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(54) Prefabricated insulating perlite slab of reverse insulation

(57) It is a prefabricated insulating perlite slab of reverse insulation having as its principal ingredient, the expanded perlite whose manufacturing principle has been invented in order to cancel the weaknesses of the conventional perlite insulation and which is used for the insulation (heat-insulation and sealing) of normal accessibility terraces and slopping roofs of buildings, with reversed perlite insulation (with reversed insulation, with permeability) for healthy living conditions.

Its construction know-how, transforms the unified water-absorbing heat-insulating layer of the conventional insulation, into small water-absorbing heat-insulating layers (1) which are sealed between them, with the reinforced concrete slab (3) of the terrace, with the balustrade of the terrace and with the external environment, having as result, the protection of the heat-insulation (the success of the insulation).

It is water tightening, heat-insulating and simultaneously sealing, while its mass is water absorbant.

It has a light weight (it does not affect the anti-seismicity of the building), it is practicable, heat-insulating, permeable (it respires) and fire-resistant.

It is manufactured in 4 types, A, B, C/Γ and D.

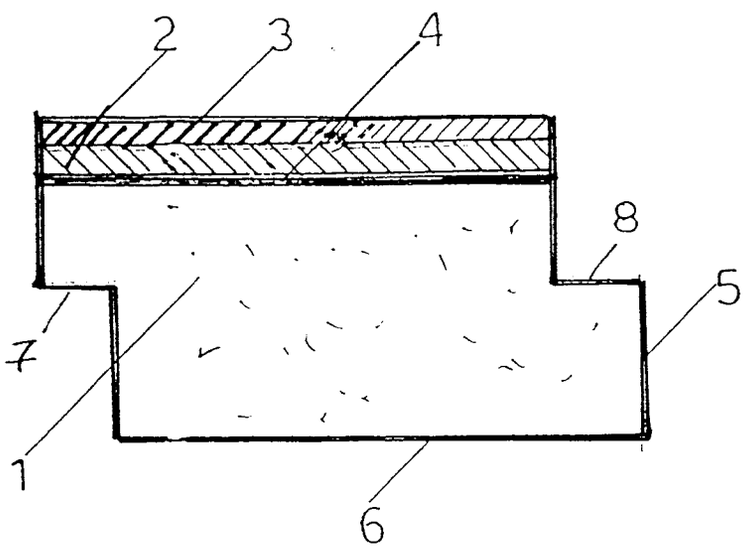

Fig. 1

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Description

[0001] This invention, refers to the manufacture of a prefabricated insulating perlite slab of reverse insulation, having as its principal ingredient for the insulation (heat insulation and sealing) of flat roofs (terraces) and sloping roofs in buildings, with a reversed perlite insulation, the expanded perlite. The manufacturing principle of the insulating perlite slab (of the reversed perlite insulation) has been invented in order to delete the weaknesses presented by the conventional perlite insulation (the conventional method of construction).

[0002] The originalities of the prefabricated insulating perlite slab of reverse insulation are the following:

It has a light weight (it does not affect the antsesmicity of the building), it is passable (due to its mass composition, to the protective sealing and heat insulating layer and to the protective layer of cement mortar), heat insulating, permeable (it respires) and fire-resistance. It is sealing, heat insulating and seals simultaneously, while its mass is water-absorbing.

It is made from a (uniform) heat-insulating layer, from a protective sealing, heat insulating layer and from a protective layer of sealing cement mortar.

[0003] This, contributes towards the increase of the accessibility (by increasing the resistance to pressure), the decrease of the thickness of the insulating perlite slab (ease in its use and decreased cost) in order to reach a coefficient of thermal conductivity equal to k=0,4 up to 0,35 Kcal/mhc° , and the protection of the sealing layers.

[0004] It is composed of two horizontal sealing layers (the 1st and the 2nd) and of the perimetrical sealing layer (that is all horizontal and vertical perimetrical surfaces are sealed).

[0005] All the sealing layers are protected, due to their position, from the adverse weather conditions, from the temperature changes of the environment, from the ultraviolet radiation of the sun and from mechanical ill-treatments.

[0006] This contributes to the protection of the flat-roof's heat protection, and the protection of the reinforced concrete slab of the terrace from any eventual infiltration of water in the insulating perlite slab.

[0007] Until now, the expanded perlite is being used as a mixture with cement (perlo-concrete), for the insulation of external surfaces of terraces with a conventional insulation (construction), because it is not possible to use expanded perlite (as perlo-concrete) for heat insulation with reversed insulation, due to its water-absorbtion.

[0008] The use of use expanded perlite (as perlo-concrete) for conventional insulation is realized as follows:

a)The perlo-concrete is prepared on spot, at the site.

b)The pumping-up of the perlo-concrete takes place with a special press, because the usual presses which are used for the pumping up of the cement-mortar cannot pump the perlo-concrete, and they shrink the expanded perlite (they transform it into dust), and thus, the result is that the thermal insulating capacity of the perlo-concrete is considerably decreased

c) The sealing of the perlo-concrete surface is made after 8 to 15 days (after it has dried and tightened).

[0009] During this period of 8 to 15 days, the perlo-concrete has to be protected from the rain until the sealing of its surface is made. The use of expanded perlite (as perlo-concrete) for a conventional insulation (construction) presents the following disadvantages:

1. It has increased cost for the following reasons:

a) It needs perlo-concrete with an increased thickness, in comparison with the thickness of the perlo-concrete (of the insulating layer) of the insulating perlo-slab in order to reach a coefficient of thermal conductivity equal to k=0,4 up to 0,35 Kcal/mhc° because in order to get an increase of the passability (the resistance to pressure) of the perlo-concrete, in a conventional insulation, we need an increased quantity of cement, leading to the result to decrease considerablythe heat insulating capacity of the perlo-concrete.

b) Due to the preparation of the perlo-concrete at the site.

c) It needs a special press for the pumping of the perlo-concrete.

d) Due to the procedure for sealing of the perlo-concrete surface (the sealing is made on spot, at the site, and the waiting time of 8 to 15 days, and the protection of the perlo-concrete from the rain).

2. The sealing layer is exposed, due to its position, to adverse weather conditions, to environmental heat changes, to the ultra-violet radiation of the sun, and to mecanical ill handling, due to the circulation at the terrace.

3. The perlo-concrete is water absorbant, and due to the encumbered position of the sealing layer, when there is some water infiltration from some point, due to damage of the sealing layer, then, the water penetrates under the sealing layer into the entire surface of the perlo-concrete (of the uniform heat-insulating layer) of the terrace, having as result:

a) the failure of the heat-insulation on the entire surface of the terrace.

b) the decrease of the building's antiseismicity, due to the increase of the building's dead loads (undesirable water weight).

c) the likely infiltration of water to the internal surface of the terrace, and its consequences, which are usually the pollution of the ceiling, the development of mould and fungi, as well as the damage to the stucco decorations, to the painted surfaces and to the plastering.

[0010] The above disadvantages contribute to the avoidance of the expanded perlite for the heat insulation of the external surfaces of terraces, and instead, to the preference of the expanded and laminated polysterene for conventional insulations (constructions) anf for reversed insulation due to their sealing capacities, although they are unhealthy, non permeable (they do not respire), chemical products non-fire resistant.

[0011] Contrary to my prefabricated insulating perlite slab of reversed insulation, which is the unique safe and inexpensive solution in order to realize the insulation (heat insulation and sealing) of terraces and sloping roofs of buildings, with reversed perlite insulation, suppressing all the disadvantages of the conventional perlite insulation. If the water penetrates the protective layer of the sealing cement mortar, it is catched in a part of the insulating perlite slab (at the protective sealing heat insulating layer), or it is caught only in one insulating perlite slab, if the water infitrates also the first horizontal insulating layer, having as result, the protection of the heat insulation (the success of the insulation).

[0012] The insulating material which is used for my construction, for the formation of the sealing layers of the insulating perlite slab is a flexible, elastic, sealing mortar composed by two ingredients with mineral elements (it does not gets old), with a large content of elastic resins, and has the following characteristics: It is permeable and it does not prevent the permeability of the insulatingperlite slab.

[0013] Thanks to its "special" elasticity, it follows the movements of the building, and bridges cracks up to 0.5 mm caused by the mobility of the buildings, resulting inthe avoidance of fissures in the sealing layers. It has great resistance in low and high temperatures, under adverse weather conditions, the ultra-violet radiation of the sun, and large heat changes. It shows great resistance against strong active chemical substances.

[0014] It is the only safe and inexpensive solution (as a prefabricated insulation) for the insulation (heat insulation and sealing) of external terrace and sloping roof surfaces of buildings with reversed perlite insulation (with reversed permeable insulation).

[0015] It is the only safe and inexpensive solution (as a prefabricated insulation) for the insulation (heat insulation and sealing) of external surfaces of existing non-insulated terraces and sloping roofs of buildings, with reversed perlite insulation (with reversed permeable insulation) and the length of the construction and subsequent disturbance, especially for inhabited buildings, is decreased, by the procedure of the conveyance and covering the surface with the materials.

[0016] It is the only safe and inexpensive solution for the heat insulation with coefficient of thermal conductivity of the external terrace surfaces, equal to K=0,35 to 0,1 Kcal/mhc° with expanded perlite and reversed insulation simultaneously (with reversed insulation and permeability).

Lower insulating cost.

[0017] Until now, the insulation (heat insulation and sealing) of the external terrace and slopping roof surfaces of buildings, is realized on spot, at the site, and under good weather conditions, leading to the result of having a high insulating cost.

[0018] On the contrary, with my prefabricated insulating perlite slab of reversed insulation (of the prefabricated insulation) the insulation cost is decreased because:

a) The insulation can be made even with unstable weather conditions.

b) We cover more square meters of insulation, at a shorter time, because the insulating perlite slab insulates and seals at the same time.

c) The installation of the perlite slabs on the surface of the terrace, can be made by the owner himself.

[0019] My know-how for the construction of the prefabricated insulating perlite slab for reversed insulation (the prefabricated insulation) renders the water-absorbing permeable (either as main substance, or as a mix) heat insulating materials, suitable (useful) for the insulation of the external terrace and slopping roof surfaces of buildings, with reversed insulation. These materials were used until today, only for the construction of conventional insulation, and are prepared on the spot, at the site. like the expanded perlite (in the form of perloconcrete), or expanded and laminated polysterene in the form of granules (like the felisol-concrete), the light concrete and the pumice.

[0020] My know-how for the construction of the prefabricated insulating perlite slab for reversed insulation (the prefabricated insulation) transforms the unified water-absorbing heat-insulating layer of the conventional insulation, into small water-absorbing heat-insulating layers, which are sealed between them, with the reinforced concrete slab of the terrace, with the balustrade of the terrace and the external environment, having as result, the protection of the heat-insulation (the success of the insulation). It cancels the methods of insulation used until now, , that is the conventional insulation without permeability or with permeability, and the reversed insulation without permeability, and constitutes the new method for insulation, that is the reversed insulation with perlite (the reversed insulation with permeability).

[0021] A practical application is given with reference

to the attached drawings which:

In drawing 1, we see in section, the type A of the insulating perlite slab.
In drawing 2, we see in section, the type B of the insulating perlite slab.
In drawing 3, we see in section, the type C/(Γ) of the insulating complementary perlite slab.
In drawing 4, we see in section, the type D of the insulating complementary perlite slab.

[0022] Refering to the drawings, the type A of the insulating perlite slab is constituted by the main heat-insulating layer -1- which at its upper part, has the 1st horizontal sealing layer -4- at its lower, the 2nd horizontal sealing layer -6- , and perimetrically, one horizontal sealing layer -5-. Over the heat-insulating layer there are one protective heat-insulating layer -2- and one protective layer of sealing cement mortar -3-. The type B of the insulating perlite slab is constituted by the main heat-insulating layer -1a- which at its upper part, has the 1st horizontal sealing layer -4a- at its lower, the 2nd horizontal sealing layer -6a- , and perimetrically, one horizontal sealing layer -5a-. Over the heat-insulating layer there are one protective heat-insulating layer -2a- and one protective layer of sealing cement mortar -3a-.

[0023] The type C/Γ refers to a complementary insulating perlite slab which is constituted by the main heat-insulating layer -1b- which at its upper part, has the 1st horizontal sealing layer -4b-, at its lower, the 2nd horizontal sealing layer -6b-, and perimetrically, one horizontal sealing layer -5b-. Over the heat-insulating layer there are one protective heat-insulating layer -2b- and one protective layer of sealing cement mortar -3b-.

[0024] The type D refers to a complementary insulating perlite slab which is constituted by the main heat-insulating layer -1c/γ-which at its upper part, has the 1st horizontal sealing layer -4 c/γ-, at its lower, the 2nd horizontal sealing layer -6 c/γ-, and perimetrically, one horizontal sealing layer -5 c/γ-.

USE OF THE INSULATING PERLITE SLAB

[0025] The prefabricated, reverse insulation, insulating perlite slab is used for the insulation (heat insulation and sealing) of external terrace surfaces, of normal practicability, and of slopping roofs in buildings, using reversed insulation with perlite (with permeable reversed insulation), for healthy living conditions.

[0026] The prefabricated, reverse insulation, insulating perlite slab in the insulation (heat insulation and sealing) of external terrace surfaces, and of slopping roofs of buildings, replaces:

a) the expanded and laminated polysterene which are unhealthy, non-permeable, chemical and non-fire-resistant materials.
b) the perlo-concrete, the light-concrete, the expanded and the laminated polysterene in the form of granules (as felisobeton/felisoconcrete) and the pumice, which are used till now, only for the construction of the conventional insulation, which are prepared and sealed on the spot, at the site.
c) the non-permeable insulating materials, like the asphalt-cloth, the asphalt emulsion and the liquid rubber.

[0027] With the prefabricated, reverse insulation, insulating perlite slab we obtain a lower cost for the insulation, because:

a) We cover more square meters of insulation in shorter time, because the insulating perlite slab insulates and seals simultaneously.
b) the insulation of the terrace and the slopping roof can be made even under unsteady weather conditions
c) The installation of the insulating perlite slabs on the surface of terraces or slopping roofs, can be made by the owner himself.

[0028] According to the coefficient of thermal conductivity we wish to obtain, the heat insulation of terraces is distinguished as follows:

1) In heat insulation with coefficient of thermal conductivity k=0,4 up to 0,35 Kcal/mhc°

a)The type A, insulating perlite slab is used with the fitting flanges -7- and -8- in order to avoid the formation of thermal-bridges.

The installation of type A insulating perlite slabs, at the external surface of the terrace, becomes homogeneous, with the system of adjacent joints, with a joint thickness (thermal-bridges) of 0,2 to p,5 mm and with a system of interrupted cross joints, with a joint thickness (thermal-bridges) of 0,2 to p,5 mm and the joining of one insulating perlite slab with the other, as well, also, as the joining of every insulating perlite slab with the balustrade of the terrace and with the sloping layer of the reinforced concrete slab of the terrace, is made with the insulating material which is used for the forming of the insulating layers of the insulating perlite slab or with the elastic sealing glue of the tiles.
During the installation of the type A insulating perlite slabs, when they do not fit, e.g. with the balustrade of the terrace, then, in order to have fewer losses of materials, we use the complementary insulating slabs type C/Γ and D.
b) For claims concerning increased ease at the installation of the insulating perlite slabs (usually when the installation is not realized by a specialised shift, but by the terrace owner, himself), the insulating perlite slab type B is being

used.

The installation of insulating perlite slabs type B at the external surface of the terrace, in order to avoid the creation of thermal bridges, is made homogenic with the system of the interrupted cross joints with a joint thickness (thermal bridges) of 0,2 - 0,5 mm, and the joining of one insulating perlite slab with the other, as well as the joining of each insulating perlite slab with the balustrade of the terrace and with the layer of the slopes of the reinforced concrete of the terrace, is executed with the sealing material which is used for the forming of the sealing layers of the insulating perlite slab or with the elastic sealing glue of the tiles.

During the installation of the type B insulating perlite slabs when they do not fit, e.g. with the balustrade of the terrace, then, in order to have fewer losses of materials, we use as complementary parts, piecesof the insulating slab which are cut with a saw, their vertical surface is sealed with the same sealing material which is used for the forming of the sealing layers of the insulating perlite slab, and then, their installation takes place.

2. In heat insulation, with coefficient of thermal conductivity k=0,35 up to 0,1 Kcal/mhc°.

For requirements of insulation, with coefficient of thermal conductivity k=0,35 to 0,1 Kcal/mhc° a larger thickness of the insulating perlite slab is required (thicker heat insulating layer), leading to an increase of the cost of installation of insulating perlite slabs (increased cost, due to small productivity).

In order to decrease thye cost and for the protection of the heat insulation (the success of the insulation), the construction of the reversed insulation with perlite, at the external surface of the terrace, in accordance with the coefficient of thermal conductivity K which we wish to obtain (k=0,35 up to 0, Kcal/mhc°), is made with the forming of two, or three heat insulating layers which are sealed between them. The final surface (tha last heat insulating layer) is formed by the A or B type insulating perlite slabs.

Example: Insulation of a terrace with a total 36 cm requested thickness of insulating layer.

[0029] The construction of the reversed perlite insulation is obtained with the forming of three heat-insulating layers of 12 cm thickness for every layer, as follows:

a) First insulating layer:

It is composed of the complementary D type, insulating perlite slabs with dimensions 30x30x12 cm which are placed on the surface of the the slopes' layer of the reinforced concrete slab of the terrace.

b) Second insulating layer:

It is composed of the complementary D type, insulating perlite slabs with dimensions 30x30x12 cm, in order to avoid thermal-bridges. These slabs are placed over the surface of the first heat insulating layer.

c) Third insulating layer:

It is composed of the complementary A or B type, insulating perlite slabs with dimensions 40x40x12 cm, which are placed over the surface of the second heat insulating layer.

[0030] The forming of the different layers of all types of insulating perlite slabs is made as follows:

PROTECTIVE LAYER OF SEALING CEMENT MORTAR -3-3a-3b-

[0031] It constitutes the external surface of the insulating perlite slab, and has a thickness of 1 to 3 mm for the insulating perlite slabs of types A, B, C/Γ. The composition of the mass is the following:

a) 1 part of white cement.
b) 1 to 3 parts of fine marble powder or fine sand.
c) 3 kg/cubic meter mix, of mass water-sealer (liquid material based on hydrophobe sulphic salts combined with liquefactors).
d) 3 kg/cubic meter of mix, multiple uses booster (emulsion of watery dispersion based on elastomer copolymeric resins).

[0032] Water 300 kg/ cubic meter of mix , or

a) white cement.
b) 3 kg/cubic meter mix, of mass water-sealer (liquid material based on hydrophobe sulphic salts combined with liquefac-tors), or
c) 3 kg/cubic meter of mix, multiple uses booster (emulsion of watery dispersion based on elastomer copolymeric resins).

PROTECTIVE SEALING HEAT-INSULATING LAYER -2-2a-2b-

[0033] It is 15 - 20 mm thick, and its mass composition is as follows:

a) 40 to 60 kg cement.
b) 80 to 100 kg pumice.
c) 3 kg/cubic meter mix, of mass water-sealer (liquid material based on hydrophobe sulphic salts combined with liquefactors).
d) 3 kg/cubic meter of mix, multiple uses booster (emulsion of watery dispersion based on elastomer copolymeric resins).

[0034] Water, 30 kg/100 litres of pumice., or

a) 50 to 75 kg cement.
b) litres of expanded perlite.
c) 3 kg/cubic meter mix, of mass water-sealer (liquid material based on hydrophobe sulphic salts combined with liquefactors), or
d) 3 kg/cubic meter of mix, multiple uses booster (emulsion of watery dispersion based on elastomer copolymeric resins).

[0035] Water, 35 kg /100 litres of expanded perlite.

HEAT INSULATING LAYER -1-1a-1b-1c/γ-

[0036] It has a coefficient of thermal conductivity λ = 0,045 up to 0,08 Kcal/m2hc°.

[0037] Its mass composition is the following:

a) 8 to 20 kg cement.
b) 100 litres of expanded perlite with granulometry 0 to 3, or 0 to 5 mm.
c) 150 to 200 grams/ 100 litres of expanded perlite, mortar plasticizer.
Water 35 kg/100 litres of expanded perlite.
d)0,3 to 0,5 kg multi-use booster/100 litres of expanded perlite (emulsion of watery dispersion based on elastomer copolymeric resins).

PERIMETRIC -5-5a-5b-5c/γ- and HORIZONTAL SEALING LAYERS -4-4a-4b-4c/y-6-6a-6b-6c/y-

[0038] The insulating material used in their preparation, is a flexible elastic sealing mortar with two ingredients containing mineral elements (it does not age), with increased content of elastic resins and has the following features :

[0039] It is permeable and does not prevent the permeability of the insulating perlite slab.

[0040] Thanks to its "special" elasticity, it follows the movements of the building and bridges cracks up to 0,5 mm caused by the mobility of the buildings, having as result, that no fissures are caused in the sealing layers. It presents high resistance in low and high temperatures, under adverse weather conditions, under the ultra-violet radiation of the sun and under extreme temperature changes.

[0041] It shows great resistance to strong chemical substances CONSUMPTION OF SEALING MATERIAL PER SQUARE METER OF SEALING LAYER.

[0042] For the preparation of the sealing layers of insulating (type A, B, C/Γ) perlite slabs, the consumption of material is as follows:

1,5 kg/square meter for the 1st and 2nd horizontal sealing layer, and
1 kg/square meter for perimetric sealing layer.

[0043] The consumption of sealing material for the type D complementary insulating perlite slab, is the following: 1 kg/square meter for all the sealing layers. Only for the 2nd horizontal, 1,5 kg/square meter when used as an intermediate heat insulating layer, for the insulation of a terrace with coefficient of thermal conductivity K=0,35 to 0,1 Kcal/mhc°.

DIMENSIONS OF A HEAT INSULATING SLAB.

[0044] The type A and B, prefabricated insulating perlite slabs, of reversed insulation are made with the following dimensions:

20 × 40 × 12 cm,	40 × 40 × 12 cm.
30 × 30 × 12 cm,	45 × 45 × 12 cm.
35 × 35 × 12 cm,	50 × 50 × 12 cm.

[0045] Also the same dimensions with a thickness of 5-6-7-8-9-10-11-13-14-15-16 and 17 centimeters.

[0046] During the installation of the type A, insulating perlite slabs for the covering of the remaining of small surfaces, when the insulating perlite slabs do not fit, for example with the balustrade of the terrace, in order to have fewer losses in material, we use as complement, the complementary type C/Γ and D, insulating perlite slabs.

[0047] The complementary type C/Γ, insulating perlite slab is made with the following dimensions:

30 × 30 × 5 cm,	40 × 40 × 5 cm.
33 × 33 × 5 cm,	45 × 45 × 5 cm.
35 × 35 × 5 cm,	50 × 50 × 5 cm.

[0048] Also the same dimensions with a thickness of 4-6-7 and 8 centimeters.

[0049] The complementary type D, insulating perlite slab is made with the following dimensions:

30 × 25 × 7 cm,	40 × 35 × 7 cm.
33 × 28 × 7 cm,	45 × 40 × 7 cm.
35 × 30 × 7 cm,	50 × 45 × 7 cm.

[0050] The same dimensions with a thickness of 5,6,7,8,9,10,11 and 12 centimeters.

[0051] The type D for intermediate heat-insulating layer and for insulation with coefficient of thermal conductivity K=0,35 to 0,1 Kcal/mhc° with dimensions of 30 × 30 × 12 cm and 35 × 35 × 12 cm also with a thickness of 5,6,7,8,9,10 and 11 centimeters.

[0052] During the installation of the type B, insulating perlite slabs for the covering of the remaining of small surfaces, when the insulating perlite slabs do not fit, for example with the balustrade of the terrace, in order to have fewer losses in order to have fewer losses in material, we use as complement, parts of the insulating perlite slab, which are cut with a saw, and their vertical surface is sealed with the same sealing material which is used for the forming of the sealing layers, and then, follows their installation.

Claims

1. A prefabricated insulating perlite slab of reverse insulation. which is characterized by the fact that it is manufactured in 4 types.
The type A of the insulating perlite slab is composed by the main heat-insulating layer-1- which on its upper part has the 1st horizontal sealing layer -4- , at its lower, the 2nd horizontal sealing layer-6- and perimetrically, one sealing layer -5-. Over the heat-insulating layer, there are one protective sealing heat-insulating layer -2- and a protective layer of cement mortar -3-.
The type B of the insulating perlite slab is composed by the main heat-insulating layer -1a- which on its upper part has the 1st horizontal sealing layer-4a- , at its lower, the 2nd horizontal sealing layer -6a- and perimetrically, one sealing layer -5a- . Over the heat-insulating layer, there are one protective sealing heat-insulating layer -2a- and a protective layer of cement mortar -3a-.
The type C refers to a complementary insulating perlite slab which is composed by the heat-insulating layer -1b- which on its upper part has the 1st horizontal sealing layer -4b-, at its lower, the 2nd horizontal sealing layer -6b- and perimetrically, one sealing layer -5b-. Over the heat-insulating layer, there are one protective sealing heat-insulating layer -2b- and a protective layer of cement mortar -3b-.
The type D refers to a complementary insulating perlite slab which is composed by the heat-insulating layer -1c/γ- which on its upper part has the 1st horizontal sealing layer -4 c/γ, at its lower, the 2nd horizontal sealing layer -6c/γ- and perimetrically, one sealing layer -5c/γ-.

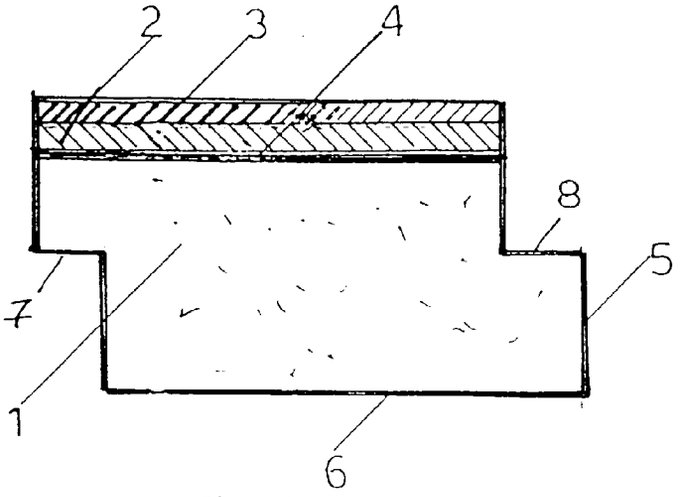

Fig. 1

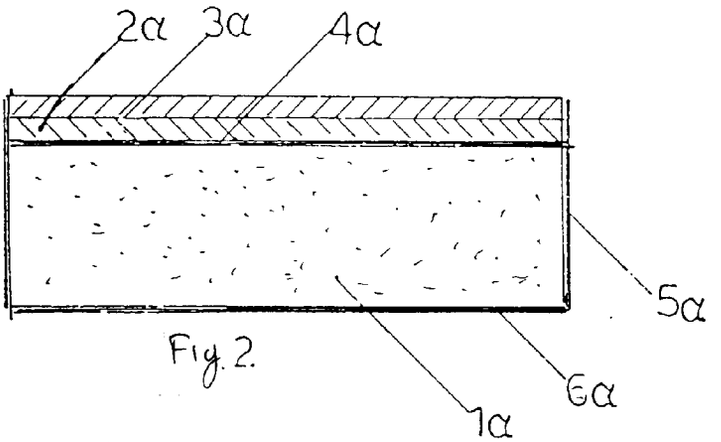

Fig. 2

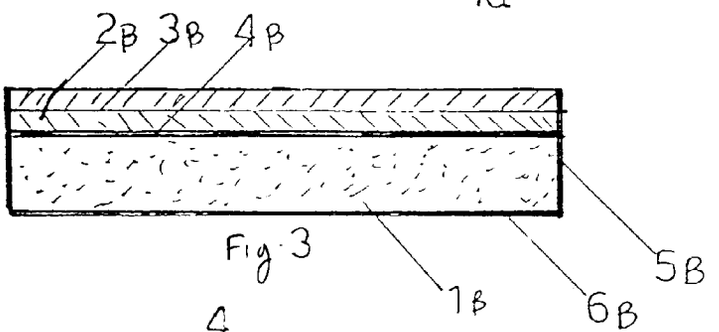

Fig. 3

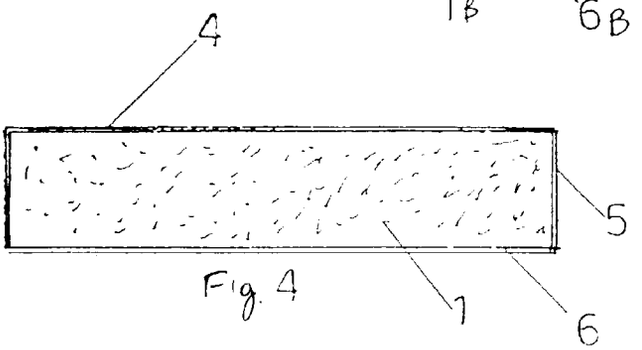

Fig. 4