriately to the first reinforcement (5). Preferably, zig-zag meshes are used. But, also bended meshes or reinforcement baskets can serve as distant holders (6). Hereafter, the concrete is being poured.

- a second part (20), whereby after a minimum of curing of the concrete, i.e. until the concrete is being passable, lost shuttering (7) is placed between the distant holders (6). Preferably, expanded polystyrene blocks with a width of circa 1000 mm, a length of a couple of meters and a thickness varying between 200 and 1200 mm are used. However, carton, plastic blocks, or even air cushions can serve as well. The space between the lost shuttering (7), i.e. where the distant holders (6) are located, might require extra bars, e.g. of iron, as reinforcement.

- a third part (30), whereby on top of the lost shuttering (7) a second reinforced concrete layer (8) is provided. Therefor, a second mesh-reinforcement (9) is provided on top of the second part (20), whereafter a layer concrete with a thickness from 50 to 150 mm is poured on top of the lost shuttering (7) and in the space created by the distant holders (6). This results in a kind of T-rib-floor, with important extra stiffness, which is obtained by the first reinforced concrete layer (2) on the bottom of the foundation slab.

[0024] On top of the third part (30) the facade (11) of the building and a layer of covering (in French "chappe") (12) is placed.

[0025] As a result, a stiff hybride foundation slab of 400 to 1500 mm thickness is obtained, using three different materials with following properties:

- concrete, which has high pressure resistance and is easy to be shaped;
- steel which has a high tensile strength, but which has to be placed as far away as possible from the neutral line to obtain a maximum use of the steel;
- polystyrene, or another light-weight shuttering material, which is light-weight and sufficient pressure resistant to support the poured concrete during its curing time. These light-weight materials are located between the active zones of the slab on the bottom and on the top, i.e. around the neutral line.

[0026] Such a concrete slab (1) can be realised in two days:

- day 1:

- measuring out the external contours (13) of the building;
- removing the soil layer and/or the stirred toplayers of the ground;
- installing sewers in a layer of stabilisator (3);
- placing of external shuttering (14) according to the external contours (13) of the building;
- optionally, placing a PE-foil (2) on top of said layer of stabilisator (3);
- laying a first mesh-reinforcement (5) on the ground;
- fixing zig-zag-meshes (6) to said first mesh-reinforcement (5);
- pouring a first layer concrete (2) on said first mesh-reinforcement (5);

- day 2:

  - after curing of said first layer concrete (2) until it is passable, placing polystyrene blocks (7) between said zig-zag-meshes (6);
  - optionally, placing extra reinforcement bars;
  - laying a second mesh-reinforcement (9) on top of said polystyrene blocks (7);
  - pouring a second layer concrete (8) on said second mesh-reinforcement (9) and in the space between the polystyrene blocks (7) created by the zig-zag-meshes (6).

[0027] On day 3, the building of the facades (11) of the building and the laying of the layer of covering (12) can start.

[0028] Before pouring the first (2) and second concrete layer (8), parts of these two concrete layers can also be repalced by precasted concrete plates, this in order to accelerate the proces.

[0029] A foundation slab made by a method according to the invention has the advantage that a light-weight foundation is provided, which is applicable on ground with low supporting capacity, where otherwise other expensive foundation techniques need to be applied.

[0030] Another advantage is that an excellent stiffness and flexural strength is obtained, as a result of which setting cracks will be reduced to a minimum.

[0031] Also no trenches are necessary. As a result, they can not collapse, which happens often in case of ground with low supporting capacity or in case of high ground-water level.

[0032] Little or no ground supplements are required. This foundation slab ends 20 to 30 cm higher than the original ground level, which is often desired.

[0033] This foundation method has a very fast execution, there is little or no removal of ground.

[0034] A combination with a prefabricated cellar, and eventually with a pile or pit foundation can easily be realised. Reinforced underground beams are not necessary. The required stiffness can be obtained by adding extra reinforcement bars in the slabs at the bottom and the top and in the space within the distant holders.

[0035] In other words, a less expensive foundation in comparison with a classic foundation is obtained, which even has better supporting capacity than the foundations known at present.

Claims

1. Foundation method, **characterised in that** the method comprises the steps:

   - providing a first concrete layer (2), provided with distant holders (6), and optionally provided with a first reinforcement (5), on the ground;
   - placing lost shuttering (7) which can bear the load of concrete between said distant holders (6);
   - providing a second concrete layer (8), optionally provided with second reinforcement (9), on top of said lost shuttering (7) and in the space created by the distant holders (6).

2. Method according to claim 1, **characterised in that** polystyrene blocks are used for said lost shuttering (7).

3. Method according to claim 1, **characterised in that** one or more devices selected from air cushions, recycled PVC-blocks, carton or plastic blocks, etc. are used for said lost shuttering (7).

4. Method according to claim 1, **characterised in that** zig-zag meshes are used for said distant holders (6).

5. Method according to claim 1, **characterised in that** bended meshes and/or reinforcement baskets are used for said distant holders (6).

6. Method according to one of claims 1 up to and including 3, **characterised in that** part of said lost shuttering (7) is replaced by replaced by technical supplies such as tanks for rain water, septic tanks, and/or heat exchangers for subfloor heating or cooling.

7. Method according to one of claims 1 up to and including 6, **characterised in that** the method comprises the steps:

   - measuring out the external contours (13) of the building;
   - removing the soil layer and/or the stirred toplayers of the ground;
   - installing sewers in a layer of stabilisator (3);
   - placing of external shuttering (14) according to the external contours (13) of the building;

- optionally, placing a PE-foil on top of said layer of stabilisator (3);
- laying a first mesh-reinforcement (5) on the ground;
- fixing zig-zag-meshes (6) to said mesh-reinforcement (5);
- pouring a first layer concrete (2) on said mesh-reinforcement (5);
- after curing of said first layer concrete (2) until it is passable, placing polystyrene blocks (7) between said zig-zag-meshes (6);
- optionally, placing extra reinforcement bars;
- laying a second mesh-reinforcement (9) on top of said polystyrene blocks (7);
- pouring a second layer concrete (8) on said second mesh-reinforcement (9) and in the space between the polystyrene blocks (7) created by the zig-zag-meshes (6).

8. Foundation slab, **characterised in that** the slab is made by the method according to one of the preceeding claims.

9. Foundation slab according to claim 8, **characterised by** following sizes:

- a thickness of 50 to 150 mm for said first concrete layer (2);
- a thickness varying between 200 and 1200 mm, a width of circa 1000 mm and a length of a couple of meters for said polystyrene blocks (7);
- a height of 200 to 1200 mm for said distant holders (6).
- a thickness of 50 to 150 mm for said second concrete layer (8).

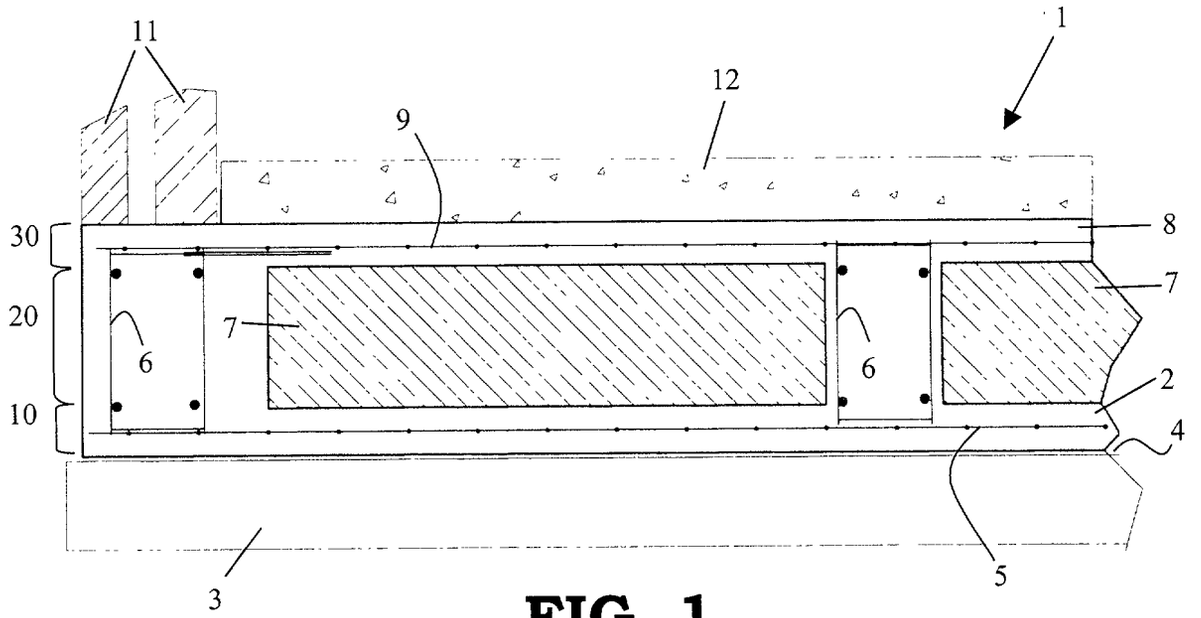

FIG. 1

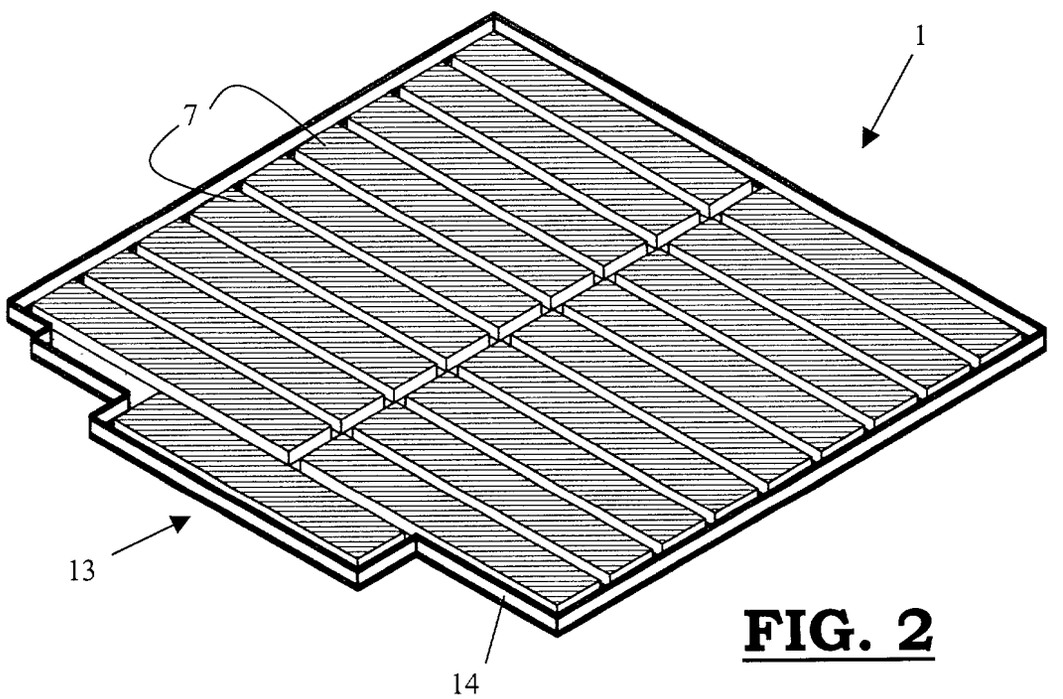

FIG. 2

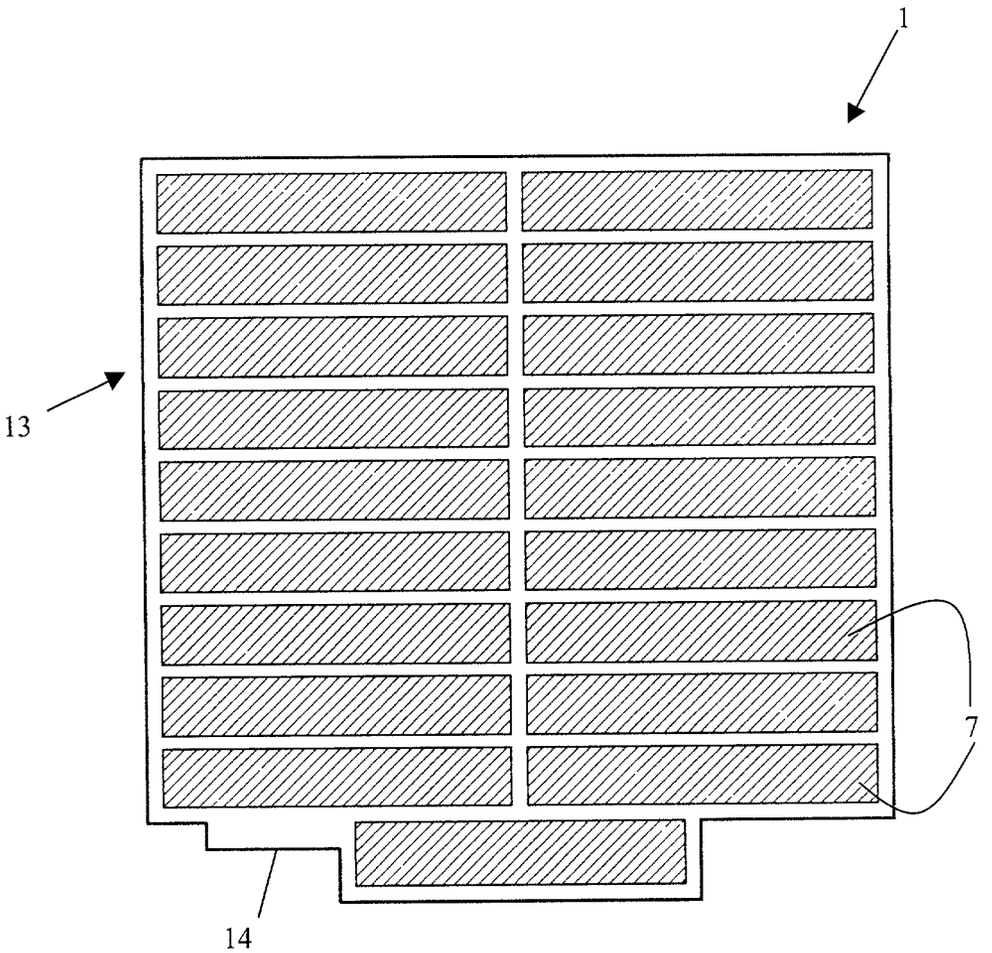

FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 01 20 1765

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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	20 June 2001	Kergueno, J

CATEGORY OF CITED DOCUMENTS

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