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(54) A method of building a foundation, and shuttering unit for the application of said method.

(57) A method of building a foundation, comprising
- making an excavation for the foundation,
- building the foundation shuttering and arranging a reinforcement therein,
- pouring concrete and subsequently allowing the same to harden, and
- filling up the excavation,

wherein the foundation shuttering is a prefabricated permanent-shuttering unit provided with reinforcement, and that the excavation is filled up after said shuttering unit has been placed therein and before the concrete is poured.

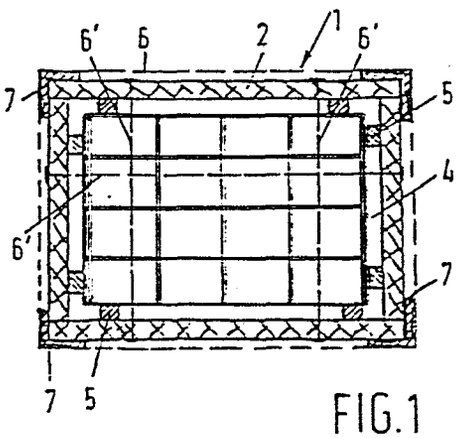

FIG.1

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Title: A method of building a foundation, and shuttering unit for the application of said method.

This invention relates to a method of building a foundation, comprising making an excavation for such foundation, building the foundation shuttering and arranging a reinforcement therein, pouring concrete and subsequently allowing the same to harden, and filling up the excavation.

The building of foundations is in practice being done on a large scale by the above method. There are some disadvantages inherent in this method, which have a cost-increasing effect. Thus the erection of the foundation shuttering and the installation of a reinforcement therein is a piece of workmanship which even under weather-working conditions requires many man-hours, while the time required is considerably lengthened in the case of regular lay-offs due to weather conditions. As the foundation shuttering and the reinforcement are installed in the excavation, the latter should be considerably larger than the extent of the foundation shuttering in order that there may be sufficient space for the necessary work to be done. In principle the shuttering remains in place until the concrete has hardened sufficiently, whereafter the shuttering is taken down and the excavation is filled up. Up to the time the excavation is filled up it should generally be dewatered, or other precautions should be taken to prevent it from being flooded.

It is an object of the invention to improve this method in such a manner that a foundation can be installed in a shorter time at lesser cost, and is characterized, to this effect, in that the foundation shuttering is a prefabricated, permanent-shuttering unit provided with reinforcement, and that the excavation is filled up after said shuttering unit has been placed therein and before the concrete is poured.

A prefabricated shuttering unit provided with reinforcement can be manufactured in a suitable space so that lay-offs due to bad weather are avoided. The shuttering unit can be transported from the place of manufacture to the building site, and placed in the excavation. The excavation itself can thus be made smaller, because no

erection work needs to be done for the foundation shuttering and the reinforcement in such excavation or trench.As the prefabricated shuttering unit is a permanent shuttering, which is left in the ground after the concrete has been poured, the excavation can be filled up before pouring the concrete, so that the excavation of smaller dimensions in addition needs to be dewatered for a short period of time only. With a suitable selection of the shuttering material, for example, polystyrene foam , the concrete is hardened in insulated surroundings, which is an additional advantage in particular in highly corrosive conditions. In addition, when installing foundations for ground floors for housing, a good floor insulation can be obtained. Filling up the excavation before the concrete is poured, further gives the advantage that the backfill provides the necessary counterpressure to the concrete, so that such counter-pressure need not exclusively be provided by the rigid walls of the shuttering or by struts placed against such walls.

The invention further relates to a shuttering unit for the application of the method. This shuttering unit comprises a box structure having four dimensionally stable walls and a bottom, as well as a reinforcement cage accommodated therein, and secured by means of spacer members in spaced relationship to the wall and the bottom.

The horizontal stiffness between the four walls of the shuttering and the spacer members and reinforcement cage placed therein is preferably produced by winding bracing wire around the four walls. The vertical stiffness between the walls and the bottom can be realized in the same way. Preferably, however, at least one rigid strip is placed on top of the shuttering unit, which strip is connected with the bottom of the shuttering unit by means of bracing wires.

For the sidewalls and the bottom of the shuttering unit, any material of sufficient dimensional stability can in principle be used. Preferably the walls and the bottom are formed of polystyrene foam. Because, when a box structure of polystyrene foam is wound, the bracing wires could cut through the foam, when polystyrene foam is used compression pieces are arranged at the corners of the walls, around which corner pieces the bracing wires are wound.

The shuttering unit may have a uniform diameter, but alternatively is stepped in the direction of its height, decreasing in diameter upwardly. Such a shape is used in casting the base of a column.

The method and the shuttering unit according to the invention will now be described in more detail with reference to the accompanying drawings. In said drawings

Fig. 1 shows a top plan view of a shuttering unit;

Fig. 2 shows a cross-sectional view of a shuttering unit in a dug-in position;

Fig. 3 shows a shuttering unit for casting a pile head;

Fig. 4 and 5 show a shuttering unit for casting the base of a column; and

Fig. 6 shows a cross-sectional view of a shuttering unit for a floor foundation.

Figs. 1-2 show a shuttering unit 1 for a block foundation. The shuttering unit comprises a reinforcement cage 4, commonly made of conventional reinforcement rods and interconnected to produce the desired dimensional stability. Along, and on, the sidewalls and bottom of the cage 4, spacer members 5 are provided and connected in a suitable manner to the reinforcing rods of cage 4. The spacer members 5 are preferably made of cement concrete or synthetic plastics material. Placed in contact with spacer members 5 are four shuttering panels 2, serving as sidewalls, and possibly a bottom 3. The material for sidewalls 2 and bottom 3 can be selected from many suitable kinds of material, naturally taking into account that the shuttering unit 1 is used as a permanent shuttering.

In addition to wood or synthetic plastics material, polystyrene foam is a highly suitable material, especially on account of its good thermo-insulating properties and low water absorption. Horizontal stiffness between sidewalls 2, spacer members 5, and reinforcing cage 4 is accomplished by means of bracing wires 6,6', preferably galvanized metal wire, or synthetic plastics material, by means of which the shuttering unit 1 built up from loose parts is connected to form a transportable unit. These bracing wires 6' can be arranged horizontally in two mutually perpendicular directions, and extend transversely through the reinforcement cage 4. Bracing wires 6' extend through two

opposed sidewalls and are locked in a suitable manner against the outerwall thereof. The bracing wires may alternatively be wound around shuttering unit 1. In that case the bracing wires are preferably straps of synthetic plastics material as frequently used in the packing industry. Fig. 1 shows both possibilities. If the material of the sidewalls is sufficiently pressure-resistant, or if plastics straps are used as the bracing wires, bracing wires 6 may be wound direct around the sidewalls. When, for example, polystyrene foam is used, it is necessary to use compression pieces 7, for example of wood, to prevent the bracing wires 6 from cutting into the material of sidewalls 2.

In addition to bracing wires 6 wound around the shuttering unit, and bracing wires 6' extending through cage 4, sidewalls 2 may be directly fixed to spacers 5, which are provided for the purpose with outwardly projecting pins extending through sidewalls 2, and on which a clamping member can be shifted which presses sidewall 2 into contact with the spacers.

If the shuttering unit 1 is provided with a bottom 3, the latter is fixed by means of vertically extending bracing wires 6". The bottom 3 is preferably provided with a peripheral groove 3' (Fig. 2) for receiving the sidewalls 2 therein, thereby supporting the sidewalls 2 and preventing the movement of the bottom 3 relative to the sidewalls 2. The top ends of these bracing wires 6" may be secured, for example, to the top reinforcing rods of cage 4, or to a strip 9 supported on sidewalls 2, which strip may be of cruciform shape (Fig. 2). Owing to the use of the bracing wires or straps 6,6', sidewalls 2, bottom 3 and reinforcing cage 4 form a stable whole. The use of an adhesive for interconnecting walls, bottom and spacer members is therefore unnecessary. When the shuttering unit has been placed in position in an excavation, strip 9 can be removed for re-use.

If desired, the bottom 3 of the shuttering unit may be omitted. In that case there is employed a working floor of lean concrete, poured in situ on the bottom of the excavation.

Fig. 2 shows the shuttering unit 1 of Fig. 1 in the dug-in position. The excavation 8 in the bottom is indicated in ghost outline.

The excavation 8 need not be much larger than the dimensions of the shuttering unit. After the shuttering unit 1 has been placed in position in the excavation, the latter is filled up again. Subsequently, concrete is poured into the interior of the shuttering unit 1, with the backfill in the excavation 8 providing for sufficient couter-pressure on the sidewalls of shuttering unit 1, as indicated by arrows in Fig. 2. After the casting of the concrete, the top of the shuttering unit 1 may, if desired, be covered to cause the concrete to harden more rapidly.

Fig. 3 illustrates an example of a shuttering unit according to the invention, in this case for casting a pile head. The shuttering unit 11 is placed on a pile 10 rammed or screwed into the ground. The bottom of the shuttering unit 11 is formed with an aperture 12 to permit slipping the bottom over the head of pile 10. Fig. 4 diagrammatically shows a stepped shuttering unit 13 suitable for casting the base of a column. Shuttering unit 13 comprises a wider lower portion 14 and a superimposed portion 15 of smaller diameter. In casting the base of a column as shown in Fig. 4, the method according to the invention must be carried out at least partially twice over. After placing shuttering unit 13 in an excavation, the excavation is filled up to the rim of the lower portion 14 only, whereafter this lower portion 14 is filled up with concrete. The top portion 15 of the shuttering unit 13 has then preferably been detached from the lower portion 14. When the column base has sufficiently hardened, the portion 15 of the shuttering unit 13 is placed around the reinforcement cage for the top part, whereafter the excavation can be fully filled up with the bottom material. Subsequently, the portion 15 is filled with concrete. The shuttering unit 13 for a column base as shown diagrammatically in Fig. 4 is shown more clearly in perspective view in Fig. 5.

The method according to the invention can be used with advantage in making floor foundations for housing. An example for such a construction is shown diagrammatically in Fig. 6. The foundation beam extends perpendicular to the plane of the page and rests on a plurality of piles 16 rammed or screwed into the bottom in a suitable manner. Designated by 18 is the reinforcement cage for the foundation beam, surrounded by walls 17 of polystyrene foam, which in this case

is preferred for its insulating properties. The spacer members provided between walls 17 and reinforcement cage 18 are not shown in the drawing. Designated by 22 is a reinforced concrete floor - the ground floor - which is perpendicular to the main foundation beam. Shown at 19 is an outer wall bearing on foundation beam 17,18, and at 20 an inner wall, with a polystyrene foam layer 21 being provided in the gap between the two walls 19,20 by way of insulation.

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* C L A I M S *

1. A method of building a foundation, comprising
- making an excavation for the foundation,
- building the foundation shuttering and arranging a reinforcement therein,
- pouring concrete and subsequently allowing the same to harden, and
- filling up the excavation,

characterized in that the foundation shuttering is a prefabricated permanent-shuttering unit provided with reinforcement, and that the excavation is filled up after said shuttering unit has been placed therein and before the concrete is poured.

2. A shuttering unit for the application of the method according to claim 1, characterized in that the shuttering unit comprises
- a box structure consisting of four dimensionally stable walls and optionally a bottom, and
- a reinforcement cage provided therein, which by means of spacer members is secured in spaced relationship to the walls and the bottom, if any.

3. A shuttering unit according to claim 2, characterized in that the four walls of the shuttering unit are connected with bracing wires to the reinforcement cage to provide horizontal stiffness between these walls, the spacer members and the reinforcement cage.

4. A shuttering unit according to claims 2-3, characterized in that at the top of the shuttering unit at least one rigid strip rests on the walls, which strip is connected with the bottom of the shuttering unit by means of bracing wires to provide vertical stiffness between this bottom and the reinforcement cage.

5. A shuttering unit according to claims 2-4, characterized in that the sidewalls and the bottom thereof consist of polystyrene foam.

6. A shuttering unit according to claims 2-5, characterized in that, in the direction of its height, the shuttering unit is formed with a stepped configuration with decreasing diameter.

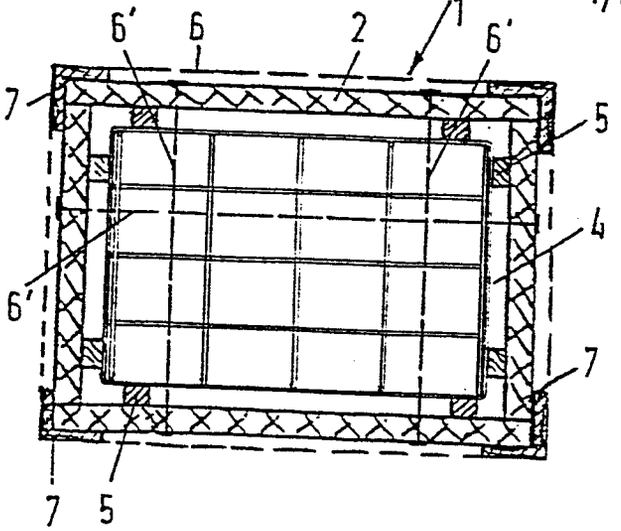

FIG.1

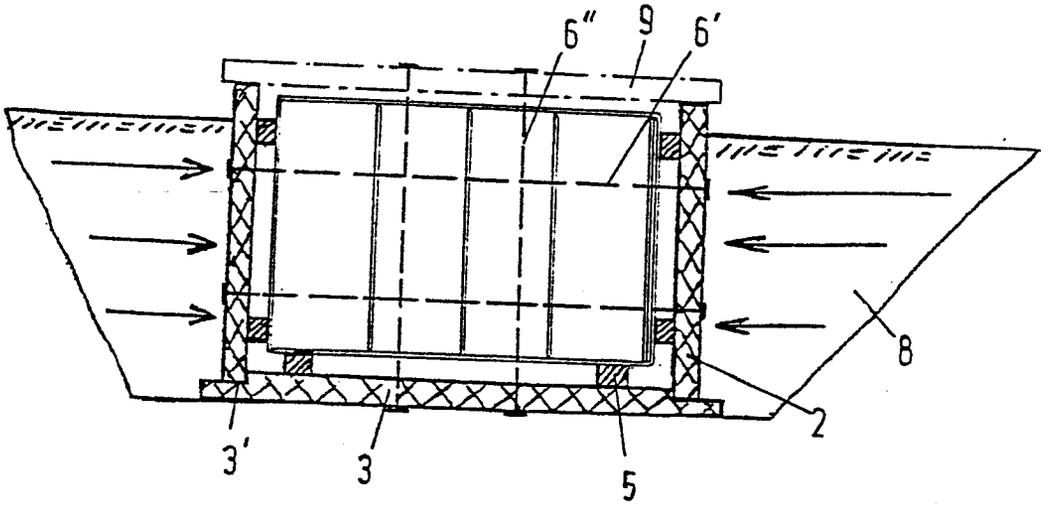

FIG.2

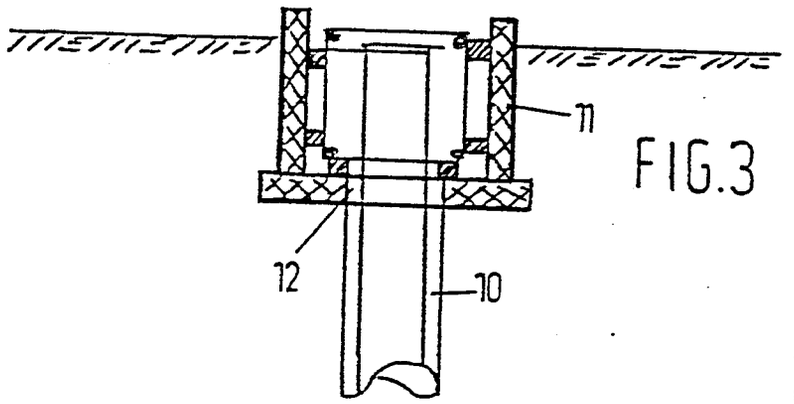

FIG.3

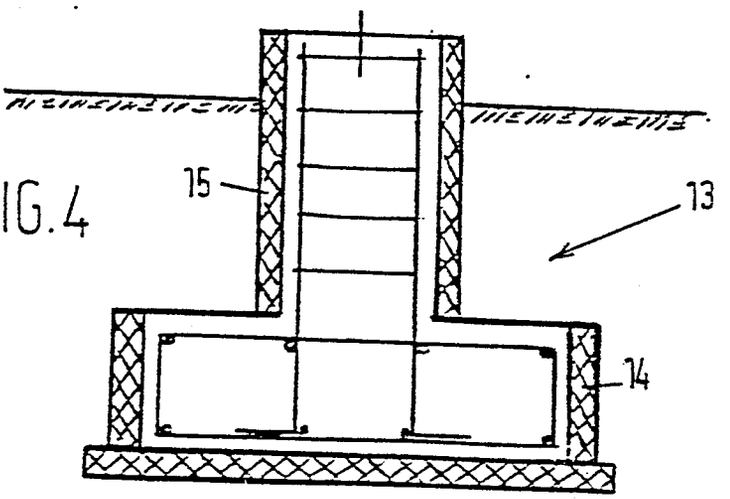

FIG.4

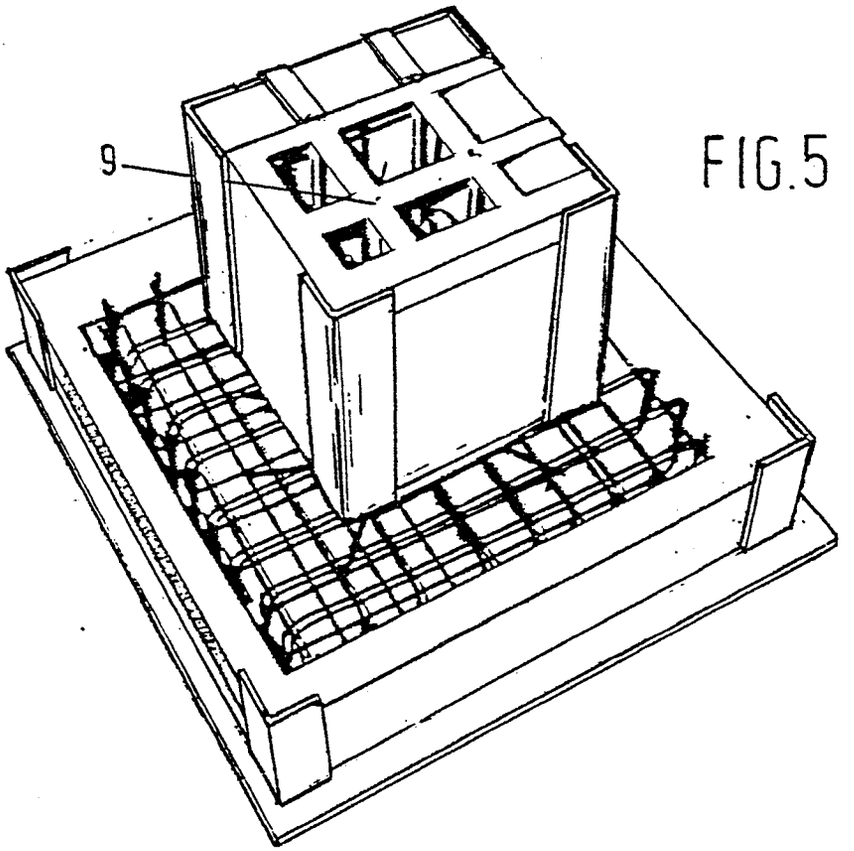

FIG.5

FIG.6