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(54) Building, foundation construction for a building and method of producing the same

(57) A foundation structure for a building comprises a slab (1) to be arranged on a ground surface. The slab (1) is prefabricated and has static load-bearing capacity and insulating capacity. A building with such a foundation structure is also disclosed, as well as a method of producing a foundation structure and a method of producing a building.

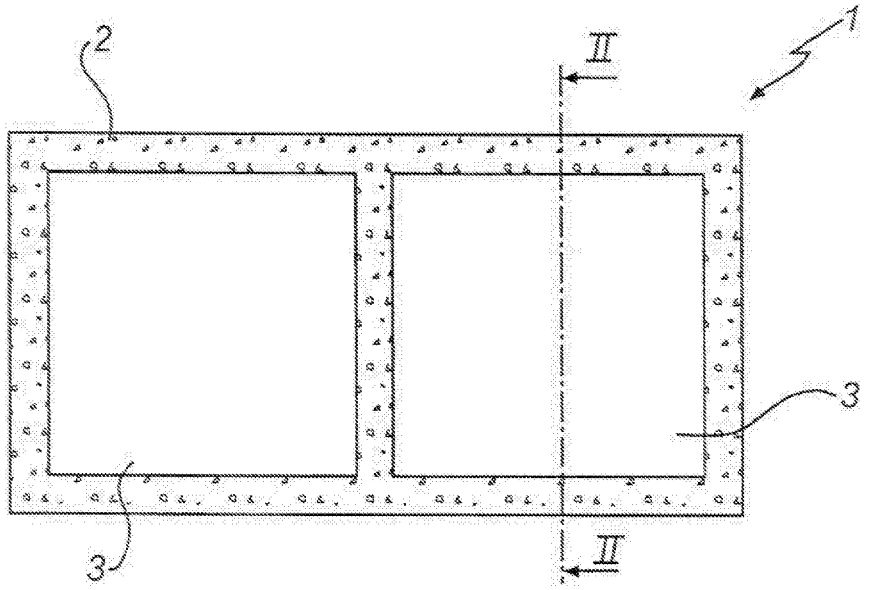

Fig. 1

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Description

Field of the Invention

[0001] The present invention relates to a foundation structure for a building, comprising a slab to be arranged on a ground surface. The invention also relates to a building with such a foundation structure, a method of producing a foundation and a method of producing a building.

Background Art

[0002] In house building, mainly two types of foundation structure are used, either crawl space or slab-on-grade. The crawl space, which essentially consists of the area between the ground and a joisted first floor set on foundation walls, on which the building rests, can be built from prefabricated components. However, in recent years crawl spaces have been associated with moisture and mildew problems since it is difficult to sufficiently ventilate off the moisture forming in the crawl space. A slab-on-grade, which consists of a concrete slab on which the house rests and which serves as a base for the floor, therefore is an interesting alternative.

[0003] When arranging a slab-on-grade, a form is generally built up where the house is to be positioned and then the concrete slab is cast in the form.

[0004] There are several problems associated with what is referred to as in situ construction of houses. For example it is difficult to control the conditions under which the concrete slab is cast since the building site is affected by wind and weather. The weather also affects the working environment of the building workers to a great extent. In situ construction also necessitates many transports of the materials that are to be used in the construction and therefore logistics is a problem in many cases. Moreover, the environment is more affected in connection with in situ construction than in prefabrication and the construction work may cause inconvenience to the surroundings.

Summary of the Invention

[0005] An object of the present invention is to provide a foundation structure which solves the above-discussed problems.

[0006] A specific object of the invention is to provide a foundation structure which enables standardisation.

[0007] Another specific object is to provide a foundation structure which facilitates the building of modules.

[0008] An object of the present invention also is to provide a building which can be efficiently produced.

[0009] Another object of the present invention is to provide a method which allows efficient production of a foundation structure.

[0010] One object of the invention is also to provide a method which facilitates construction of buildings from modules.

[0011] According to the invention, these objects are achieved by a foundation structure according to claim 1. Preferred embodiments are defined in claims 2-9. The objects are also achieved by a building according to claim 10, a method according to claims 11-13 and a method according to claims 14-16.

[0012] The inventive foundation structure comprises a prefabricated slab with static load-bearing capacity and insulating capacity. The prefabrication of the foundation structure makes it possible to render the production of the building more efficient. A prefabricated foundation structure is easy to transport to the construction site and mount. Prefabrication also causes saving in time since the work at the construction site proceeds more quickly. In industrial prefabrication, there are better possibilities of using a type of concrete which dries more quickly than the one normally used in in situ construction.

[0013] The slab comprises a frame and a self-supporting insulating means arranged in the frame, the frame providing the main static load-bearing capacity of the slab and the insulating means comprising an insulating material which provides the main insulating capacity of the slab. By the slab only partly consisting of heavy concrete and being supplemented with an insulating material, which generally is considerably lighter than concrete, the prefabricated foundation structure is easy to handle and transport.

[0014] The insulating material of the self-supporting insulating means is preferably capillary breaking. Moisture from the ground can thus be prevented from penetrating into the building.

[0015] The insulating material is advantageously cellular plastic. Cellular plastic has a good insulating capacity and a good bearing capacity and therefore reduces the risk of deformations in a joisted first floor which can be built on top of the slab. Additional advantages of cellular plastic are that it can easily be cut to the desired size and shape and ducts for pipes and cables can easily be made in it.

[0016] The frame preferably comprises reinforcement to improve the tensile strength.

[0017] In one embodiment, the reinforcement consists of reinforcing bars. This is a well-tried method of reinforcing concrete.

[0018] In another embodiment, the reinforcement consists of reinforcing fibres, which make it possible to provide a lighter reinforcement with the same strength. By choosing a suitable fibre type, it will be possible to affect the properties of the reinforced concrete. Fibre reinforcement requires less work than traditional reinforcing bars and therefore results in particularly efficient production.

[0019] A lower insulating layer is advantageously arranged on an underside of the slab. In this way the occurrence of thermal bridges in the foundation structure is reduced.

[0020] The lower insulating layer preferably is made of cellular plastic, thus providing good insulation and good capillary breaking properties.

[0021] The building according to the invention has a

foundation structure according to any one of claims 1-9. By prefabrication of the foundation structure, the production of the building can be rendered more efficient.

[0022] The inventive method for producing a foundation structure for a building comprises the steps of

forming a slab with static load-bearing capacity and with insulating capacity, the slab being formed with a frame which provides the main static load-bearing capacity of the slab and a self-supporting insulating means which is arranged in the frame and provides the main insulating capacity of the slab, and

placing the slab on a levelled surface where the building is to be built. This method makes it possible to prefabricate a foundation structure for a building.

[0023] The step of forming a slab preferably comprises the steps of

making a frame essentially of concrete,

arranging a self-supporting insulating means of an insulating material in the frame to form a slab. This method makes it possible to produce an easily handled slab with good insulating capacity in a particularly efficient way.

[0024] According to a variant of the inventive method, the frame is produced by moulding. This is a well-tried technique of forming concrete constructions.

[0025] The inventive method of producing a building comprises the steps of

forming a slab with static load-bearing capacity and with insulating capacity, the slab being formed with a frame which provides the main static load-bearing capacity of the slab and a self-supporting insulating means which is arranged in the frame and provides the main insulating capacity of the slab,

mounting walls on an upper side of the slab,

mounting a ceiling on the walls,

placing the slab with walls and ceiling on a levelled surface where the building is to be positioned. This method makes it possible to efficiently prefabricate a building, thereby avoiding the drawbacks of in situ construction.

[0026] According to a preferred variant of the inventive method, the step of forming a slab comprises the steps of

making a frame essentially of concrete,

arranging a self-supporting insulating means of an insulating material in the frame to form a slab. This method makes it possible to provide the foundation structure of the building in a particularly efficient manner.

[0027] A plastic foil is advantageously arranged on the upper side of the slab, under a floor slab, between the walls and the slab. The plastic foil prevents transport of moisture, and the arrangement on top of the slab, under the walls, allows the plastic foil to be protected during transport and placing of the building.

Brief Description of the Drawings

[0028] The invention will in the following be described in more detail with reference to the accompanying schematic drawings which by way of example illustrate a currently preferred embodiment of the invention.

Fig. 1 is a top plan view showing a slab in a foundation structure according to an embodiment of the invention.

Fig. 2 is a sectional view along line II-II in Fig. 1.

Fig. 3 is a top plan view which shows a slab in a foundation structure according to another embodiment of the invention.

Fig. 4 is a sectional view along line IV-IV in Fig. 3.

Fig. 5 is a top plan view which shows four slabs according to Fig. 1 arranged next to each other to form a foundation for a building.

Fig. 6 is a top plan view which shows two slabs according to Fig. 3 arranged next to each other to form a foundation for a building.

Fig. 7 is a sectional view showing a building with a foundation structure with a slab according to Fig. 1 or Fig. 3.

Description of Preferred Embodiments

[0029] Fig. 1 shows a slab 1 included in the inventive foundation structure and consisting of a frame 2 and two insulating means 3 enclosed by the frame 2. The frame 2 is made of reinforced concrete and the insulating means 3 consist of cellular plastic. As is evident from Fig. 2, the insulating means 3 consists of two layers 3a, 3b of cellular plastic. A lower insulating layer 4 is attached to the underside of the frame 2. Along the frame there is a base wall insulation 5. Also the insulating layer 4 and the base wall insulation 5 are made of cellular plastic. The base wall insulation 5 is provided with a surface layer of cement-bound material.

[0030] The concrete frame 2 is prefabricated at the factory and the insulating means 3 are placed in the frame 2 before the completed slab 1 is transported either to a construction site where a building is to be built on top of the slab 1, or to further production of an entire prefabricated building module.

[0031] In the first case, which can be referred to as part prefab, slabs 1 of the type shown in Fig. 1 are placed next to each other, with the long sides against each other on a levelled surface where the building is to be built. On this foundation, which is shown in Fig. 5, a building can then be built in situ, but it is preferred to mount prefabricated volume elements consisting of joist floor, walls and ceiling on the slabs 1. Two elongate volume elements are then placed side by side transversely to the slabs 1.

[0032] In the second case, which can be referred to as full prefab, complete building modules 6 are prefabricated, consisting of foundation 1, joist floor 7, walls 8 and ceiling 9, as illustrated in section in Fig. 7. In this case, the slab 1 is preferably given a more elongate shape, so that two juxtaposed slabs 1, as shown in Fig. 6, cover the same surface as the four slabs 1 shown in Fig. 5. For full prefab, a joist floor in the form of steel sections 7 is integrated in the prefabricated slab 1, and a floor 10 in the form of a sheet of particle board or plywood is mounted on the steel sections 7. A moisture barrier in the form

of a plastic foil 11 is placed between the steel sections 7 and the floor 10. The prefabricated building modules 6 are transported to the site where the building is to be positioned. At the site, a levelled drained surface 12 is put in order, on which the building modules 6 are arranged next to each other, with their long sides against each other, as shown in Fig. 6. The two building modules 6 are connected to form a main body of a house, as shown in Fig. 7.

[0033] Also in the part-prefab case, the completed building will in section have essentially the appearance as shown in Fig. 7, if the building is built in situ on the prefabricated slab 1 and also if prefabricated volume elements with joist floor 7, walls 8 and ceiling 9 are mounted on the prefabricated slab 1.

[0034] Ducts for pipes and cables are easy to make by punching holes in the cellular plastic of the insulating means 3. In addition, the cellular plastic has good capillary breaking properties, preventing moisture from penetrating from the ground into the building.

[0035] Since the slab 1 largely consists of insulating material, a well-insulated foundation structure is obtained.

[0036] The invention makes it possible to achieve the advantages of slab-on-grade while at the same time the prefabrication advantages of the crawl space can be utilised. Moreover prefabrication can be conducted further with slab-on-grade than with crawl space since the foundation structure can be made up of a small number of prefabricated slabs 1.

[0037] It will be appreciated that many modifications of the here described embodiments of the invention are conceivable within the scope of the invention, which is defined in the appended claims.

[0038] For instance the concrete frame 2 can, instead of being conventionally reinforced with reinforcing bars, be reinforced with fibres of different kinds, such as steel, glass, plastic, carbon or cellulose fibres. The choice of reinforcing fibres affects the properties of the reinforced concrete. The concrete frame 2 can advantageously be cast in a mould, but other methods of production, such as compression moulding, may also be used.

[0039] The above-described insulating means 3 consists of two layers of cellular plastic. Of course, a different number of layers and other insulating materials can be used. For example, rock wool can be used. The main thing is that the insulating means is self-supporting to provide a stable slab, and light so as to make the slab easy to handle. Cellular plastic or some other insulating material is cut to a suitable size and placed in the concrete frame 2. It is also conceivable to use, for instance, polyurethane foam as insulating material. In that case, the foam is injected into the frame 2 and allowed to solidify to a self-supporting insulating means 3. The insulating means could also be made of a supporting screen which is filled with loose insulating material.

[0040] In the examples illustrated, the frame 2 is divided into two or four compartments. Of course, a larger or smaller number of compartments can be used.

[0041] Instead of two different materials to provide the desired properties of the slab 1, that is concrete for the static load-bearing capacity and cellular plastic for the insulating capacity, it would be possible to make the slab of a single material having both properties. For instance, the whole slab could be made of lightweight concrete, such as ceramsite concrete. Aerated concrete, as well as different plastics, would also be a conceivable material. The production method is adjusted to the material selected. If the entire slab is made of one material, it can be extruded for instance.

[0042] Above all the invention is suitable for houses with up to two storeys. However, it is possible to apply the invention also to buildings of other types and sizes. The dimensioning of the concrete frame is adjusted to the load that is to be carried by the slab 1. In dimensioning, the possibility of transporting the slab 1 should be taken into consideration.

[0043] The frame 2 and thus the slab 1 can be given a form other than the rectangular as shown in the drawings. The slabs 1 can also be placed next to each other in other ways, for instance for production of a building forming an L shape.

[0044] It should be emphasised that the fact that the slab 1 is prefabricated is not to be interpreted as if the slab 1 must necessarily be delivered in one piece to the site. It is also conceivable to prefabricate the frame 2 separately and the insulating means 3 separately and not assemble these two parts to form a slab 1 until at the site. The idea of prefabrication is that the time required for the work at the actual site should be minimised.

Claims

1. A foundation structure for a building, comprising a slab (1) to be arranged on a ground surface, which slab (1) is prefabricated and has static load-bearing capacity and insulating capacity and comprises a frame (2) and a self-supporting insulating means (3) arranged in the frame (2), **characterised in that** the frame (2) provides the main static load-bearing capacity of the slab (1) and the insulating means (3) comprises an insulating material which provides the main insulating capacity of the slab (1).

2. A foundation structure as claimed in claim 1, in which the frame (2) comprises concrete.

3. A foundation structure as claimed in claim 1 or 2, in which the insulating material is capillary breaking.

4. A foundation structure as claimed in claim 3, in which the insulating material is cellular plastic.

5. A foundation structure as claimed in any one of claims 1-4, in which the frame (2) further comprises

reinforcement.

6. A foundation structure as claimed in claim 5, in which the reinforcement comprises reinforcing bars.

7. A foundation structure as claimed in claim 5, in which the reinforcement comprises reinforcing fibres.

8. A foundation structure as claimed in any one of the preceding claims, further comprising a lower insulating layer (4) on an underside of the slab (1).

9. A foundation structure as claimed in claim 8, in which the lower insulating layer (4) is made of cellular plastic.

10. A building comprising walls (8), ceiling (9) and a foundation structure as claimed in any one of claims 1-9.

11. A method of producing a foundation structure for a building, comprising the steps of
forming a slab (1) with static load-bearing capacity and with insulating capacity, the slab (1) being formed with a frame (2) which provides the main static load-bearing capacity of the slab (1) and a self-supporting insulating means (3) which is arranged in the frame (2) and provides the main insulating capacity of the slab (1), and
placing the slab (1) on a levelled surface (12) where the building is to be built.

12. A method as claimed in claim 11, in which the step of forming a slab comprises the steps of
making a frame (2) essentially of concrete,
arranging a self-supporting insulating means (3) of an insulating material in the frame to form the slab.

13. A method as claimed in claim 12, wherein the frame (2) is formed by moulding.

14. A method of producing a building, comprising the steps of
forming a slab (1) with static load-bearing capacity and with insulating capacity, the slab (1) being formed with a frame (2) which provides the main static load-bearing capacity of the slab (1) and a self-supporting insulating means (3) which is arranged in the frame (2) and provides the main insulating capacity of the slab (1),
mounting walls (8) on an upper side of the slab (1),
mounting a ceiling (9) on the walls (8),
placing the slab (1) with walls (8) and ceiling (9) on a levelled surface (12) where the building is to be positioned.

15. A method as claimed in claim 14, in which the step of forming a slab comprises the steps of
making a frame (2) essentially of concrete,
arranging a self-supporting insulating means (3) of an insulating material in the frame (2) to form the slab (1).

16. A method as claimed in claim 14 or 15, further comprising the step of arranging a plastic foil (11) on the upper side of the slab (1), under a floor sheet (10), between the walls (8) and the slab (1).

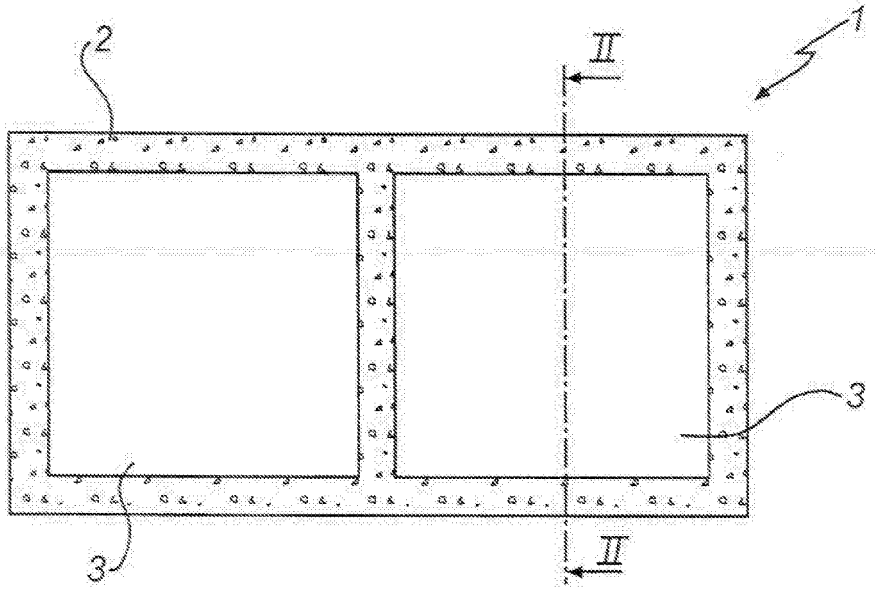

Fig. 1

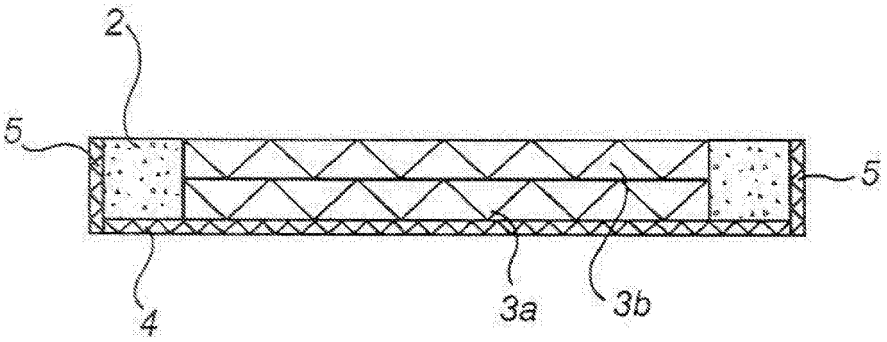

Fig. 2

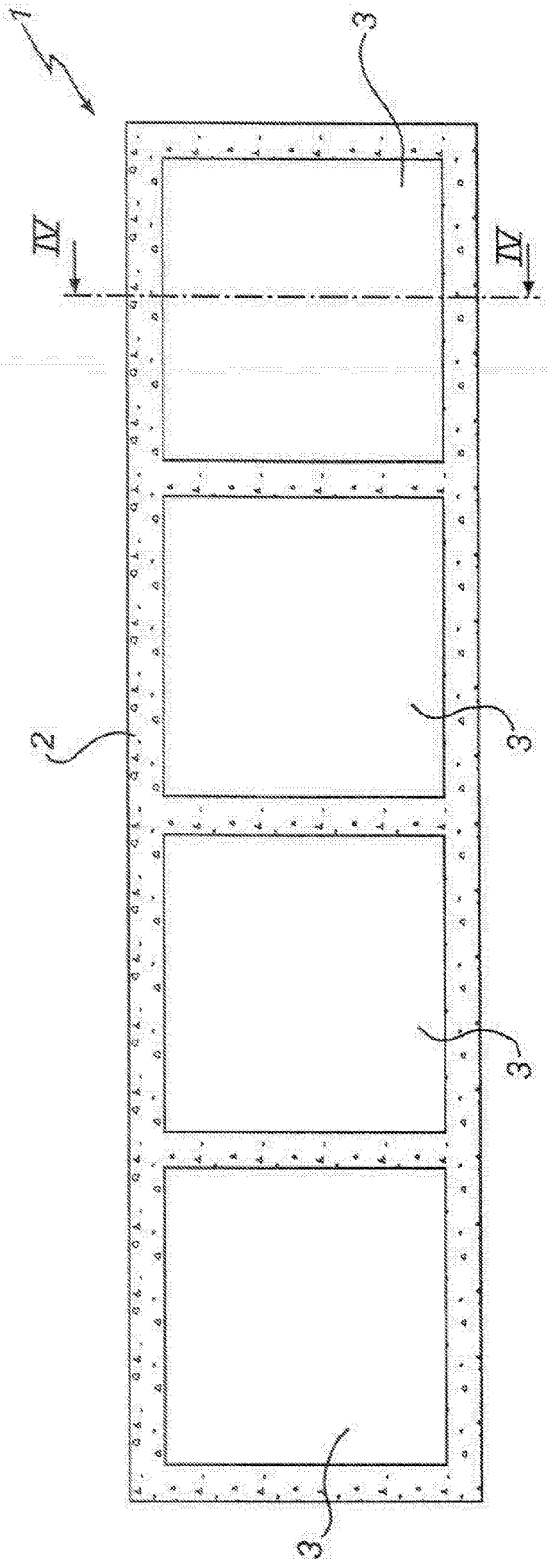

Fig. 3

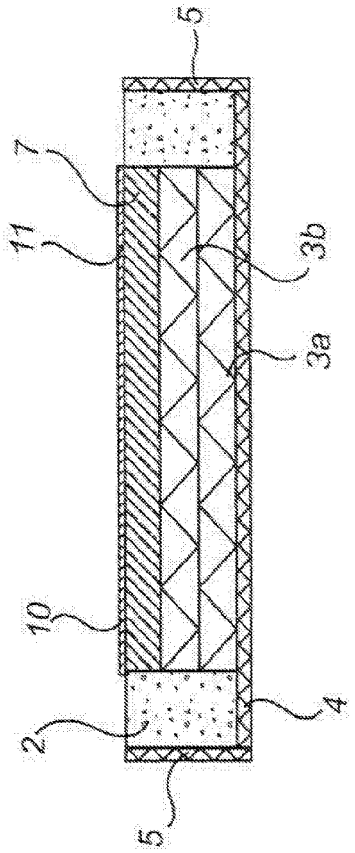

Fig. 4

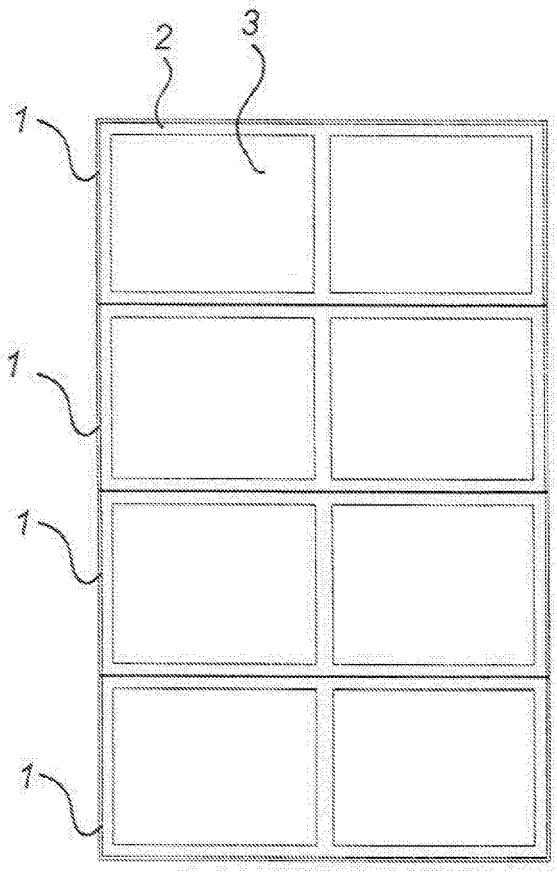

Fig. 5

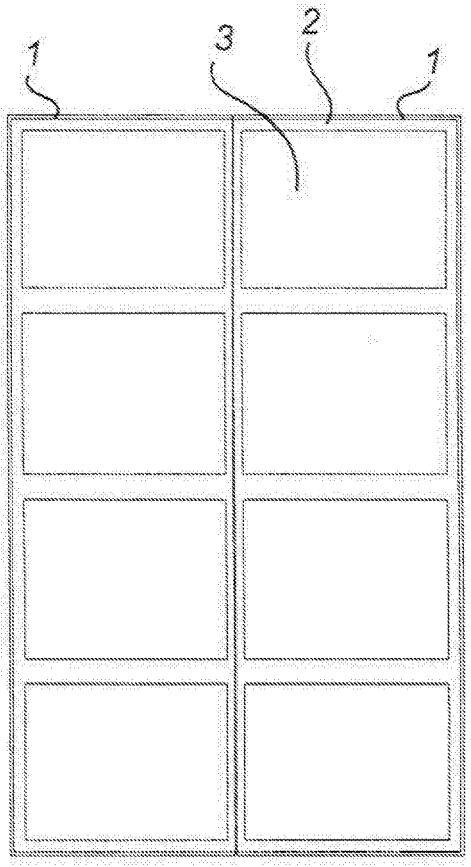

Fig. 6

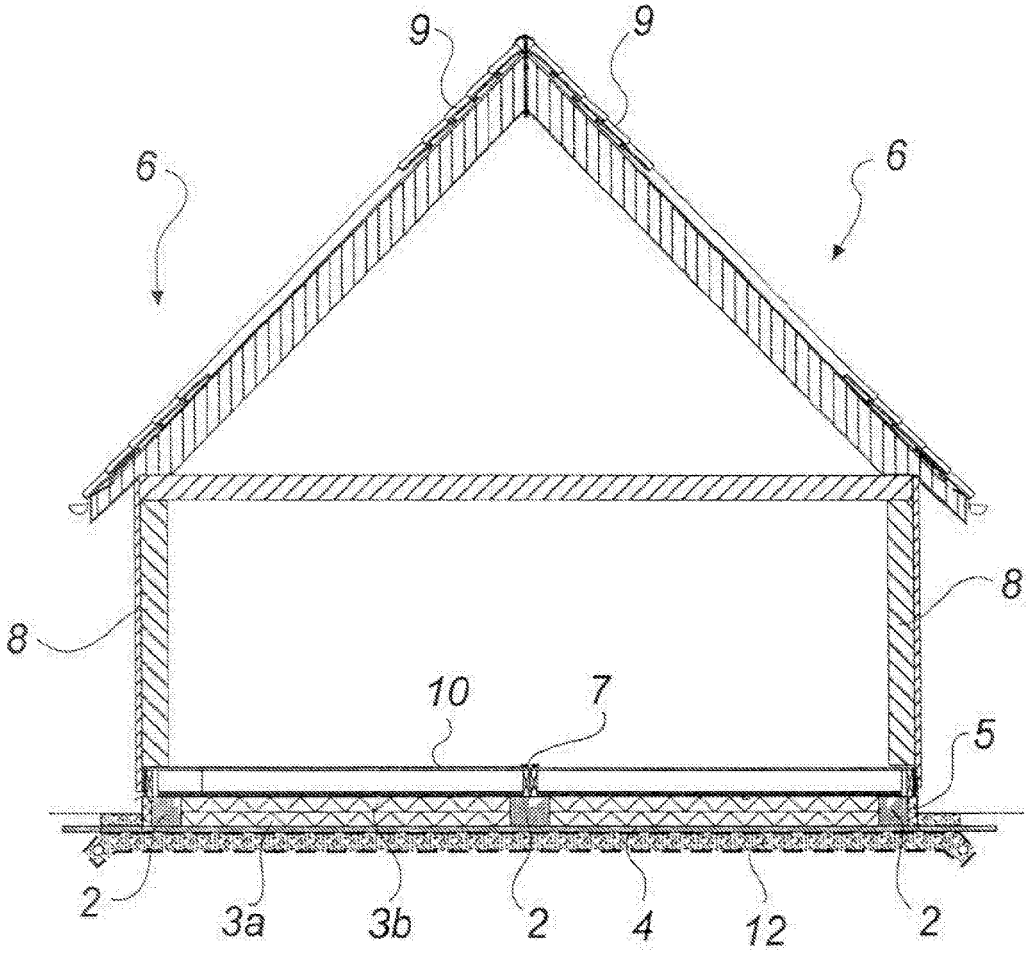

Fig. 7