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(54) **Prefabricated façade element for buildings**

Vorgefertigtes Fassadenelement für Gebäuden

Elément de façade préfabriqué pour bâtiments

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Description

[0001] The present invention relates to a prefabricated façade element for buildings as in the preamble of claim 1 disclosed in DE-A-2 254 748, comprising a thermal insulation accommodated internally within the element enclosed by an inner leaf facing inwards towards the interior of an intended building and an outer leaf facing outwards from the interior of said building.

[0002] SE-B-335217 relates to a facade element constructed from various materials incorporating a connecting rod to hold the different layers of material together. A frame constructed from U-section beams is enclosed in recesses in the insulating material. The frame executed in this way is attached to an outer leaf of the material in the various layers consisting of concrete, and reinforcement is absent from the border. This façade element does not, however, permit free shrinkage and is also complicated.

Movements, shrinkage

[0003] All common building materials are subject to temperature-induced movements. Porous materials or materials with the capacity to absorb water in some way are additionally subject to moisture-induced movements.

[0004] Cement-based materials experience so-called initial shrinkage, which is associated with the hardening process of the material. Shrinkage is caused by a certain reduction in volume due to hydration, but also by the loss of water. The latter is associated with the fact that pourability as a rule requires the addition of a certain amount of surplus water in relation to the water required for hydration and the long-term moisture content.

[0005] The expressions shrinkage and shrinkage-induced movement are often used in the sense of both shrinkage and swelling. The expression contraction is sometimes used in place of shrinkage.

[0006] The symbol ε is generally used for shrinkage. The shrinkage ε is defined as the relationship between the change in length (in m) and the original length (in m).

[0007] Shrinkage (swelling) rarely exceeds 1 part per thousand.

Chronological development

[0008] Initial shrinkage is also known as non-periodic shrinkage due to the fact that it is linked to a period after manufacture. The length of this period can vary within wide limits.

[0009] Temperature-induced and moisture-induced movements may be referred to as periodic movements, because this is a chronologically recurring phenomenon.

[0010] A periodic phenomenon may be described in its simplest form with reference to three parameters: mean value **M**, amplitude **A** and time (period length) **T**.

[0011] For example, the temperature can be stated as a function of the time **t**, as follows: $\text{Temp} = \mathbf{M} + \mathbf{A} \times \sin(2 \times \pi \times \mathbf{t}/\mathbf{T})$.

5 Damping, phase displacement

[0012] If the sun shines on the external surface of an exterior wall, the outer part of the wall will naturally vary considerably in respect of its temperature in proportion to the variation in intensity of the sun. The effect is less at a certain distance into the wall, when the oscillation is said to be damped.

[0013] It may be assumed that, when the sun is shining at its most intensive, say at 12 noon, it will also be hottest on the outside. A certain increase in temperature will occur on the inside a few hours later. This time displacement is usually referred to as phase displacement.

[0014] It can also be said that the climatic factors affect a part of a building in a way that can produce both damping and phase displacement.

[0015] From a practical point of view, it is true to state that a facade layer is affected by phase displacement and damping to a small degree, whereas the inner parts of an exterior wall are affected in a more damped fashion. The consequence of this is that differences in movements and displacements will occur between, for example, the facade layer of a wall and the structure situated behind it.

30 Free and restrained shrinkage

[0016] If a part of a building shrinks (swells), and if it is assumed that this shrinkage can take place without any restraint, no stresses will arise as a general rule and also no associated problems.

[0017] It is customary to distinguish between free shrinkage and various degrees of restrained shrinkage. In particular when comparing different mixing recipes and the like, a comparison is made according to the principle of free shrinkage. It can be stated in general terms that the aim should be to achieve a mixing recipe which gives little shrinkage.

[0018] The determination of free shrinkage must take place in a manner which permits the material to move to all intents and purposes freely during the shrinking process.

[0019] Free shrinkage may be much greater than restrained shrinkage. It may be assumed that the first part of the free shrinkage does not occur at all in the course of experiments into restrained shrinkage, due to the ability of the material to absorb the shrinkage as plastic deformations.

55 Stresses, invisible cracks

[0020] One problem is associated with the fact that steel is a material with highly distinctive characteristics, whereas plaster is more indeterminate and variable.

This means, for instance, that the modulus of elasticity may vary within quite wide limits for plaster.

[0021] Because plaster and other cement-based materials exhibit low tensile strength in relation to their compressive strength, it may be observed that the estimated stress is high. It is accordingly not uncommon to find that a fine structure of cracks forms even in effectively functioning and durable layers of plaster.

Visible cracks

[0022] Fine cracks can conceivably occur in almost all layers of plaster, and these are not normally harmful.

[0023] The question then is why wide cracks occasionally occur in plaster.

a) If the base for the plaster, for example masonry, cracks or contains cracks, there is every likelihood that cracks will also form in a layer of plaster on such a plaster base.

b) Assume that a layer of plaster is applied to masonry. The layer of plaster is exposed to relatively great shrinkage, which gives rise to splitting stresses between the masonry and the plaster. A so-called barrier can occur if the adhesion is insufficient, and the shrinkage that takes place over the area with a barrier can gather in the form of a relatively wide and visible crack.

c) A layer of plaster on a solid or flexible base: the first variant is described above. The second variant corresponds in its most highly developed form to plaster on soft mineral wool, where the own weight of the plaster is transferred to an underlying carcass via readily movable attachments. The plaster cake may shrink and swell in such a case, without any stresses necessarily arising in the plaster of a kind which can give rise to cracks. If the design were to be unsuccessful, however, leading to unintentional holding, individual wide cracks may form as a result. This is because shrinkage over a large area of plaster can gather in a single wide crack.

Stress concentrations, reinforcement

[0024] It is obvious that an area of plaster will begin to crack in those parts of the area where the stress is greatest.

[0025] It is possible to envisage stress in a material as a flow (stress flow). The flow must be concentrated for a reduction in area. Extra-high stress occurs in the corner of a window, for example. This is explained by the fact that the stress lines at that point must be curved, which causes them to be forced closer together in the "curve". If a crack is to form in a facade area, it is likely to occur at the corner of a window. Plaster can be reinforced to varying degrees. A first stage may involve laying in reinforcement where particular stress concentrations may be expected to occur. The next stage involves

reinforcing over the entire area, and laying in strengthened reinforcement wherever stress concentrations can be expected to occur. In order for the reinforcement to be effective, it must be present in sufficient quantity. It may be said that a threshold value exists below which one should not go, since probably no significant effect: is achieved from the reinforcement below the threshold value.

[0026] The general aim of plaster reinforcement should be to distribute any cracks.

[0027] The condition for the crack-distributing effect may be formulated as follows:

[0028] In order for reinforcement to have a crack-distributing effect, the tensile force present in the plaster cake immediately prior to crack formation must be capable of being absorbed by the reinforcement. The requirement for crack reinforcement can accordingly be formulated as follows:

$$A_p \times f_{ctk} < A_s \times f_{yk} \quad A_p = d_p \times c \quad A_s = \pi \times \varnothing^2 / 4$$

It can be said that the reinforcement ratio (A_s/A_p) of the cross-section must be greater than the quotient (f_{ctk}/f_{yk}).

The need for reinforcement thus increases in relation to the thickness of the plaster layer and the tensile strength of the plaster.

[0029] The principal object of the present invention is thus in the first instance to make available a prefabricated facade element for buildings which solves the aforementioned problems of crack formation along the outside of the element in an effective and simple fashion.

[0030] The aforementioned object is achieved by means of an element according to claim 1, which is characterized essentially in that the outer leaf or surface leaf and the inner leaf are arranged attached to one another via stainless reinforcement ladders, in that the inner leaf, which consists of light clinker concrete, is securely attached to a border of light clinker material extending around the insulation and is provided with internal reinforcement extending into the border, in conjunction with which the surface leaf with the reinforcement and an external surface layer applied to it is so arranged as to be secured by the aforementioned inner leaf with its associated border in such a way that it is capable of absorbing the forces which give rise to periodic movements.

[0031] The invention is described below as a number of preferred illustrative embodiments, in conjunction with which reference is made to the following drawings, where:

Fig. 1 shows a façade element for buildings in accordance with the invention in its effective position on a represented building;

Fig. 2 shows a horizontal section along two interconnected elements;

Fig. 3 shows a vertical section along the area of mutually meeting elements and flooring joists in the ar-

ea designated as III;

Fig. 4 shows a cross-section through an element in accordance with the invention;

Fig. 5 shows an example of the prior art using the previously applied free shrinkage process in the outer layer of a wall; and

Fig. 6 shows a further example in accordance with the invention.

[0032] A so-called prefabricated facade element 1 for buildings, which is formed by thermal insulation 3 accommodated inside a space 2 in the element 1, which insulation is enclosed by an inner leaf 5 facing inwards towards the interior 4 of an intended building and by a surface leaf 6 facing outwards away from the interior 4 of said building, which surface leaf is thus intended to face towards the open air 7, has the inner leaf 5 and the outer leaf 6 securely attached to one another in accordance with the present invention. More specifically the inner leaf 5, which consists of light clinker concrete, is securely attached to a border 8 extending around the insulation 3, which border also consists of light clinker material, and which inner leaf 5 is provided with internal reinforcement 9 and extends into the border 8.

[0033] In this way the surface leaf 6, with the reinforcement 10 and the surface layer 11, is so arranged as to be held securely by the aforementioned inner leaf 5 with its associated border 8 for the purpose of absorbing the forces which give rise to periodic movements, that is to say shrinkage or swelling in the aforementioned element 1.

[0034] The problem of arising stresses is effectively solved in this way, and the risk of cracking is reduced in the external facade layer 11 of plaster applied to the element 1 on-site when the element 1 was raised into position and securely installed in the intended desired location.

[0035] More precisely, the element 1 may consist of an inner leaf 5, the strength of which is adapted to the loads which the element 1 is intended to bear, with a thickness A which varies from 100 mm to 120 mm, for example.

[0036] The selected thermal insulation is preferably a cellular plastic with a thickness B of 120 mm to 150 mm, for example.

[0037] The surface leaf 6 also consists preferably of light clinker material with a strength classification of K5, and with a thickness C which varies between approx. 50 mm and 80 mm.

[0038] More specifically, the surface leaf 6 exhibits internal reinforcement, or so-called crack reinforcement 10, in order to distribute any cracks occurring in the surface leaf 6 and its watertight plaster layer 11 of light clinker material so that they become a greater number of finer cracks than before. The aforementioned reinforcement 10, 9 in the surface leaf 6 and also in the inner leaf 5, which preferably consists of a centrally positioned reinforcement mesh, for example Ø5 cc 200 mm, is se-

curely attached to the border 8. Otherwise the reinforcement 9 in the inner leaf 5 is adapted to the needs to cope with the carrying capacity. The reinforcement in each vertical section is constant, which means that the quantity of reinforcement is increased around windows and other openings through the element 1.

[0039] Reinforcement ladders 9 are arranged between the aforementioned surface leaf 6 and inner leaf 5 in order for the aforementioned leaves 6, 5 to be connected together via these reinforcement ladders. They are preferably executed in stainless steel of Ø 4.5 mm, vertically oriented with cc 1000, and are cast into the respective leaf 6, 5.

[0040] The aforementioned facade element 1 for buildings, which may have a height of up to approx. 2.7 m and a length of up to approx. 6 m, and may be used for buildings, is manufactured by casting. The first item to be cast is the inner leaf 5, which is provided with a border 8 around windows, etc., and at vertical joints 12 between elements. A reinforcement ladder 9 is laid in the aforementioned border 8, after which thermal insulation 3 is placed between the reinforcement ladders. The aforementioned reinforcement ladders 9 project by a certain amount, whereby the surface leaf 6 is attached during casting to the interior of the element 1.

[0041] The aforementioned surface leaf 6 is thus securely attached to the interior leaf at vertical joints 12.

[0042] The elements 1 thus exhibit an externally finished facade of brushed or smooth concrete, or else they consist of light clinker as a base for plastering on-site after installation, whereby a joint-free facade is obtained.

[0043] A reinforced thick plaster has been used as the surface layer 11 of the elements 1 along the facade 13 of the building. The plaster layer consists of stopping and surface plaster with a total thickness of approx. 20 mm. The reinforcement 10 for the surface leaf 6 may consist of a galvanized plaster mesh, for example with a mesh width of 20 mm and with a wire diameter of 1 mm.

[0044] The performance of a building structure produced in this way from the point of view of building physics may be described as follows:

Climate:

[0045] The outer part of an exterior wall is exposed to severe climatic effects. This applies to the effect of both temperature and moisture. The effect reduces towards the inside of the wall. This means that the inner leaf will be in an indoor climate both thermally and from the point of view of moisture. Relative to the outer leaf, it can be said that the inner leaf is to all intents and purposes in a constant climate.

[0046] All materials, even light clinker concrete and plaster, shrink and swell.

[0047] The initial non-periodic shrinkage is common to all cement-based materials. This shrinkage progress-

es rapidly to start with, and further shrinkage during the second year is only a few per cent of the value for the first year. It may be said that most shrinkage takes place during the first few months.

[0048] Depending on climatic variations (over a 24-hour period and over a year), the various layers in an outer wall will shrink and swell alternately. Such movements are usually referred to as periodic.

[0049] It is possible from the foregoing to arrive at the conclusion that an inappropriate design from the point of view of movement already exhibit a high probability of cracking up during the first annual cycle.

Movements and stresses

[0050] If both the inner leaves 5 and the outer leaves 6 are accompanied fully in their movements, no stresses will arise.

[0051] The question is what happens if the inner leaf 5 remains stationary and the surface leaf 6 shrinks, when the outer leaf 6 is securely attached to the inner leaf 5 via the borders 8 at windows and vertical joints 12? As further shrinkage takes place in the leaf 6, the shrinkage is prevented because of holding. The result is that tensile stress occurs in the surface leaf 6. Under full holding, the stress $\delta = E \times \epsilon$.

[0052] The anticipated shrinkage is dependent on the climate in which the structure is located. Thus, for certain materials, shrinkage is stated as ranging from 0.7 to 1.0 part per thousand for an indoor climate, and from 0.4 to 0.6 part per thousand for an outdoor climate. A higher U-value gives rather lower shrinkage.

[0053] The indicated shrinkage values are so great that it cannot be assumed that they will be capable of being absorbed in the form of stresses in light clinker concrete.

[0054] The following applies approximately at a density $\rho_0 = 1200 \text{ (kg/m}^3\text{)}$:

$$f_{ctk} = 0.6 \text{ (MPa) and } E_{ck} = 9.2 \text{ (G}_{pa}\text{)} = 9200 \text{ (MPa)}.$$

[0055] Shrinkage of 0.25 part per thousand, for example, would give rise to stress of $0.00025 \times 9200 = 2.3 \text{ (MPa)}$ in the case of restrained shrinkage, i.e. far in excess of f_{ctk} . Even very insignificant shrinkage will cause the ultimate tensile strength to be exceeded. The shrinkage to be withstood is not only the non-periodic shrinkage, but also the shrinkage (swelling) produced by periodic influences. This problem can be solved by providing the leaf 6 with crack reinforcement 10 for the purpose of distributing unavoidable cracks in such a way that they are more numerous and thus fine. The inner leaf 5 is dimensioned having regard for the load or is provided with mini-reinforcement 9.

[0056] In order for reinforcement 10 to have a crack-distributing effect, the tensile force present in the surface leaf 6 immediately prior to crack formation must be

capable of being absorbed by the reinforcement 10. It is thus possible to formulate the requirement for crack reinforcement as follows:

$$A_c \times f_{ctk} < A_s \times f_{yk}$$

Assume K_5 and f_{ctk} approximately $5/6 = 0.83 \text{ (MPa)}$

$$0.05 \times 0.83 < (1000/200) \times (\pi \times 0.005 \times 0.005/4) \times 500$$

$0.04 < 0.05$, which is what it should be.

The value $f_{yk} = 500 \text{ (MPa)}$ has been assumed for the steel.

[0057] Characteristic values are used here for the purpose of making cost estimates, given that the purpose is to study the construction from the point of view of the material.

[0058] If the above condition is met, small fine cracks will be prevented from continuing to become wider because the yield point in the reinforcement 10 will not be reached. If the strain continues, a new crack will form instead at a certain distance from the first crack. In order for this to function in the manner described, any forces that are generated must be transmitted between the outer reinforcement 10 and the inner leaf 5.

[0059] The border 8 is capable of absorbing the forces that shrinkage (or swelling) can produce. From the static point of view, it will function as a short cantilever.

[0060] Fig. 5 shows an example of how a leaf arranged so that it is free to move changes in length (becomes shorter) due to free shrinkage.

[0061] The preferred illustrative embodiment shown in the drawings in Fig. 6 has the border 8 arranged so as to extend only along the periphery of the aforementioned formed element. The surface leaf 6 and the inner leaf are arranged in this case connected to one another also via a centrally positioned reinforcement 9, preferably the indicated ladders, which is enclosed to the sides by the thermal insulation 3.

Plaster

[0062] Plaster has traditionally been applied to a brickwork base or some other base. This can be characterized as plaster on a solid base. Also previously disclosed are methods permitting the application of a plaster layer to mineral wool, for example. This can be designated as plaster on a flexible base. A critical factor as to whether consideration must be given to one or other principle is the nature of the relationship between the plaster and the solidity of the base.

[0063] Plaster on the surface leaf 6 will function in this case according to the principle of plaster on a solid base. This means that the risk of cracking between element joints and the rest of the leaf is small. One condition for this is the presence of the previously-mentioned crack-

distributing reinforcement. It should also be noted in this case that a good crack-distributing function in the reinforcement requires stress concentrations around window orifices, etc., to be met to a reasonable extent through strengthened reinforcement.

[0064] When plastering on a solid base, it is naturally not possible to exclude the possibility of a pattern of scarcely visible cracks (micro-cracks) arising. Such cracks are not usually regarded as harmful.

Carcass relative to façade layer

[0065] It is particularly significant at this point to bring up the question of how the present structure differs from facade layers consisting of bricks. A cavity wall as a facade layer on a multi-storey facade is normally set on a foundation wall or on a cantilever. Such a façade layer will move in relation to the underlying carcass in proportion to the combined height of the cavity wall. For a height of 5 floors, for example, the top edge of the wall will experience movements from the entire height, i.e. approx. 14 m. A façade wall of this kind must be attached to the underlying carcass in a way which permits the façade layer to move freely to all intents and purposes. This can be achieved by the use of ties adapted for that purpose.

[0066] The present structure has a function which means instead that the facade elements 1 may be regarded as acting essentially independently.

[0067] It may be stated generally, therefore, that no cracks can occur in element joints if the facade element and the carcass shrink to the same degree.

[0068] The invention is not restricted to the illustrative examples of facade elements for buildings described above and illustrated in the drawings, but may be modified within the scope of the Patent Claims without departing from the idea of invention.

Claims

1. Prefabricated façade element (1) for buildings comprising a thermal insulation (3) accommodated internally within the element enclosed by an inner leaf (5) intended to face inwards towards the interior of a building and an outer leaf (6) intended to face outwards from the interior of said building, where the outer leaf (6), which consists of light clinker material and the inner leaf (5) are arranged attached to one another via stainless reinforcement ladders (9), **characterized in that** the inner leaf (5), which consists of light clinker material, is securely attached to a border (8) of light clinker material extending around the insulation (3) and is provided with internal reinforcement (9) extending into the border (8); the outer leaf (6) with its reinforcement (10) and an external surface layer (11) in the form of plaster being in conjunction with and arranged to be held se-

curely by the aforementioned inner leaf (5) through the associated border (8) in order that said inner leaf and border are capable of absorbing the forces which give rise to periodic movements as shrinkage or swelling.

2. Element in accordance with Patent Claim 1, **characterized in that** the outer leaf (6) exhibits internal reinforcement (10) in the form of galvanized plaster mesh, which is securely attached to the border (8).
3. Element in accordance with one or other of the foregoing Patent Claims, **characterized in that** the outer leaf (6) comprises a watertight plaster layer (11) made of light clinker concrete.
4. Element in accordance with one or other of the foregoing Patent Claims, **characterized in that** the aforementioned outer leaf (6) comprises crack reinforcement so that any cracks occurring are distributed so that they become more numerous and finer than before.
5. Element in accordance with one or other of the foregoing Patent Claims, **characterized in that** the outer leaf (6) is securely attached to the interior leaf (5) at vertical joints (12) between elements.
6. Element in accordance with one or other of the foregoing Patent Claims, **characterized in that** the border (8) extends around windows and at vertical element joints (12).
7. Element in accordance with Patent Claim 6, **characterized in that** a number of reinforcement ladders are laid in the border (8) with the thermal insulation being a cellular plastic sheet (3) accommodated between the aforementioned reinforcement ladders (9).
8. Element in accordance with one or other of the foregoing Patent Claims, **characterized in that** the border (8) extends only along the periphery of the aforementioned element, in conjunction with which the outer leaf (6) and the inner leaf (5) are arranged connected to one another also via the reinforcement (9) enclosed by the insulation (3).

Patentansprüche

1. Vorgefertigtes Fassadenelement (1) für Gebäude mit einer Wärmeisolierung (3), die intern innerhalb des Elementes untergebracht und durch eine Innenplatte (5), die dazu bestimmt ist, einwärts in Richtung des Innenbereiches eines Gebäudes zu weisen, und eine Außenplatte (6) umschlossen ist, die dazu bestimmt ist, von dem Innenbereich des

Gebäudes nach außen zu weisen, wobei die Außenplatte (6), die aus leichtem Klinkermaterial besteht, und die Innenplatte (5) über Verstärkungsleitern (9) aus rostfreiem Stahl aneinander befestigt angeordnet sind, **dadurch gekennzeichnet**,
dass die Innenplatte (5), die aus leichtem Klinkermaterial besteht, sicher an einem Rand (8) aus leichtem Klinkermaterial befestigt ist, der sich um die Isolierung (3) erstreckt, und mit einer Innenverstärkung (9) versehen ist, die sich in den Rand (8) erstreckt; und dass die Außenplatte (6) mit ihrer Verstärkung (10) und eine Außenflächenlage (11) in der Form von Putz in Verbindung miteinander stehen und derart angeordnet sind, um von der vorher erwähnten Innenplatte (5) durch den zugehörigen Rand (8) sicher gehalten zu werden, damit die Innenplatte und der Rand dazu in der Lage sind, die Kräfte zu absorbieren, die zu periodischen Bewegungen wie Schrumpfen oder Schwellen Anlass geben.

2. Element nach Anspruch 1,
dadurch gekennzeichnet,
dass die Außenplatte (6) eine Innenverstärkung (10) in der Form eines galvanisierten Putzgewebes aufweist, das sicher an dem Rand (8) befestigt ist.
3. Element nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
dass die Außenplatte (6) eine wasserdichte Putzlage (11) umfasst, die aus leichtem Klinkerbeton hergestellt ist.
4. Element nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
dass die vorher erwähnte Außenplatte (6) eine Verstärkung gegen Risse umfasst, so dass Risse, die auftreten, so verteilt werden, dass sie zahlreicher und feiner als zuvor werden.
5. Element nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
dass die Außenplatte (6) sicher an der Innenplatte (5) an vertikalen Verbindungsstellen (12) zwischen den Elementen befestigt ist.
6. Element nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
dass der Rand (8) sich um Fenster und bei vertikalen Elementverbindungsstellen (12) erstreckt.
7. Element nach Anspruch 6,
dadurch gekennzeichnet,
dass eine Anzahl von Verstärkungsleitern in den

Rand (8) gelegt sind, wobei die Wärmeisolierung eine zelluläre Kunststofflage (3) ist, die zwischen den vorher erwähnten Verstärkungsleitern (9) untergebracht ist.

8. Element nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet,
dass sich der Rand (8) nur entlang des Umfangs des vorher erwähnten Elementes erstreckt, in Verbindung mit dem die Außenplatte (6) und die Innenplatte (5) miteinander auch über die Verstärkung (9), die von der Isolierung (3) umschlossen ist, verbunden angeordnet sind.

Revendications

1. Élément préfabriqué (1) pour façade de bâtiments comprenant une isolation thermique (3) logée à l'intérieur de l'élément et renfermée dans un panneau interne (5) prévu pour se présenter de l'intérieur, face à l'intérieur d'un bâtiment et un panneau externe (6) prévu pour être orienté vers l'extérieur en regardant à partir de l'intérieur dudit bâtiment, dans lequel le panneau externe (6) qui consiste en une matière légère à base de mâchefer, et le panneau interne (5) sont assemblés entre eux par des armatures inoxydables (9), **caractérisé en ce que** le panneau interne (5) qui consiste en une matière légère à base de mâchefer, est fixé sur un chant de bordure (8) de matière légère à base de mâchefer s'étendant autour de l'isolation (3) et comporte l'armature interne (9) se prolongeant à l'intérieur de la bordure (8) ; le panneau externe (6) avec son renfort (10) et une couche de surface externe (11) sous la forme d'un enduit étant utilisés conjointement et prévus pour être maintenus solidement par le panneau interne susmentionné (5) à travers la bordure associée (8) de sorte que le panneau interne et la bordure puissent absorber les forces qui génèrent des mouvements périodiques de retrait et de boursofflure.
2. Élément selon la revendication 1, **caractérisé en ce que** le panneau externe (6) présente un renfort interne (10) sous la forme d'un filet galvanisé recouvert d'enduit solidarisé à la bordure (8).
3. Élément selon l'une ou l'autre des revendications précédentes, **caractérisé en ce que** le panneau externe (6) comporte une couche d'enduit étanche à l'eau (11) réalisée en béton léger de mâchefer.
4. Élément selon l'une ou l'autre des revendications précédentes, **caractérisé en ce que** le panneau externe susmentionné (6) comporte un renfort antifissures permettant aux fissures quelconques ap-

paraissant d'être réparties pour devenir plus nombreuses et plus fines qu'auparavant.

5. Elément selon l'une ou l'autre des revendications précédentes, **caractérisé en ce que** le panneau externe (6) est solidarisé au panneau interne (5) au niveau de joints verticaux (12) existant entre les éléments. 5
6. Elément selon l'une ou l'autre des revendications précédentes, **caractérisé en ce que** la bordure (8) s'étend autour des fenêtres et au niveau des joints verticaux (12) des éléments. 10
7. Elément selon la revendication 6, **caractérisé en ce qu'un** certain nombre d'armatures sont noyées dans la bordure (8), l'isolation thermique étant une feuille de matière plastique cellulaire (3) disposée entre les armatures de renfort susmentionnées (9). 15
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8. Elément selon l'une ou l'autre des revendications précédentes, **caractérisé en ce que** la bordure (8) s'étend seulement sur le pourtour de l'élément susmentionné, faisant que le panneau externe (6) et le panneau interne (5) sont reliés entre eux ainsi par l'intermédiaire du renfort (9) enfermé dans l'isolation (3). 25

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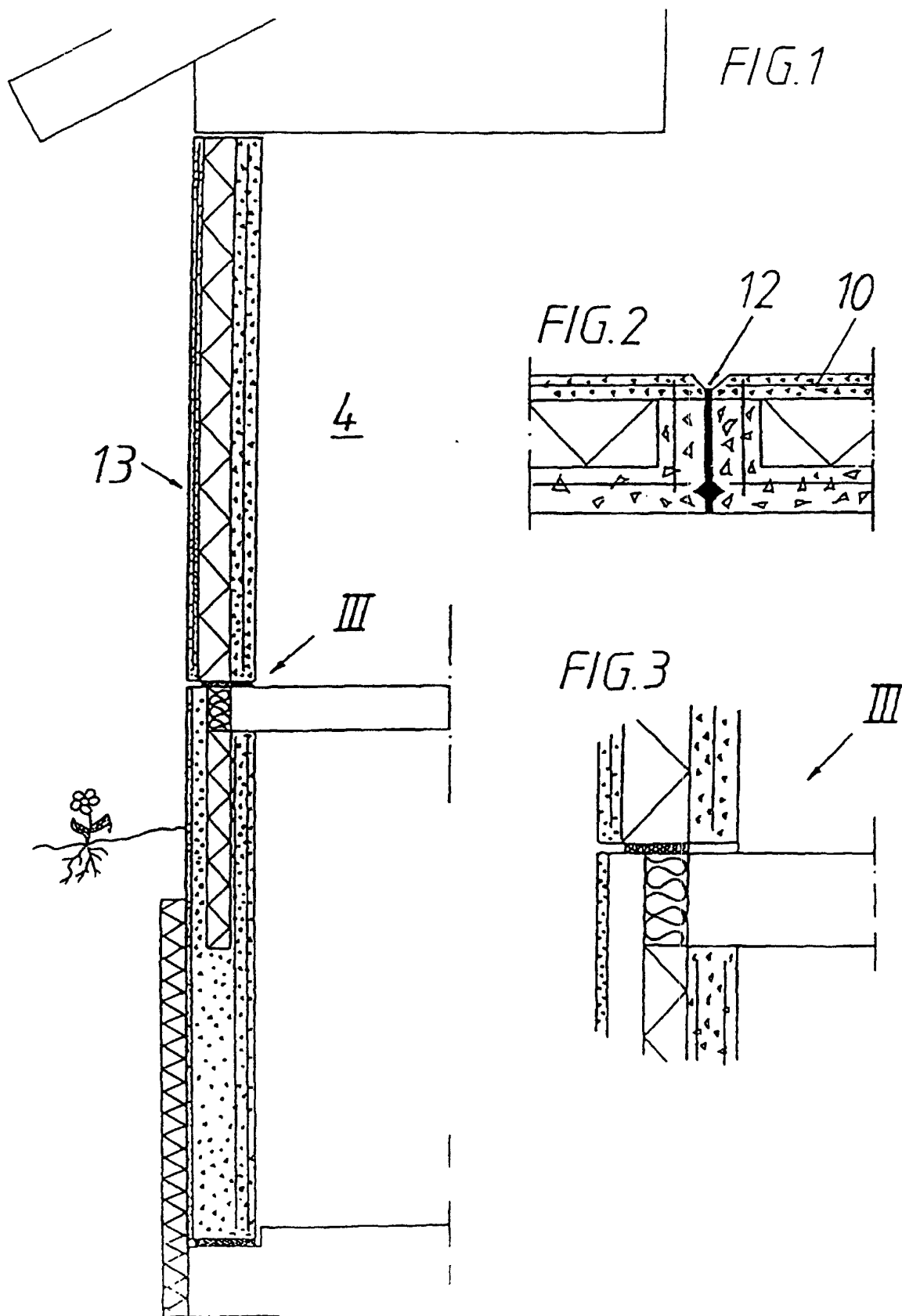
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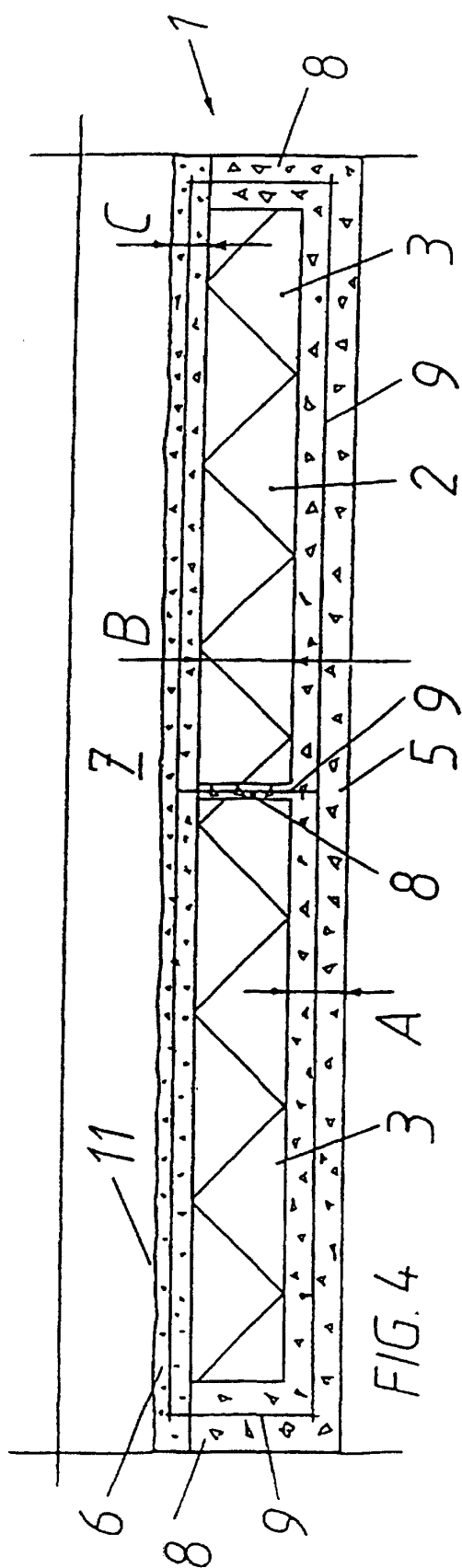
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Prior Art - Free Contraction

