



(11) **EP 2 070 671 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.06.2009 Bulletin 2009/25

(51) Int Cl.:
B28B 1/50 (2006.01) B28B 23/00 (2006.01)

(21) Application number: **08021024.8**

(22) Date of filing: **04.12.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
 Designated Extension States:
AL BA MK RS

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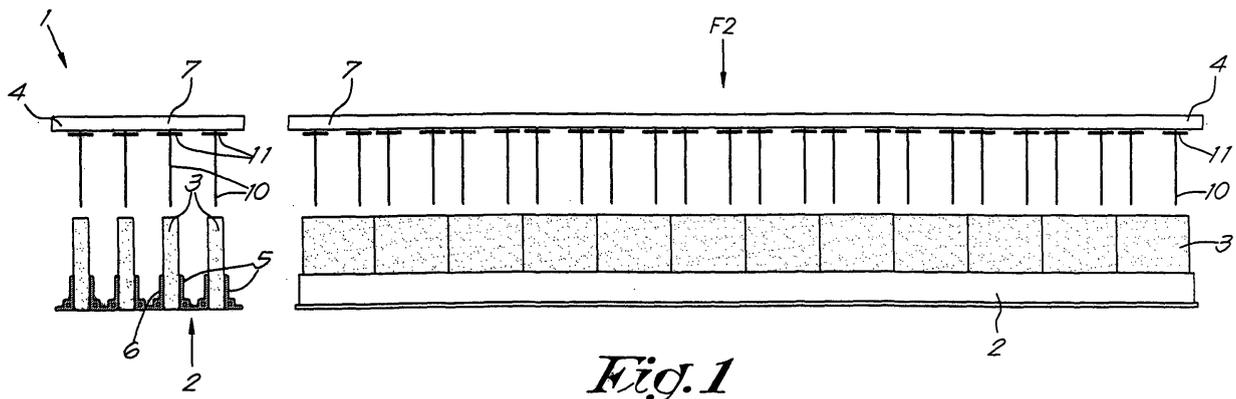
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(30) Priority: **10.12.2007 BE 200700588**

(54) **Method for manufacturing layered building components**

(57) Method for manufacturing building components consisting of at least two layers of cellular concrete, with a low and a high density respectively, characterised in that the method consists of pouring a liquid cellular concrete slurry (16) in a mould (15); in at least partially submerging at least one pre-autoclaved cellular concrete plate (3) of another density in said liquid cellular, concrete slurry (16); in making the liquid cellular concrete slurry

(16) rise; in making it harden until it has sufficient strength to disassemble the whole (17); dicing and subsequently cutting the whole (17) into building components (18) of the desired dimensions and of the desired number of layers; and finally autoclaving the building components (18) so as to obtain a durable bond between the successive layers of cellular concrete with low and high densities and so as to obtain the required compression strength for the cellular concrete with a high density.



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Description

[0001] The present invention concerns a method for manufacturing layered building components.

[0002] In particular, the invention aims at manufacturing building components formed of at least two layers of cellular concrete with different densities.

[0003] The present invention also concerns the layered building component.

[0004] It is known that building components made of low density cellular concrete have good heat insulating qualities, but that they often lack bearing capacity to realise constructions with them.

[0005] Building components consisting of several layers of cellular concrete are already known whereby a plate of low density cellular concrete is glued together with a plate of cellular concrete of a higher density or another building material, and whereby the high density cellular concrete serves as the supporting element in the construction and the low density cellular concrete serves as thermal insulator.

[0006] A disadvantage of this method is that it is labour-intensive and time-consuming because of the glueing, whereby the individual plates need to be manipulated.

[0007] Another disadvantage is that the glued plates of cellular concrete must be perfectly aligned to one another so as to avoid any dimensional deviations in the end product.

[0008] Another disadvantage is that the dimensional deviations of the glued plates cumulate in the end product.

[0009] Another additional disadvantage is that the glue is less permeable to vapour than the cellular concrete, so condensation and moisture problems may arise in the building component.

[0010] Moreover, any possible glue remnants may be visible in the building component.

[0011] The present invention aims at resolving the above-mentioned and other disadvantages.

[0012] To this end, the invention concerns a method for manufacturing building components formed of at least two layers of cellular concrete, with a low and a high density respectively, whereby the method consists in pouring a liquid cellular concrete slurry in a mould; in at least partially submerging at least one pre-autoclaved cellular concrete plate with another density in said liquid cellular concrete slurry; in making the liquid cellular concrete slurry rise, in making it harden until it is sufficiently strong to discase the whole; discasing and subsequently cutting the whole into building components with the desired dimensions and the desired number of layers; and finally autoclaving the building components so as to obtain a durable bond between the successive layers of cellular concrete with low and high density and so as to obtain the required compression strength for the high density cellular concrete.

[0013] An advantage is that, by autoclaving the building components, the cellular concrete that has already

been autoclaved and the cellular concrete which still needs to be autoclaved will bond, such that a very well bound whole is obtained due to the formation of crystalline compounds.

[0014] Another advantage is that the obtained building component made of cellular concrete is autogenous and consists of cellular concrete only, resulting in a more uniform behaviour of the whole.

[0015] Another advantage is that this autogenous building component made of cellular concrete has improved thermal and acoustic insulation qualities and improved bearing capacities compared with the composing plates.

[0016] Another advantage is that this method can be carried out mechanically, which improves the verifiability and accuracy of the building components, and that this method is less labour-intensive and less time-consuming and consequently cheaper.

[0017] Yet another advantage of this method is that there is no use of glue, which considerably reduces the risk of condensation and moisture problems in the building component and glue costs are avoided.

[0018] Preferably, the cellular concrete layer which is obtained from the pre-autoclaved cellular concrete plate forms a layer with a low density and the cellular concrete layer obtained from the liquid cellular concrete slurry forms a layer with a higher density, as a result of which the whole can be cut with conventional cutting wires.

[0019] The present invention also concerns a building component consisting of layers of cellular concrete with different densities, whereby the building component is autogenous or in other words comprises merely cellular concrete only.

[0020] In order to better demonstrate the characteristics of the invention, the following preferred steps of the method for manufacturing building components according to the invention are described by way of example only without being limitative in any way, with reference to the accompanying drawings, in which:

figure 1 represents the first step of the method for manufacturing building components according to the invention;

figure 2 shows a view according to arrow F2 in figure 1;

figures 3 to 19 represent the subsequent steps of the method for manufacturing building components according to the invention;

figures 20 to 28 represent a number of embodiments of a building component.

[0021] Figure 1 schematically represents the first step of the method which uses a subdevice 1 formed of a clamping device 2 to hold pre-autoclaved cellular concrete plates 3 at a distance from one another and of a fixing frame 4 provided on top of it to pick up the above-mentioned plates 3.

[0022] The surface of the pre-autoclaved plates 3 may

possibly be treated with water or another substance so as to not obstruct the rise of the liquid concrete slurry.

[0023] The clamping device 2 in this case consists of a number of parallel struts 5 provided at a distance from one another in agreement with the thickness of the above-mentioned plates 3 and which are provided with standing walls 6 in between which said plates 3 can be held in a standing position.

[0024] The distance of the struts 5 may possibly be set as a function of the thickness and of the number of the used plates 3.

[0025] The fixing frame 4 consists of a frame 7 at the perimeter to support a trellis 8 of beams 9, as represented in figure 2, to which are fixed parallel rows of downward directed pins 10 above the pre-autoclaved cellular concrete plates 3 in the clamping device 2.

[0026] The number and the position of the beams 9 and the pins 10 may possibly be adjusted as a function of the dimensions of the pre-autoclaved cellular concrete plates.

[0027] Every pin 10 is provided with a stop 11 at the top.

[0028] The frame 7 may be made of steel or another appropriate material.

[0029] In order to manipulate the plates 3 that are present in the clamping device 2, the fixing frame 4 with the pins 10 is lowered or pushed down in to the direction of arrow P, as shown in figure 3, by means of a ramp or another appropriate means which is not represented in the figures, so as to push the pins 10 in the pre-autoclaved cellular concrete plates 3 up against the stops 11.

[0030] As shown in figure 4, needles 12 may be provided in the beams 9 or in additionally added beams of the frame 7 between the pins 10 onto which reinforcement nets 13 may be hung up.

[0031] As soon as the pins 10 have been pushed sufficiently deep in the autoclaved plates 3, the fixing frame 4 may be lifted, as shown in figure 5, and moved to a subsequent subdevice 14 for the following steps of the method according to the invention, as shown in figure 6.

[0032] The subdevice 14 used in the following step mainly consists of a mould 15 whose dimensions correspond, for example with a length of 6 meter, a width of 1.50 meter and a height of 0.70 meter, in which, as shown in figure 6, a measured amount of liquid cellular concrete slurry 16 is provided, so as to form cellular concrete which preferably has a higher density after having hardened than the pre-autoclaved cellular concrete plates 3.

[0033] The pre-autoclaved cellular concrete plates 3 and any possible reinforcement nets 13 are hereby aligned with the moulding jig 15.

[0034] Preferably, the high-density cellular concrete has a density of more than 300 kg/m³ and the low-density cellular concrete has a density of less than 150 kg/m³.

[0035] In a following step, as shown in figure 7, the pre-autoclaved plates 3 and any possible reinforcement nets 13 in between are lowered as soon as possible after the liquid cellular concrete slurry 16 has been poured in the moulding jig 15, by moving the fixing frame 4 onto

which the plates 3 are hung up.

[0036] The amount of this liquid cellular concrete slurry 16 may be a measured amount so as to obtain that, when the liquid cellular concrete slurry 16 rises, the level of the liquid cellular concrete slurry 16 rises up to the highest level of the plates 3, as shown in figure 8.

[0037] Due to the difference in density between the pre-autoclaved cellular concrete plates 3 and the liquid cellular concrete slurry 16 and the upward forces of the rising process, the fixing frame 4 will be subjected to an upward force as the liquid cellular concrete slurry 16 rises.

[0038] In order to prevent the fixing frame 4 with the cellular concrete plates 3 from moving upwards, the fixing frame 4 may be fixed to the mould 15.

[0039] As soon as the liquid cellular concrete slurry 16 has sufficiently hardened and consequently has acquired the necessary strength, the fixing frame 4 may be lifted in the direction of arrow Q, as shown in figure 9, as a result of which the pins 10 are removed from the autoclaved cellular concrete plates 3 and the autoclaved plates 3 remain in place in the cellular concrete slurry 16 which has not been autoclaved yet.

[0040] If reinforcement nets 13 were hung to the fixing frame 4 as well, the needles 12 which hold these nets 13 will have to be put in an appropriate position first, such that they can be detached from the nets and, as the fixing frame 4 is lifted, cannot pull the nets 13 along, such that the reinforcement nets 13 stay behind in the cellular concrete which has not been autoclaved yet, as shown in figure 10.

[0041] By this method a cellular concrete block is obtained with different successive layers of cellular concrete having different densities, which are alternately either or not autoclaved (figure 9) and whereby non-autoclaved layers may possibly be provided with a reinforcement net 13 (figure 10).

[0042] After the removal of the fixing frame 4, the obtained block-shaped whole 17 can be discarded, as is represented in figures 11 and 12.

[0043] Next, the whole 17 can be cut so as to form the building components 18 with the desired dimensions and the desired number of layers.

[0044] Cutting is done by means of for example smooth or twisted steel wires 19, as represented in figures 13 to 19.

[0045] Figures 13 to 16 show a horizontal production system whereby the horizontal cutting wires cut simultaneously through the pre-autoclaved cellular concrete plates and the cellular concrete slurry that still needs to be autoclaved (figures 13 to 15). The vertical cutting wires can cut through the pre-autoclaved cellular concrete (figure 15) and/or through the cellular concrete that still needs to be autoclaved (figure 13 and 14). When cross-cutting, the crosscut cutting wires cut simultaneously through the non-autoclaved and the already autoclaved cellular concrete, as shown in figure 16 for the case without any reinforcement nets.

[0046] Figures 17, 18 and 19 show a tilting production system 21. When cutting horizontally, the non-autoclaved cellular concrete (figure 17) and/or the already autoclaved cellular concrete (figure 18) is cut through. When cutting vertically (figures 17 and 18) and cutting crosswise (figure 19) the already autoclaved and the non-autoclaved cellular concrete is cut through simultaneously.

[0047] The distance between the steel wires 19 can be selected such that building components 18 are obtained with a layer of cellular concrete having a high density and a layer of cellular concrete having a low density, as represented in figure 20.

[0048] The distance between the steel wires 19 in figures 13 to 15 can also be selected such that a sandwich panel 22 is obtained whereby a low density core cellular concrete is surrounded by two adjacent layers of high density cellular concrete, as shown in figure 21.

[0049] One of the high density layers may hereby be either reinforced or not, as shown in figure 22.

[0050] When cutting the building components 18 they may also be profiled, such that after the cutting we may have building components 18 with for example a tooth 23 and a groove 24, an example of which is shown in figure 23.

[0051] The whole 25 which is composed of the obtained building components 18 (figures 20 and 21) is subsequently autoclaved, whereby the pre-autoclaved cellular concrete plates and the cellular concrete which is to be autoclaved bond, such that a building component is formed with added insulation, acoustic and bearing qualities.

[0052] It may also be possible to mill out handles before or after the autoclaving.

[0053] By post processing the autoclaved building components, all sorts of shapes can be obtained, some of which are given by way of example in figures 26 to 28.

[0054] It goes without saying that the pre-autoclaved cellular concrete plates in the building component, when autoclaved in the building component for a second time, undergo a thermal treatment, but that this second thermal treatment does not harm the thermal and acoustic quality of the cellular concrete in any way. Quite to the contrary even.

[0055] Thanks to the construction of the cellular concrete with layers of different densities, building components are obtained with a bearing capacity which is primarily determined by the high density layers, which are either or not reinforced, and which is sufficient to be applied in a supporting structure, while the thermal insulating value of such a building component is primarily determined by the low density layer or layers.

[0056] Due to the layered structure one also obtains a building component with favourable qualities as far as acoustic insulation is concerned.

[0057] The present invention is by no means restricted to the embodiment(s) described by way of example and represented in the accompanying figures; on the contra-

ry, such a method can be made according to several variants while still remaining within the scope of the invention.

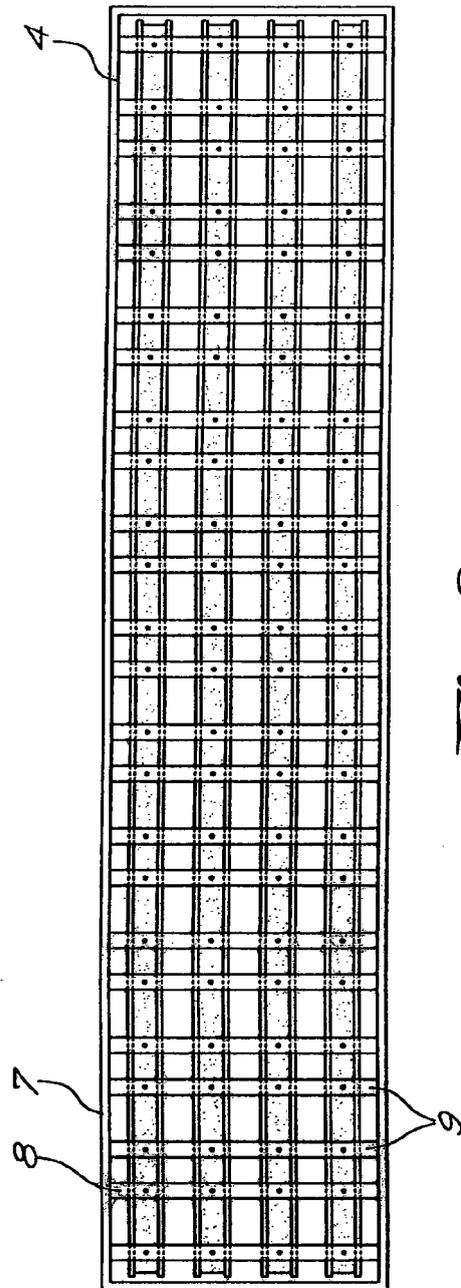
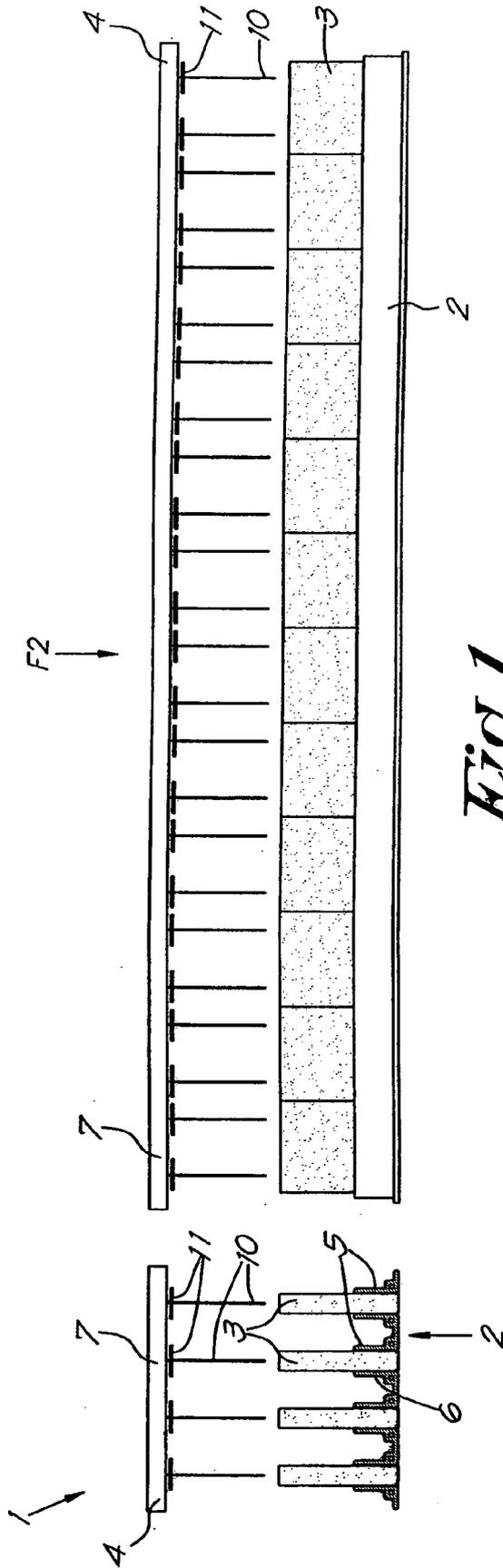
Claims

1. Method for manufacturing building components formed of at least two layers of cellular concrete, with a low and a high density respectively, **characterised in that** the method consists of pouring a liquid cellular concrete slurry (16) into a mould (15); in at least partially submerging at least one pre-autoclaved cellular concrete plate (3) of another density in said liquid cellular concrete slurry (16); in making the liquid cellular concrete slurry (16) rise; in making it harden until it has sufficient strength to disengage the whole (17); discasing and subsequently cutting the whole (17) into building components (18) with the desired dimensions and the desired number of layers; and finally autoclaving the building components (18) so as to obtain a durable bond between the successive layers of cellular concrete with low and high densities and so as to obtain the required compression strength for the high density cellular concrete.
2. Method according to claim 1, **characterised in that** the cellular concrete layer which is obtained from the pre-autoclaved cellular concrete plate (3) forms a layer having a low density, whereas the cellular concrete layer formed of the liquid cellular concrete slurry (16) forms a layer having a high density.
3. Method according to any one of the preceding claims, **characterised in that** the pre-autoclaved cellular concrete plates (3) must be aligned with the moulding jig (15).
4. Method according to any one of the preceding claims, **characterised in that** the pre-autoclaved cellular concrete plates (3), before being submerged, are fixed to a fixing frame (4) with pins (10) which are pushed in the material of the plates (3) in order to fix the plates (3).
5. Method according to claim 4, **characterised in that** in order to provide the plates (3) on the fixing frame (4) the plates (3) are fixed in a clamping device (2) at a distance from one another.
6. Method according to claim 4 or 5, **characterised in that** the plates (3) in the liquid cellular concrete slurry (16) are submerged by moving the fixing frame (4) onto which the plates (3) are suspended.
7. Method according to any one of the preceding claims, **characterised in that** the amount of liquid cellular concrete slurry (16) which is provided in the

mould (15) is a measured amount which is such that it rises up to the highest level of the plates (3) as the liquid cellular concrete slurry (16) rises.

8. Method according to any one of claims 4 to 7, **characterised in that** the liquid cellular concrete slurry (16) is situated in a mould (15) to which the fixing frame (4) can be clamped. 5
9. Method according to any one of the preceding claims, **characterised in that** the whole (17) is cut into building components (18) by means of a smooth or twisted steel wire (19). 10
10. Method according to claim 9, **characterised in that** the distance between the steel wires (19) is such that building components (18) are obtained with a layer of high density cellular concrete and a layer of low density cellular concrete. 15
20
11. Method according to claim 9 or 10, **characterised in that** the distance between the steel wires (19) is such that a sandwich panel (22) is obtained with a core made of cellular concrete with a low density and two adjacent layers with a high density. 25
12. Method according to any one of the preceding claims, **characterised in that** when the cellular concrete is cut, the layers with a low and a high density are simultaneously cut through. 30
13. Method according to any one of the preceding claims, **characterised in that** when cutting the formed cellular concrete elements profiling may also take place. 35
14. Method according to any one of the preceding claims, **characterised in that** the layers of cellular concrete with a low density have a maximum density of 150 kg/m^3 and the layers of cellular concrete with a high density have a minimum density of 300 kg/m^3 . 40
15. Building component consisting of layers of cellular concrete with different densities, **characterised in that** the building component is autogenous. 45
16. Building component according to claim 15, **characterised in that** the layers of cellular concrete with a high density are equipped with reinforcement nets. 50

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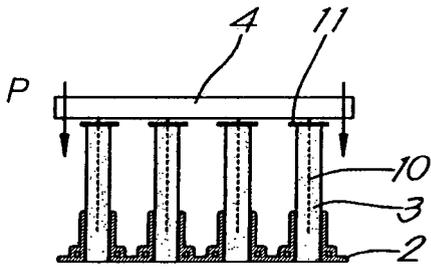


Fig. 3

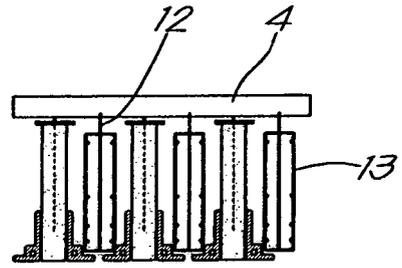


Fig. 4

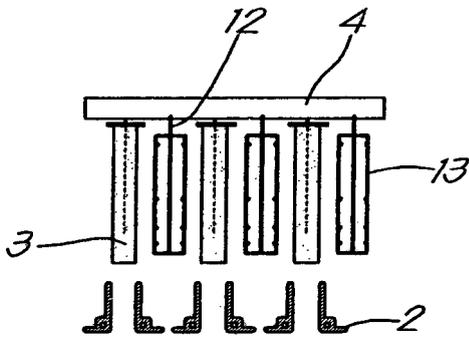


Fig. 5

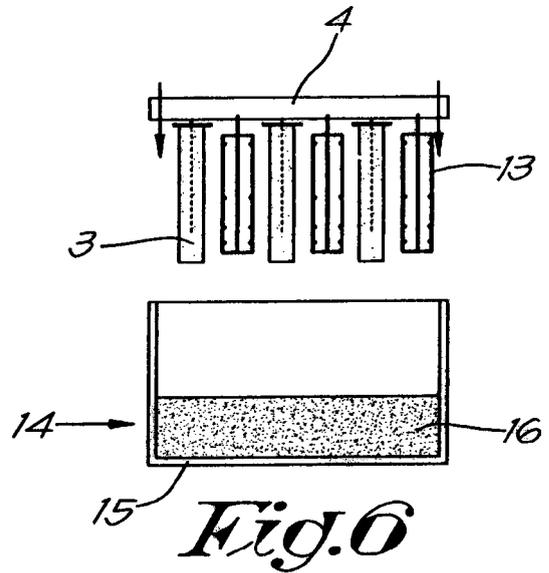


Fig. 6

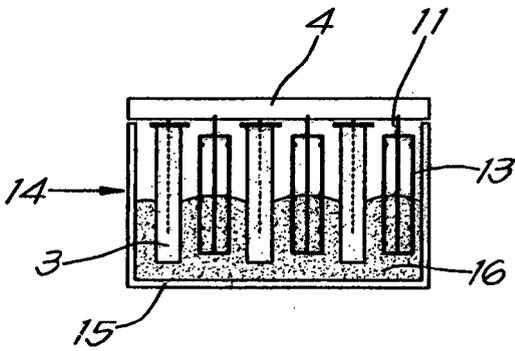


Fig. 7

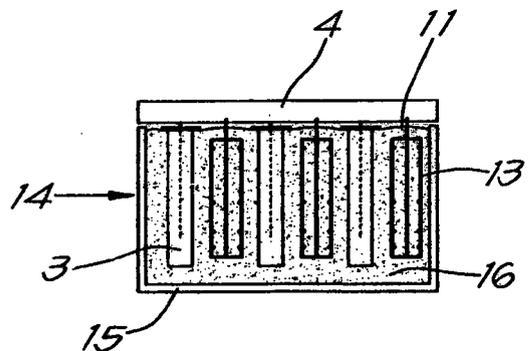
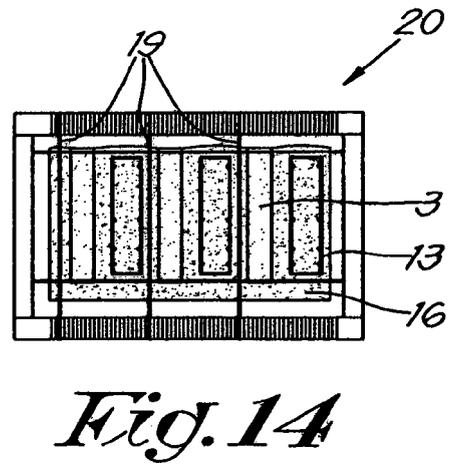
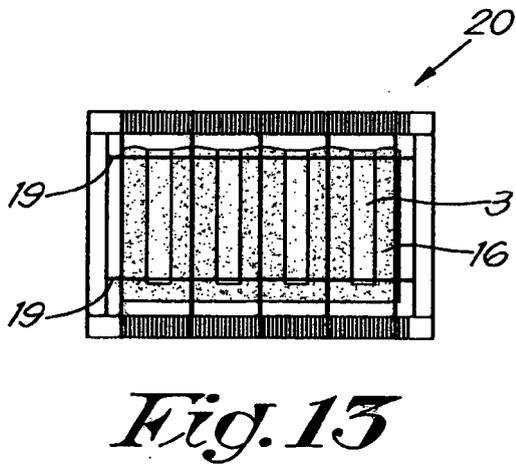
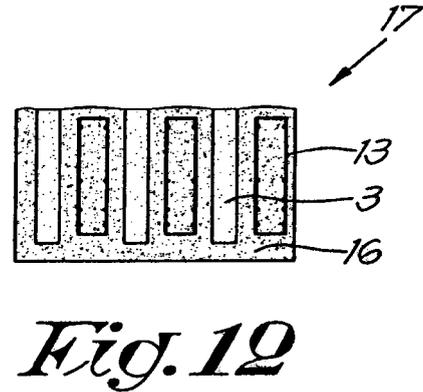
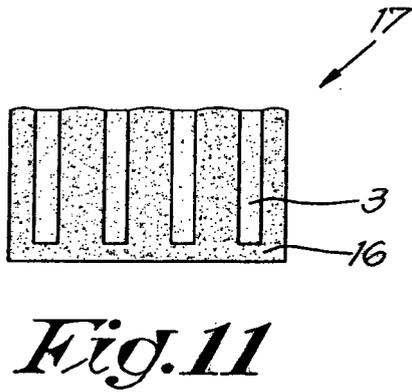
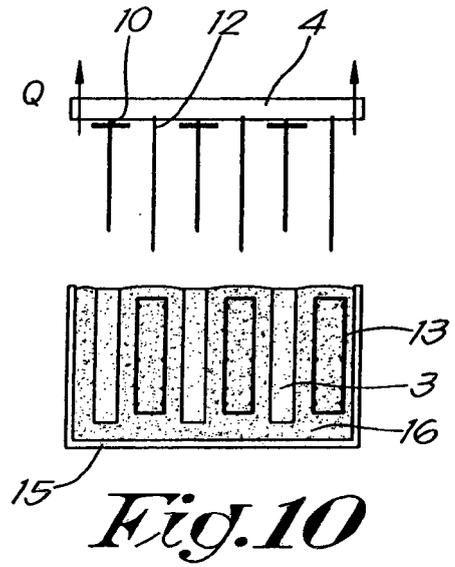
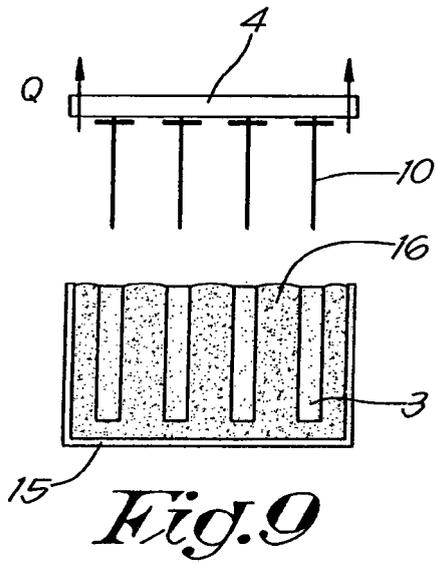


Fig. 8



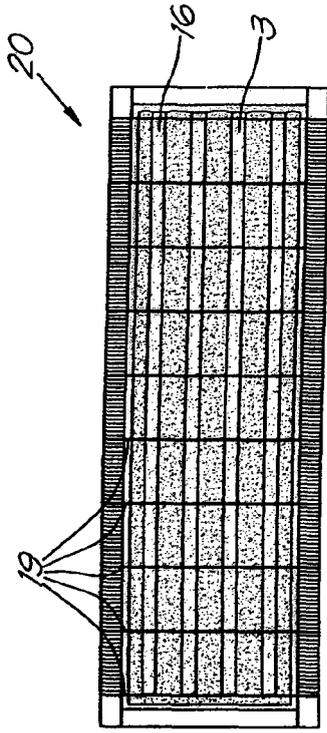


Fig. 10

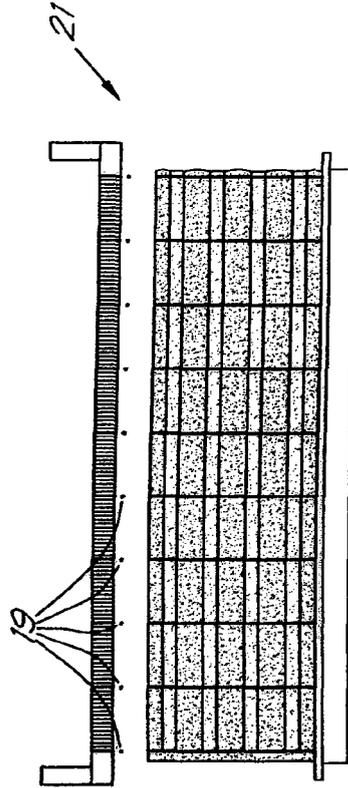


Fig. 19

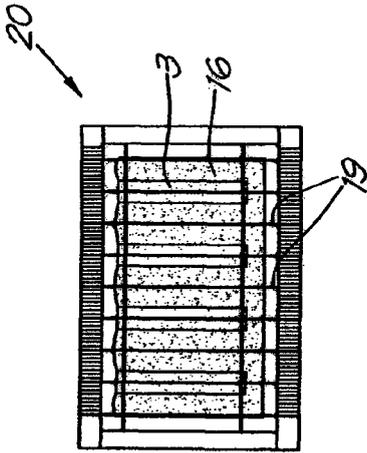


Fig. 15

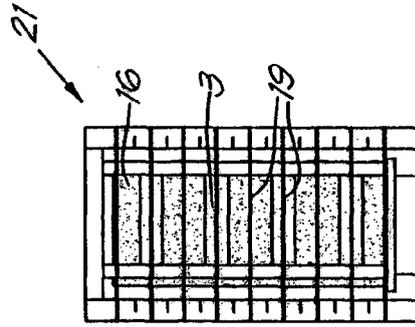


Fig. 18

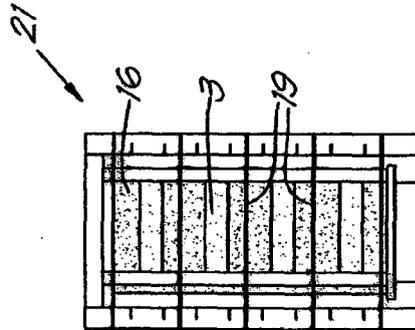
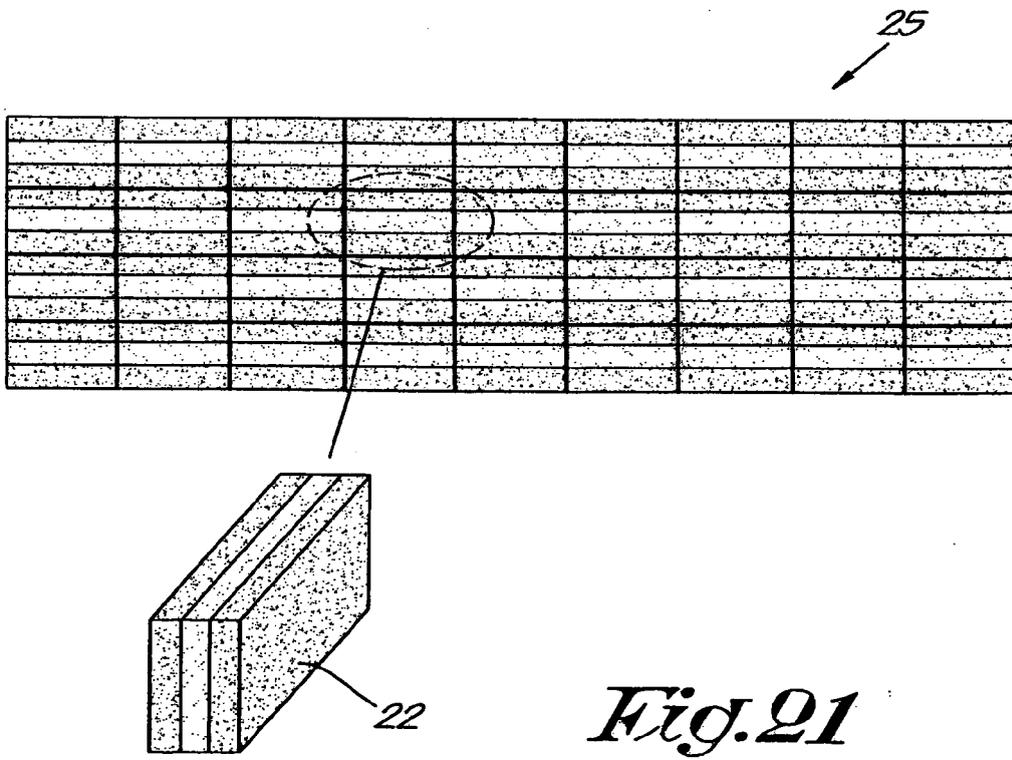
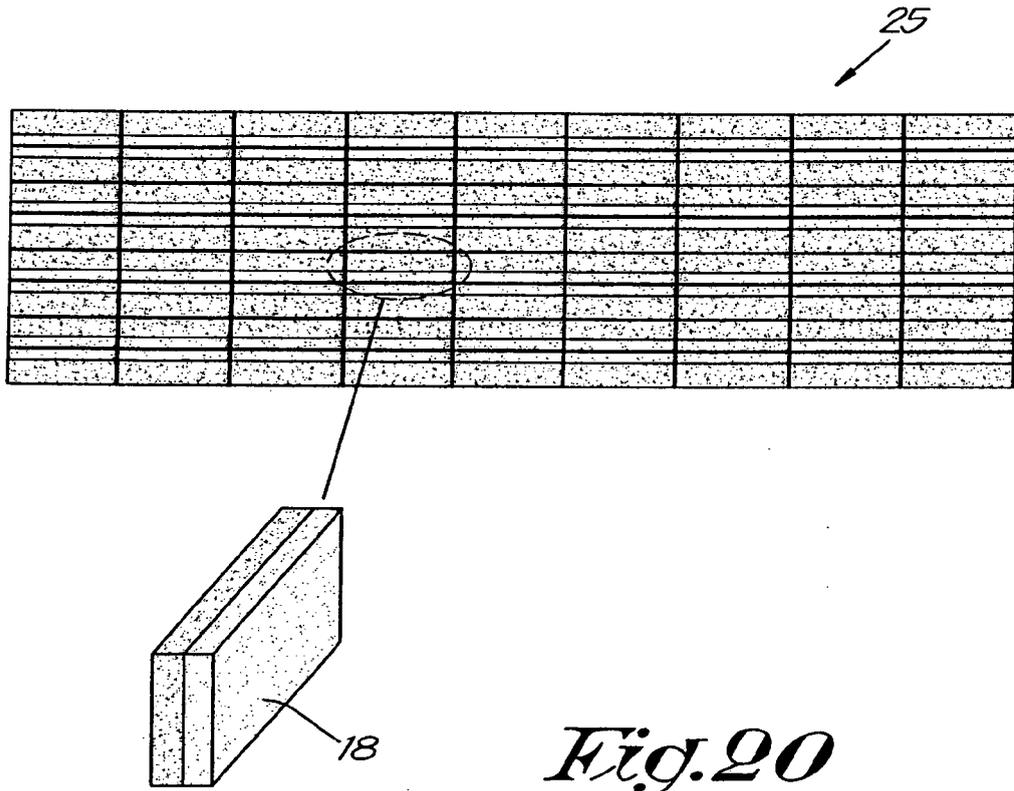


Fig. 17



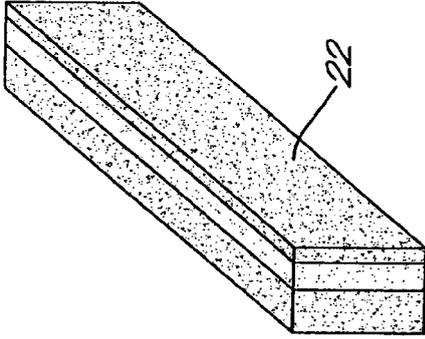


Fig. 04

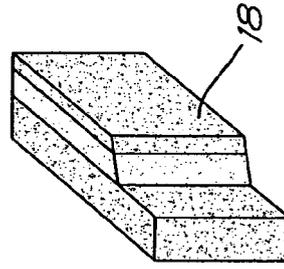


Fig. 08

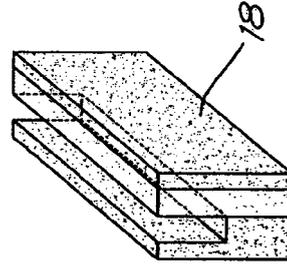


Fig. 07

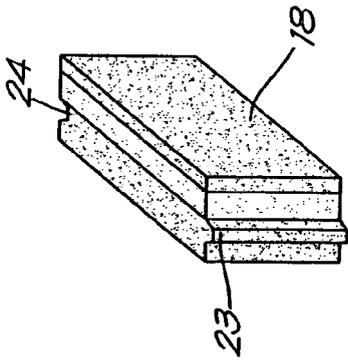


Fig. 05

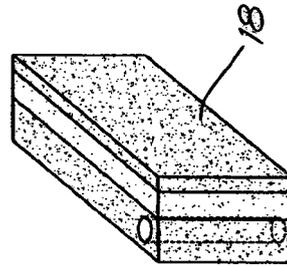


Fig. 06

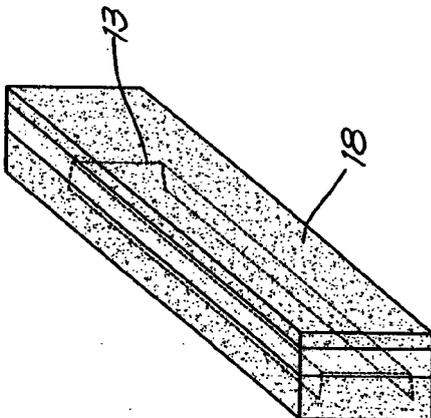


Fig. 09

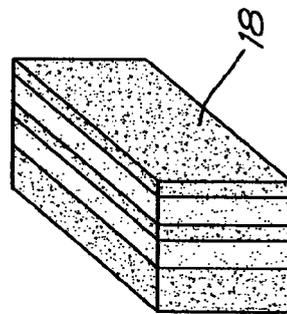


Fig. 05



EUROPEAN SEARCH REPORT

Application Number
EP 08 02 1024

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	* page 1, line 98 - page 2, line 65; figures 1-9 *	11,12	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			B28B
3	Place of search The Hague	Date of completion of the search 15 January 2009	Examiner Orij, Jack
CATEGORY OF CITED DOCUMENTS		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	
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ANNEX TO THE EUROPEAN SEARCH REPORT
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