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(11) **EP 1 308 253 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.05.2003 Bulletin 2003/19

(51) Int Cl.7: **B28B 7/00, B28B 7/36**

(21) Application number: **01309313.3**

(22) Date of filing: **02.11.2001**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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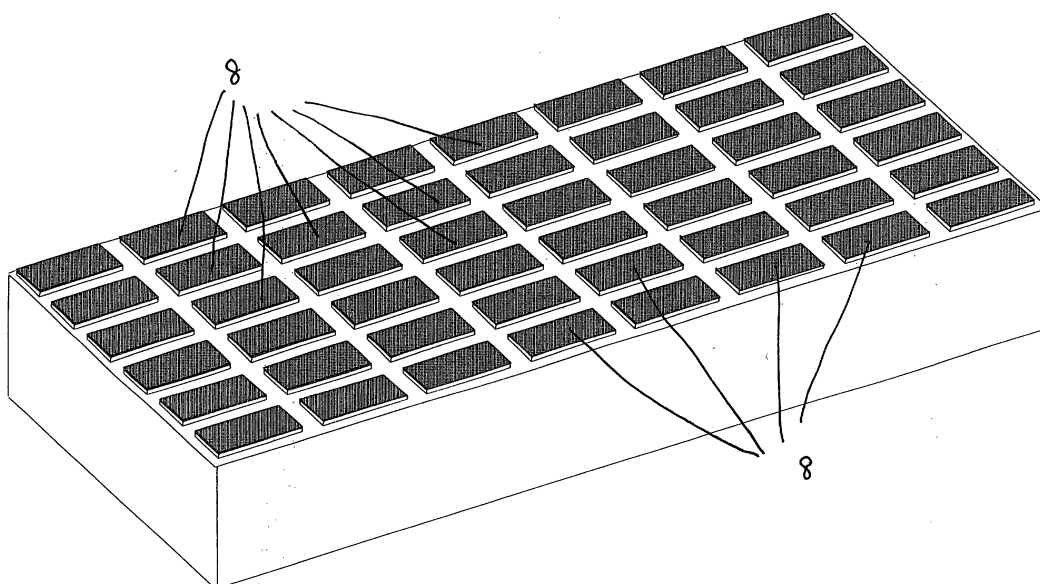
(54) **Method of making concrete panels**

(57) The invention relates to a method for producing concrete panels that when assembled together replicate brick or masonry walls. The method involves applying a mask (5) to the surface (1) of an uncured concrete panel and pressing the mask into the concrete. The concrete is allowed to at least partially cure before the mask (5) is removed.

Advantageously, the mask (5) includes an absorbent

material to absorb water from the uncured concrete in which it comes into contact, thereby compacting the concrete in the contact areas (1c) and enhancing the embossed effect created on the concrete surface. The areas of uncured concrete exposed by the mask (1b) are coloured by the application of mortar dust or powder (7) to provide contrasting colouration between the exposed and covered areas, thereby imitating the brick and mortar colours of a conventional wall.

Fig 6



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Description

[0001] This invention relates to methods of producing concrete panels and in particular to methods of producing concrete panels which when laid resemble brick or masonry walls. In another aspect this invention also relates to masks used in the production of concrete panels.

[0002] Modern methods of building construction place an onus on reducing materials cost and construction time, while still being able to deliver a quality and aesthetically pleasing product. As a result, many methods require co-operation from contractors and materials suppliers to provide products and materials that are compatible for use with modern construction methods and allow quick installation when delivered on-site. Therefore suppliers and contractors have an incentive to devise new products which replace or incorporate more than one existing product to bring about reductions in cost and construction time.

[0003] One common construction method starts by erecting an internal load-bearing girder frame upon which are attached all the other components necessary to complete the building such as roofing, flooring, wiring, ducting and plumbing. Once all the outsize components such as air-conditioning and heating plant have been installed, the open floor areas can then start to be enclosed by installing the surrounding walls.

[0004] A preferred method of producing the external walls of the building is to attach pre-fabricated wall panels onto the internal frame. The wall panels are attached adjacent to one another and the effect of the contiguous wall panels is to resemble a larger one-piece wall. This type of wall construction is well received and commonplace. The chief advantages of using pre-fabricated wall panels are their lower cost compared to a regular wall built on-site using traditional methods and materials, and the considerable time savings available through not having to supervise and coordinate the logistics and personnel required for building a wall on-site.

[0005] An important factor that is considered when choosing a suitable wall panel is the aesthetic appeal of the completed wall. One popular style is that of a brick or masonry wall. Amongst the reasons for choosing such a type of wall are the connotations of strength, solidity and expense that a brick or masonry wall implies. However, in order to supply a wall panel compatible with the aforementioned method of frame construction, it is usual to make the basic panel from cast concrete and then finish it to resemble a brick or masonry wall panel. The cost of an imitation brick or masonry wall panel made from concrete is highly competitive with other types of wall panelling.

[0006] It goes without saying that in order for a concrete panel, such as a wall panel, to accurately and effectively imitate a brick or masonry wall, the surface of the panel must be as realistic as possible. This means that not only should the colouration of the concrete be

consistent with that of bricks and mortar, or with masonry, but also the surface should closely mimic the three dimensional topography of the type of wall that it aims to imitate. For one thing, the way in which the protruding bricks and masonry blocks on a real wall produce distinctive shadows under different lighting conditions is impossible to replicate with painted flat concrete wall panels. This inability to recreate the lighting effects under different lighting conditions easily distinguishes flat imitation wall panels from real ones, thus reducing the imitation effect and the eye appeal of that part of the building. Any imitation brick or masonry wall, which does possess the ability to mimic the lighting effects of a real wall, has a considerable commercial advantage over those that don't.

[0007] Furthermore, it is desirable for the surface finish to be similar to a real wall down to the scale of the surface texture of the bricks or masonry blocks. Achieving this means that even when standing in close proximity to the wall panel one would not be able to tell easily that it is an imitation brick or masonry wall. An imitation wall panel that is able to replicate the surface texture of the real wall has the additional benefit, and commercial advantage, of giving users the same tactile experience as the real wall, further enhancing the all round imitation effect.

[0008] One of the known methods of producing wall panels which accurately imitate a brick or masonry wall is to embed full bricks and brick masonry slips into pre-cast wall panels, but this procedure is slow, labour-intensive and costly.

[0009] Another known method of making concrete wall panels is to spray paint the external surface of the pre-cast concrete panel after it has been cured and removed from its mould. A mask is used to ensure that brick or masonry coloured paint is sprayed only onto the places which correspond to the bricks or masonry blocks. Apart from being tedious, costly, and prone to emission of harmful airborne pollutants, this process also does not sufficiently provide the three-dimensional effect desired.

[0010] An alternative method often used is to cast concrete into a mould face down such that the brick pattern is formed in-situ against the base of the mould. The moulded panel has to be cured and de-moulded before it is painted to create the required highlighting. However, as before, the painting process which only takes place after curing adds to the cost and manufacturing time.

[0011] A yet further method taught by the prior art is one in which the concrete element is printed in the uncured state with the desired patterning to provide the three-dimensional effect, but again the de-moulded wall panel has then to be painted to create the desired colouration.

[0012] Therefore, the main object of the invention is to provide a new method of making concrete panels which produces a panel giving an enhanced visual and tactile experience for the user compared to the previous

methods.

[0013] With a view to fulfilling these requirements, and from one aspect, the invention resides in a method of making a concrete panel having a specific surface topography comprising applying a mask to an exposed surface of an uncured concrete panel, the mask selectively acting on the uncured concrete to create the desired topography.

[0014] From another aspect the invention resides in applying an absorbent mask to the exposed surface of an uncured concrete panel and allowing the concrete to at least partially cure before removing the mask to expose the surface featuring a desired topography created by the mask.

[0015] The invention embodies a principle, namely that the surface of a concrete panel which by design is meant to be uneven, can be made from a flat panel of uncured concrete. To achieve this, a mask which is shaped so as to produce the uneven characteristics of the design surface of the uncured concrete is forced onto the concrete so that it can affect the way in which the previously flat concrete cures. By doing so, after the concrete has cured, the surface of the cured concrete is then set in a topography which is in accordance with the surface design.

[0016] Preferably the uncured concrete is compacted, for example by known means, such as vibration, and levelled, such as by trowelling, before the mask is applied. Typically, the uncured concrete is first poured into a mould whereupon it is then compacted and levelled. After the mask is applied to the exposed surface of the still uncured concrete, the mask is then preferably pressed into the surface, for example, by trowelling or rolling. Thereafter, the concrete is allowed to cure in the normal way before the mask is stripped from the surface. When the mask is removed, the concrete is left with an embossed surface where there has been no contact with the mask.

[0017] The invention is particularly applicable to making concrete panels which are designed to imitate brick and mortar, or masonry, wall panels. At first, the Applicant expected the depth of the embossed brick effect to be only the same as the thickness of the mask used to create the effect. However, it was discovered that the inclusion of an absorbent material in the mask, for example in the form of an absorbent layer, had the surprising benefit of compacting the volume of the concrete in the areas contacting the mask. This compacting in the volume of the concrete, believed to be through reduction of water content, was sufficient to overcome the natural ability of concrete to recover from compaction, so that a permanent lowering in the height of the affected concrete resulted. At the same time, the exposed area of concrete (the area not covered by the mask) appeared to become less viscous by the energy applied and recovered normally to reside proud of the upper surface of the mask.

[0018] The mould into which the uncured concrete is

preferably poured may comprise a simple open-top box. It will be appreciated that the complexity of the mould can be kept low, i.e. without recesses or protrusions in the sides or bottom of the mould, due to the innovative mask that is applied to the top surface of the concrete. In other words, there is no need for specially designed moulds to produce the desired surface effects and therefore the capital investment required to produce the concrete panels is kept low.

[0019] The mask itself is advantageously of composite construction, preferably comprising an absorbent layer and a supporting layer. It is particularly preferred that the supporting layer imparts strength to the mask, for example, it may be of a plastics material suitably resistant to tearing. In use, the absorbent layer which may be paper-based is first placed in contact with the uncured concrete whereupon it starts to absorb water from the concrete it is in immediate contact with. The absorption is believed to enhance the frictional contract between the mask and the concrete therefore reducing the possibility of relative slippage between their respective surfaces, especially when the mask is subsequently pressed against the concrete surface.

[0020] It is a further preferred feature that the mask possesses a plurality of apertures in order to create the desired topography. It is particularly preferable that the size and location of the apertures in the mask replicate the size and location of the bricks or masonry blocks in a real brick or masonry wall so that the imitation effect of the cured concrete wall panel is enhanced.

[0021] In order that the cured concrete panel may look and feel like a real brick and mortar or masonry wall, a coloured material is preferably applied to the surface of the uncured concrete not covered by the mask. A suitable material for this type of use is a dry mortar or powder, and if a brick or masonry coloured mortar or powder is used the illusion of the imitation brick or masonry panels being made of real bricks or masonry blocks is further enhanced. A further benefit of adhering a secondary coloured material to the exposed concrete surface is that the unmasked surface becomes even more proud of the masked surface.

[0022] After the coloured material, such as the brick-coloured mortar dust, has been applied the upper surface of the concrete is preferably compacted again, for example, by further trowelling or rolling. The compacting process secures any mortar dust that was not previously secured to the concrete.

[0023] As an optional feature, prior to the final compaction step mentioned above, one or more further coloured materials may be applied to further enhance the colouration and texture of the surface of the imitation concrete bricks, building them even more proud of the upper surface of the mask. If more than one colour of mortar powder, for example, is applied in series prior to final compaction before curing, a random colouration of multi-coloured bricks may be arrived at. Specific colours may be selected to give the appearance of an old,

weathered brick wall which may be appropriate for use in new buildings located within areas of existing old buildings.

[0024] After colouration and compaction as described above, the concrete is left to cure in the normal way. The mask is then stripped from the upper surface to leave a distinctly embossed brick-like appearance with pigmentation only in the embossed surfaces not the mortar joint areas. There is no need for secondary processing as is required in the aforementioned prior art methods.

[0025] To further enhance realism, the top surface of the uncured concrete with the mask still in place may be rolled with a roller exhibiting surface irregularities, such as riven bumps or depressions, of a similar size and character as may be found on a hand-cast brick. This way, rolling with such a roller imparts the irregularities to the surface of the exposed concrete and creates a yet more convincing brick-like appearance when the mask is removed after curing.

[0026] In order that the brick wall imitation effect may be enhanced still further, it is preferable that the absorbent mask be treated with a concrete retarder. In particular, the Applicant has found that by applying a mask treated with concrete retarder to the uncured concrete, it results in those parts of the uncured concrete in contact with the mask more closely resembling mortar joints of sandy consistency rather than the more closed texture of precast concrete.

[0027] From another aspect, the invention also resides in a mask for creating a specific surface topography on uncured concrete comprising an absorbent material which contacts the uncured concrete when in use.

[0028] Preferably the mask comprises a composite material including an absorbent layer and a supporting layer. The supporting layer is advantageously a tear-resistant layer, for example made of a suitably strong plastics material, for maintaining the integrity of the mask in use. The absorbent layer may be paper based.

[0029] In order that the mask may be re-used, it is preferred that the absorbent layer be replaceable, for example by being removeably attached to the backing layer.

[0030] The invention also embraces an imitation brick and mortar wall, or an imitation masonry wall, comprising a plurality of imitation brick and mortar wall panels, or a plurality of imitation masonry wall panels, made by the method as previously described.

[0031] Although the invention has been described as being applied to making brick or masonry wall panels, the invention may also be applied to making any other type of panel for which colouration and surface detailing are important.

[0032] Further beneficial but optional features are set forth in the subsidiary claims appended to this description and in the specific description that now follows. Although the method of the invention may be applied to all types of wall panels, or any other suitable type of panel for which colouration and surface topography are im-

portant, for clarity purposes the invention shall henceforth be described only in relation to making imitation brick and mortar wall panels.

[0033] Accordingly, in order that this invention can be more readily understood, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 shows a side sectional view of a wall panel made according to one of the methods known in the prior art;

Figure 2 shows a perspective view of a mould used in the method of making a wall panel according to the invention;

Figure 3 shows a perspective view of the mould shown in Figure 2 filled with semifluid concrete;

Figure 4 shows a perspective view of the filled mould of Figure 3 with a mask applied to the top surface of the concrete;

Figure 5 shows a perspective view of the mould shown in Figure 5 after mortar dust has been applied to the concrete exposed by the mask;

Figure 6 shows a perspective view of the wall panel after removal from the mould shown in Figures 2 to 5, and after the concrete has cured and the mask removed; and

Figures 7a to 7e show in detail the steps of the method as applied to one section of the concrete in Figures 3 to 6.

[0034] Referring first to Figure 1, there is shown in section a wall panel made according to the prior art. The concrete panel base 1 has paint 2 applied on the top surface to represent the colouration and detailing of the brick wall. Although this type of imitation wall panel imitates a real brick wall acceptably when viewed from a distance, the primarily two-dimensional paint is easily identified when inspected at close quarters and the three-dimensional like appearance quickly loses its effectiveness.

[0035] Figure 2 shows an empty mould 3 that is suitable for producing a moulded panel in accordance with the invention. The mould is simply a rectangular, open-topped box having substantially flat side walls and base.

[0036] Figure 3 shows the mould of Figure 2 now filled with semifluid concrete 4. The concrete is cast into the mould and compacted by vibration, and then levelled by trowelling or rolling so that the top surface is reasonably flat and uniform, ready for the application of a mask to the top surface.

[0037] Mask 5 is now placed on top of the concrete 4, as is shown in Figure 4. The mask 5 fits into the frame

of the mould 3 and the apertures 6 in the mask correspond to the exposed areas of the simulated bricks which will be seen in the finished wall panel. The mask 5 itself is fashioned so as to replicate the mortar joints in a brick wall, and is of composite construction consisting of two layers. The top layer of mask 5 is made of a resilient plastic material to resist against tearing, and the lower layer is made of a water absorbent material which attached to the underside of the plastic layer when in use. The absorbent layer not only absorbs water from the concrete it is in immediate contact with, but also enhances frictional contact between the mask and the concrete, thus reducing any risk of slippage between the two.

[0038] Once the mask has been applied to the top surface of the uncured concrete, the mask is pressed down by trowelling or rolling into the top surface of the concrete, and consequently concrete rises into the apertures 6. The surface of the mask is then trowelled or rolled again so that the height of the concrete 4 in the mask apertures 6 is substantially level with the top surface of the mask 5.

[0039] Brick-coloured mortar dust 7 is then brushed onto the surface of the concrete. The resultant appearance of the concrete wall panel in the mould is shown in Figure 5. The mortar dust 7 is initially adsorbed onto the surface of concrete portions 1b (not shown), which are the parts of the concrete pushed into the mask apertures 6. In time the mortar dust is also absorbed into the top surface, thus allowing the mortar dust eventually to bind with the concrete. To enhance adhesion, the upper surface of the concrete is compacted following application of the coloured mortar dust.

[0040] The binding of the brick-coloured dust to the surface and the immediate surface region of the concrete in the mask apertures is what lends realism to the finished wall panel after curing. Of course the portions of the panel which were covered by the mask will not be brick-coloured, and these parts correspond to the mortar which would be used to secure the bricks in a real brick wall.

[0041] Referring to Figure 6, when the concrete is cured the panel is de-moulded and the mask 5 is removed. The portions of the concrete which were in the mask apertures 6 now stand embossed on the surface of the wall panel. Due to the pigmentation applied to the selected areas of the concrete by the brick-coloured mortar dust, the concrete panel has now taken on the look of a bricks and mortar wall.

[0042] Figures 7a to 7e show the action of the composite mask on the concrete in more detail:

Figure 7a shows the concrete 1 which has just been laid into the mould 3 (not shown in views 7a to 7e), and having been compacted by vibration and levelled for the first time by rolling or trowelling. Mask 5 is then laid onto the surface of the concrete. The mask comprises a backing layer of resilient plastic

material 5a and an absorbent paper layer 5b.

Referring to Figure 7b, after the mask has been laid onto the concrete, it is then compacted again, by rolling or trowelling, so that concrete 1b fills any apertures in the mask. The mask 5 is pushed down enough so that the top surface of the mask is substantially flush with the top surface of the exposed concrete 1b.

In Figure 7c, brick coloured mortar dust 7 is brushed onto the combined top surface of the mask and concrete, and the mortar dust is initially adsorbed onto the surface of the exposed concrete portions 1b. The concrete is then compacted again so that all the surfaces of the exposed concrete portions 1b are covered with mortar dust, and the dust that falls on the exposed concrete portions is attached securely. The dust generally does not stick to the top surface of the mask, although it would make no difference if it did.

Now referring to Figure 7d, concrete portions 1b appears to become less viscous possibly due to the energy that has been applied to the concrete during the preceding steps. This reduction in viscosity has the surprising benefit of allowing the concrete portions 1b to rise above the level they were previously at, causing the surface of exposed concrete areas 1b' to bulge outwards slightly to form the new topography of the concrete surface. At the same time, the absorbent layer 5b of the mask draws water from the concrete 1c surrounding it so that these affected areas are permanently compacted due to reduction in water content. The lowering of the concrete thickness below the absorbent layer of the mask increases the relative height of the concrete forming the surrounding bricks 1b'.

7e shows the finished imitation brick wall panel with the mask removed. As described above, treatments can be applied to the surfaces of the bricks and the mortar joints by way of rollers and concrete retarder so that they appear even more realistic. At this point the wall panels are ready for use and do not require any further processing after curing.

[0043] Although the invention has been described with reference to a wall panel made from cast concrete, it will be appreciated that the present invention is applicable to making other concrete products, such as simulated paving having contrasting surface features.

[0044] Many other variations are possible within the inventive concept, and the present invention may be embodied in other specific forms without departing from its essential attributes. Accordingly, reference should be made to the appended claims and other conceptual statements herein rather than to the foregoing specific

description as indicating the scope of the invention.

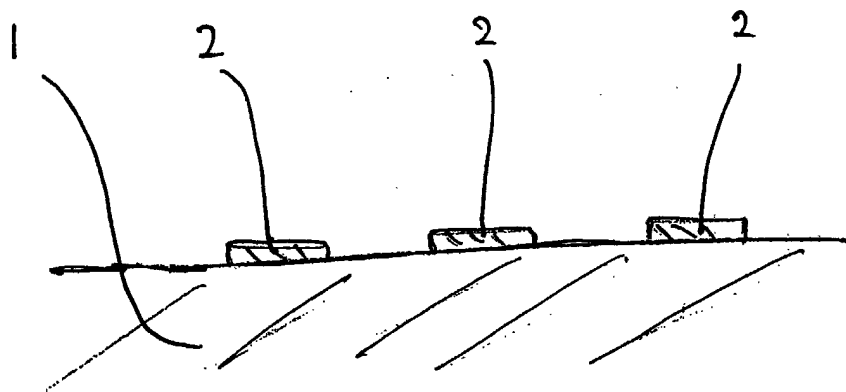
Claims

1. A method of making a concrete panel having a specific surface topography comprising applying a mask to an exposed surface of an uncured concrete panel, the mask selectively acting on the uncured concrete to create the desired topography. 5
2. A method according to claim 1, comprising applying an absorbent mask to the exposed surface of the uncured concrete panel and allowing the concrete to at least partially cure before removing the mask to expose the surface featuring the desired topography. 10
3. A method according to claim 1 or claim 2, wherein the mask is pressed into the surface of the uncured concrete. 15
4. A method according to any preceding claim, wherein the mask is applied to an uncured concrete panel retained in a mould. 20
5. A method according to any preceding claim, wherein a mask having a plurality of apertures is applied to the uncured concrete to create the desired topography. 25
6. A method according to claim 5, wherein the apertures are disposed to create embossed areas simulating bricks or masonry in a bricks and mortar or a masonry wall. 30
7. A method according to any preceding claim, further comprising applying a first coloured material to the surface of the uncured concrete not covered by the mask. 35
8. A method according to claim 7, further comprising the step of applying a second coloured material for enhancing the colouration effect created by the first coloured material. 40
9. A method according to claim 8 wherein the step of applying a second coloured material comprises applying a coloured material different in colour to the first coloured material. 45
10. A method according to any of claims 7 to 9, wherein the first or second coloured material applied comprises a mortar dust or powder. 50
11. A method according to any of claims 7 to 10, wherein the surface of the uncured concrete is compacted after application of the first and/or second coloured

material.

12. A method according to any preceding claim, wherein the surface of the uncured concrete is compacted with a textured roller to produce a textured surface on the concrete not covered by the mask.
13. A method according to any of claims 2 to 10, further comprising treating the absorbent mask with a concrete retarder before application of the mask to the uncured concrete.
14. An imitation brick and mortar wall comprising a plurality of imitation brick and mortar wall panels made by a method according to any one of claims 1 to 13.
15. An imitation masonry wall comprising a plurality of imitation masonry wall panels made by a method according to any one of claims 1 to 13.
16. A mask for creating a specific surface topography on uncured concrete comprising an absorbent material for contacting in use designated parts of the surface of the uncured concrete and creating embossed areas in the concrete where there is no contact with the material .
17. A mask according to claim 16, comprising an absorbent layer and a supporting layer.
18. A mask according to claim 17, wherein the supporting layer comprises a tear-resistant material.
19. A mask according to any of claims 16 to 18, wherein the absorbent material is paper-based.
20. A mask according to any of claims 17 to 19, wherein the absorbent layer is detachable from the backing layer for replacement with another absorbent layer.
21. A mask according to any of claims 16 to 20, wherein the mask is provided with rows of regularly spaced apertures for replicating the surface topography of a bricks and mortar wall or a masonry wall.
22. A method of creating a specific surface topography on a solidifying material through application of a mask to the surface of the solidifying material substantially as hereinbefore described with reference to Figures 2 to 7e of the accompanying drawings.
23. A mask for creating a specific surface topography on a solidifying material selectively acting on the solidifying material to create the required topography substantially as hereinbefore described with reference to Figures 4, 5, 7a to 7d of the accompanying drawings.

Fig 1



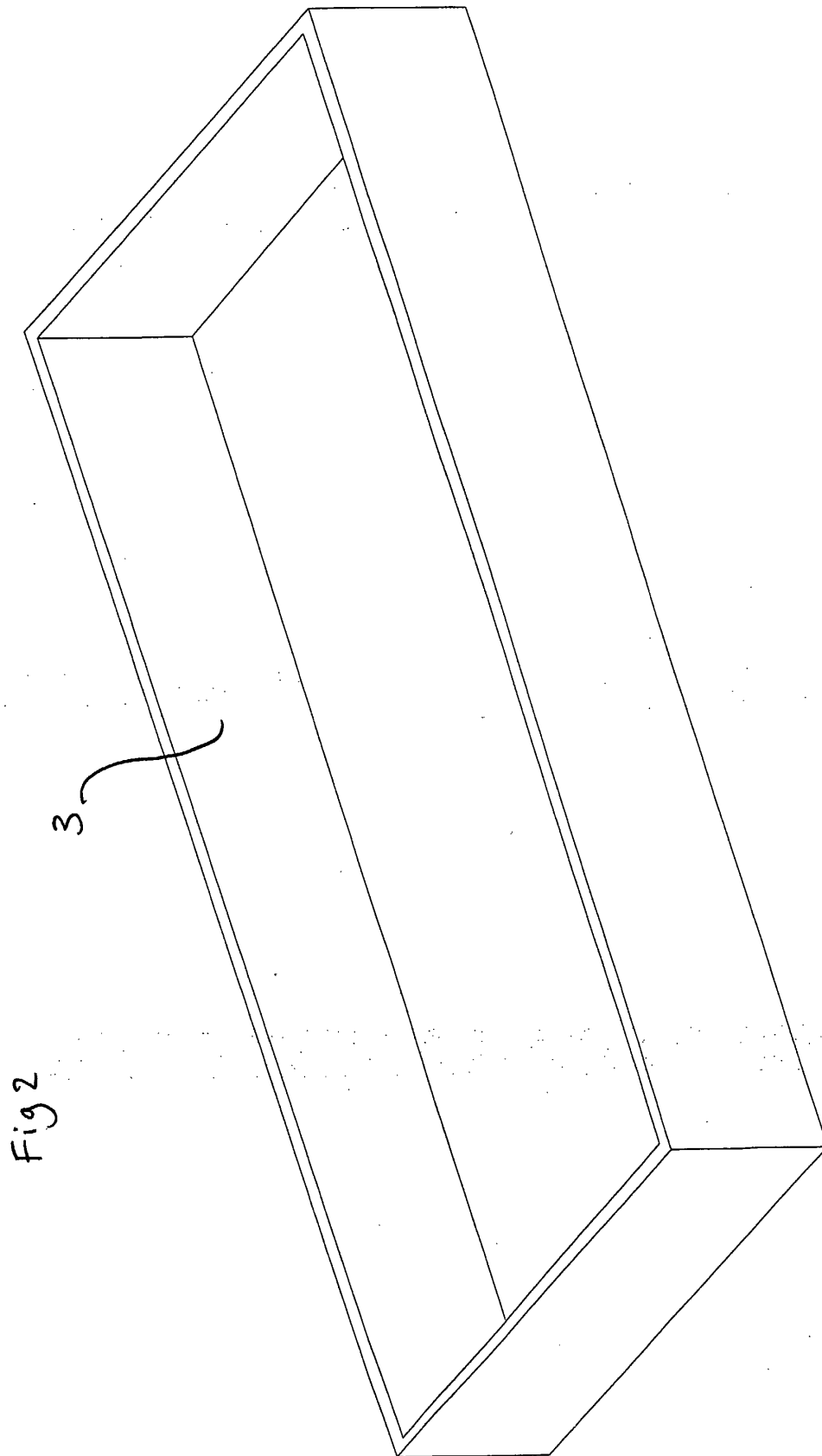


Fig 2

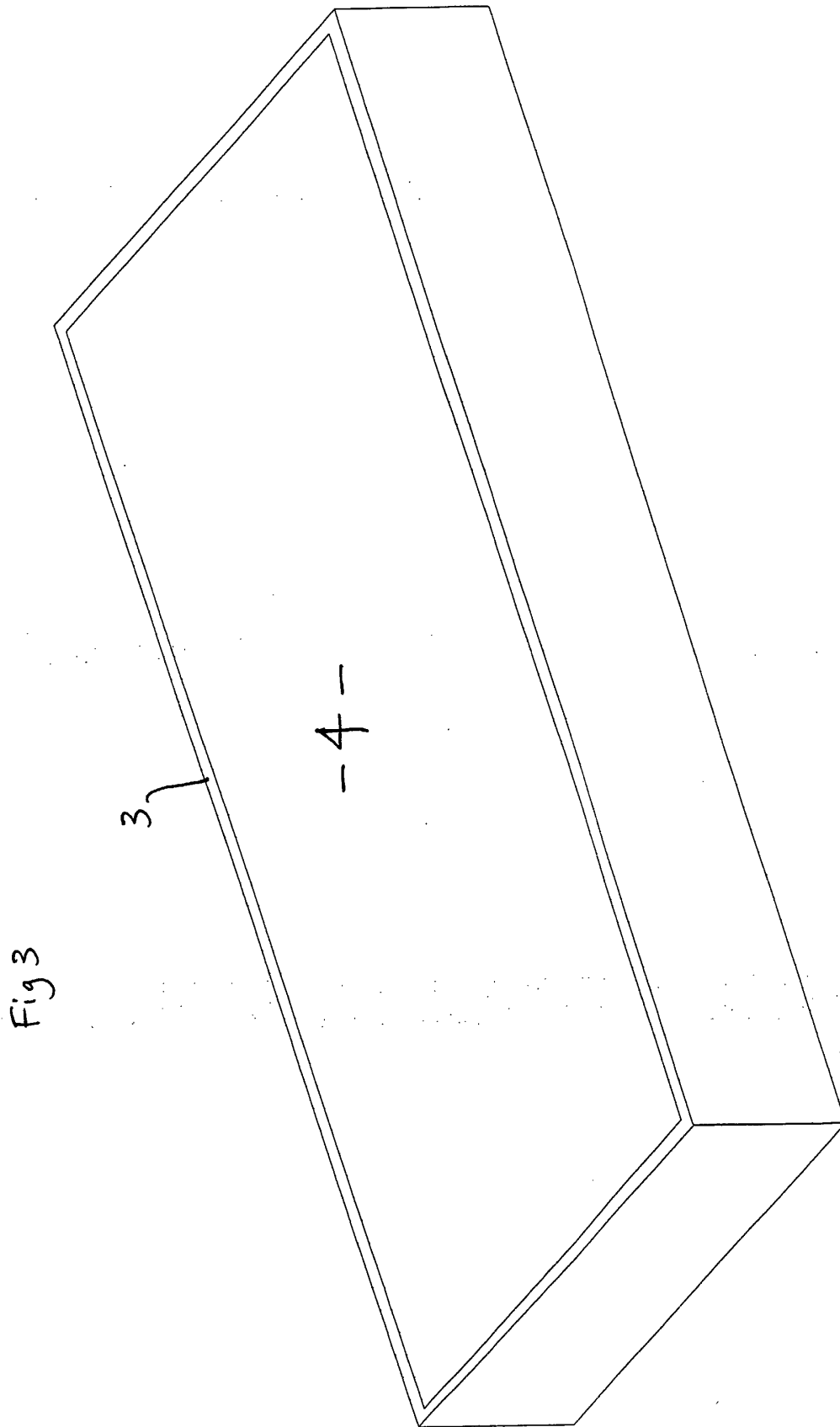


Fig 4

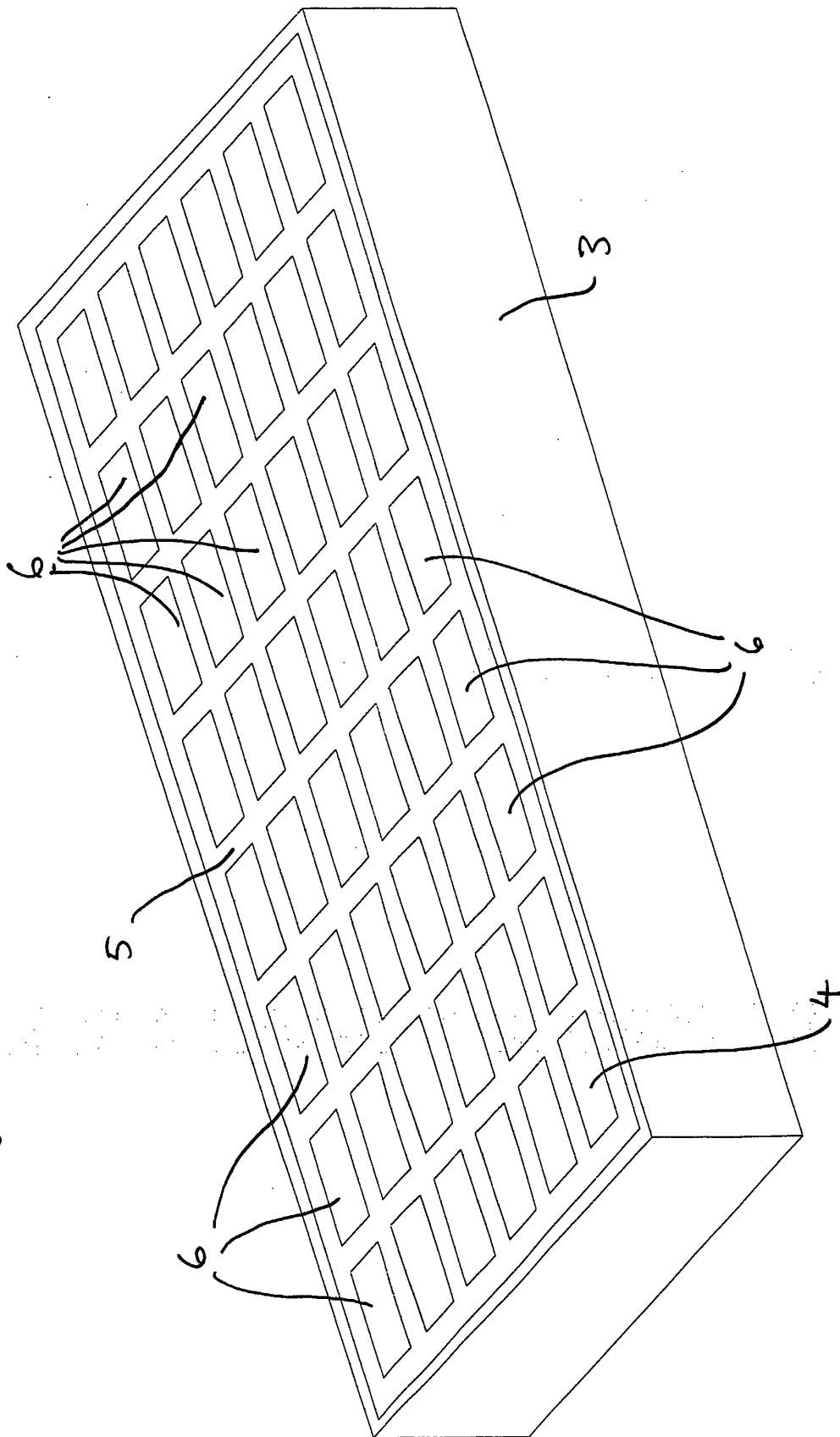


Fig 5

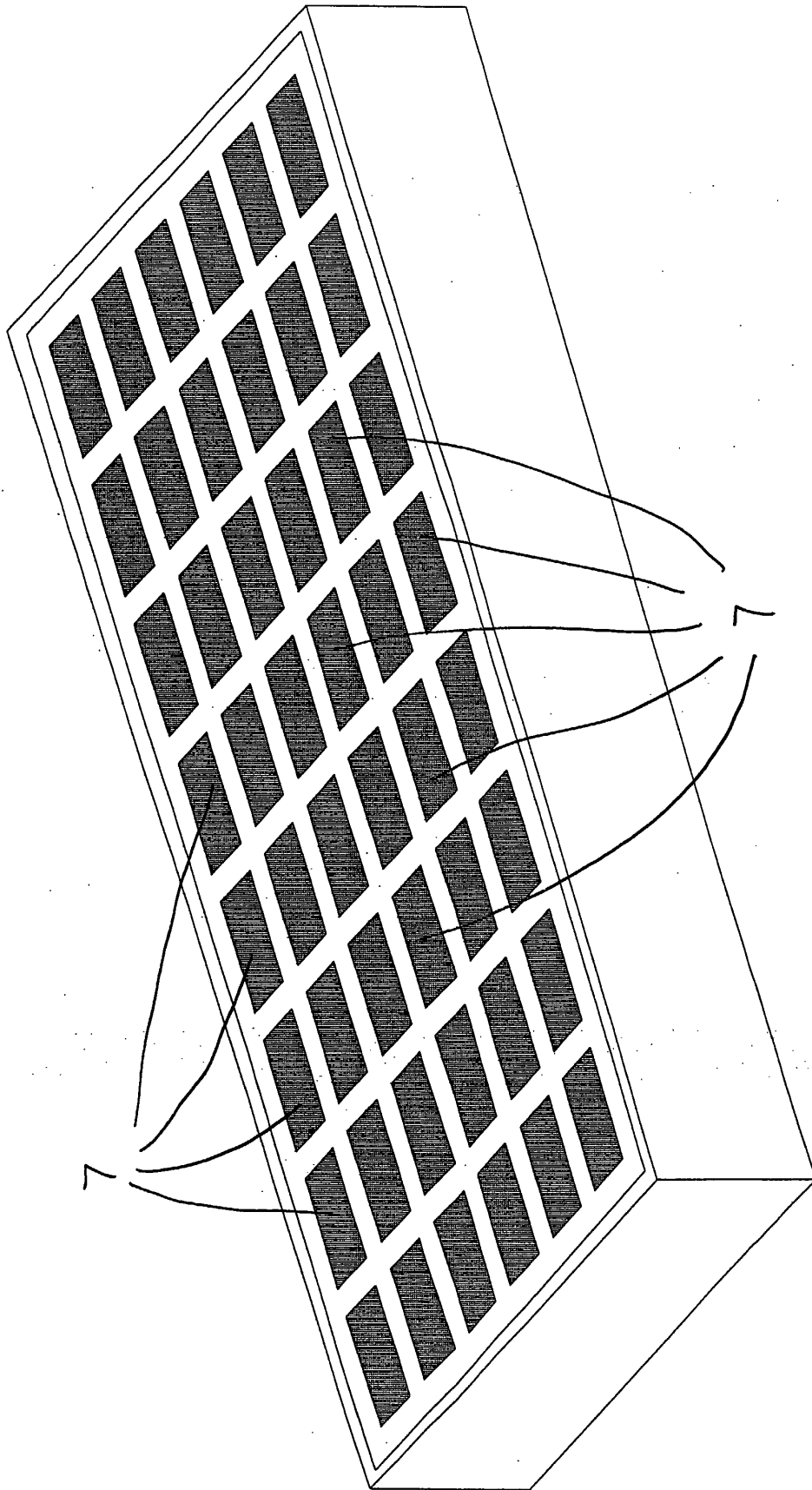


Fig 6

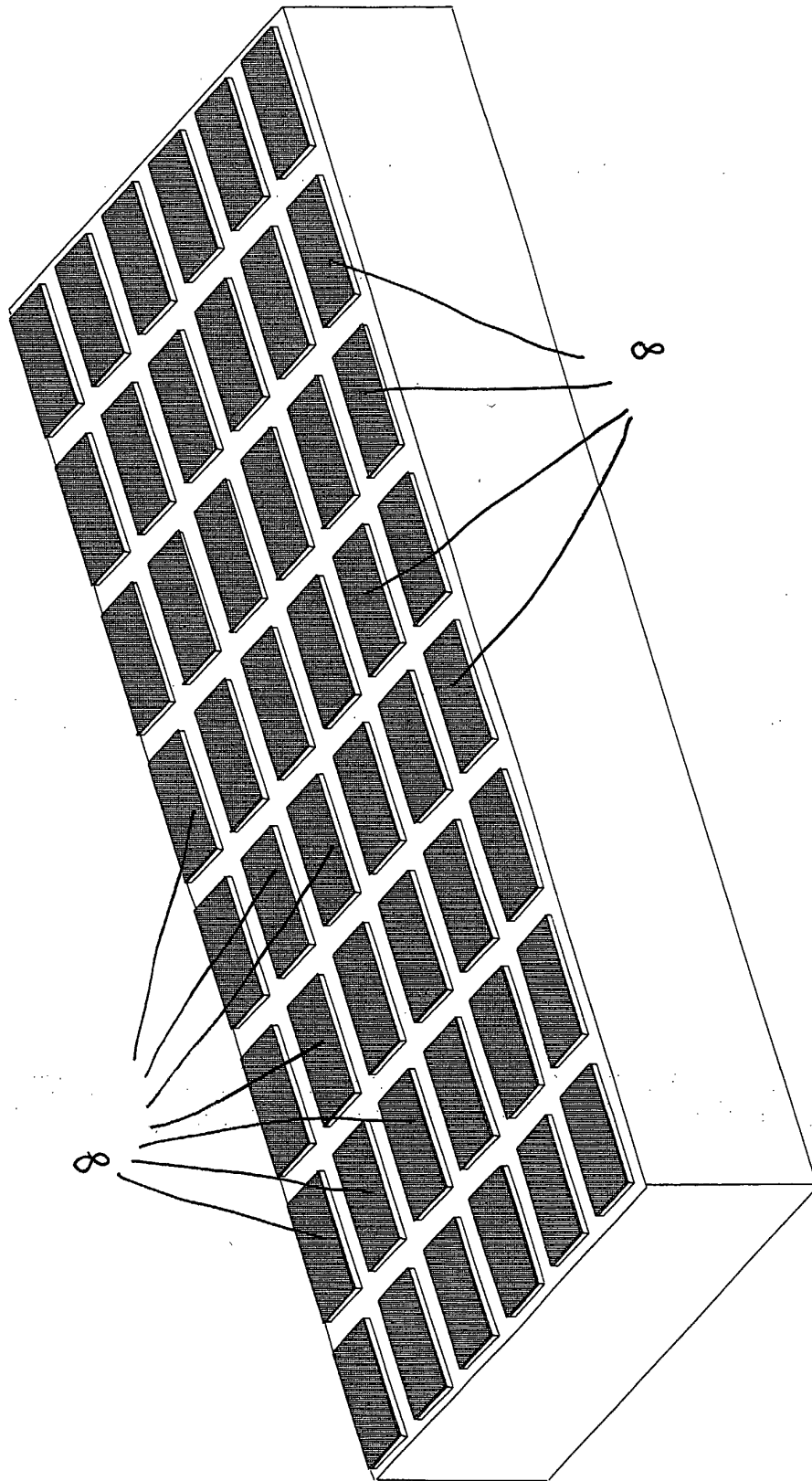


Fig 7d

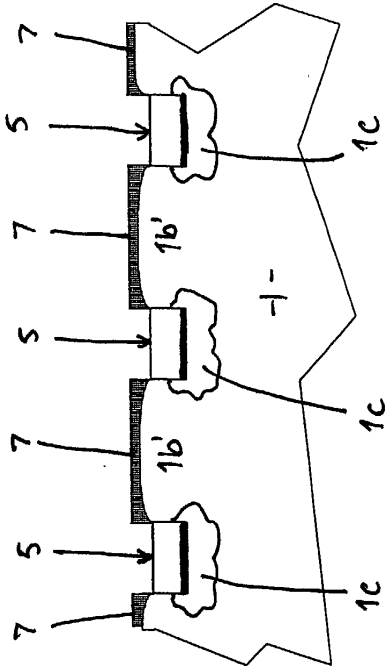


Fig 7e

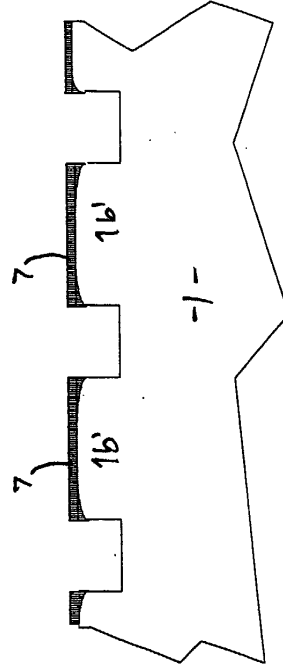


Fig 7a

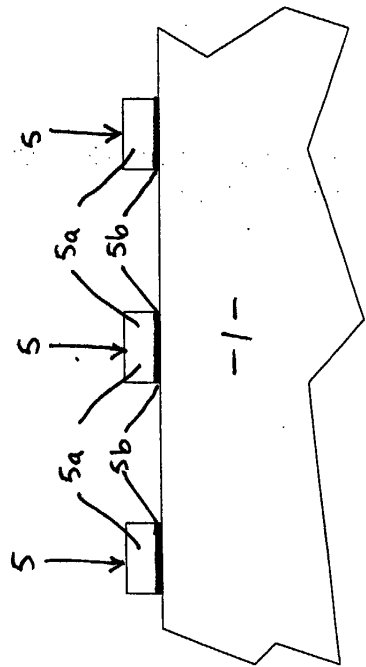


Fig 7b

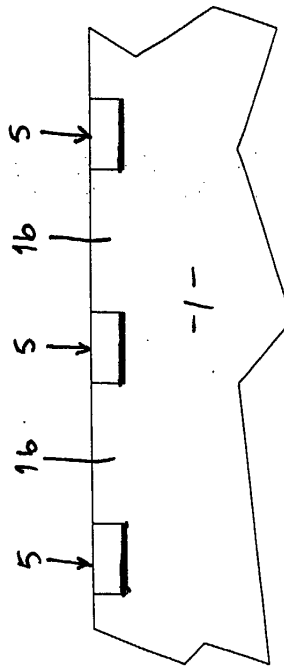
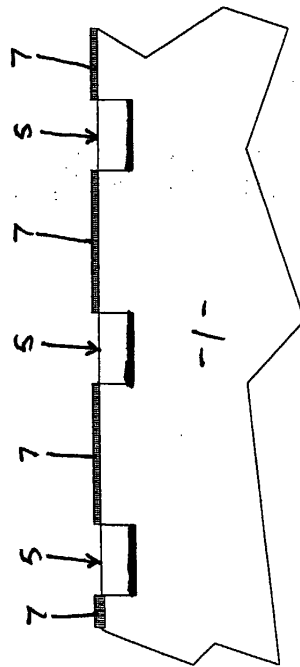


Fig 7c





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 9313

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 2 391 805 A (GEORGE SMOLAK) 25 December 1945 (1945-12-25)	1-3,5-7, 9,11, 14-16, 21-23	B28B7/00 B28B7/36
A	* the whole document * ---	13	
A	US 4 094 941 A (MANNERS STANLEY H ET AL) 13 June 1978 (1978-06-13) * column 3, line 60 - column 4, line 50 * ---	1,6,7, 14,15	
A	US 3 712 825 A (YOCUM T) 23 January 1973 (1973-01-23) * column 4, line 33 - line 57 * * column 5, line 46 - line 62 * -----	1,6,7,12	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B28B B44F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 30 July 2002	Examiner Orij, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 30 9313

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-07-2002

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 4094941	A	13-06-1978	NONE	
US 3712825	A	23-01-1973	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82