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(54) **Tray-like mould for the manufacture of concrete slabs**

Tablett-ähnliche Schalungsform zur Herstellung von Betonplatten

Moule en forme de plateau pour fabriquer des plaques en béton

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EP-A- 0 460 331
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FR-A- 2 469 992
WO-A-98/58783
DE-A- 2 909 491

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Description

[0001] The present invention relates to the manufacture of concrete slabs and more specifically to a tray-like mould utilised during said manufacture.

[0002] In a method, developed during the last few years, for the production of slabs from a granulate of stone material and a cement binder - which method is described and claimed in Italian Patent No. 1,288,569 in the name of Marcello Toncelli - it is envisaged that the starting mix is prepared using particular ratios of the granulate and cement binder, with a suitable fluidifier for cement mixes being added to the latter.

[0003] The mix is loaded into container-like or tray-like moulds, forming a layer of predetermined thickness. The mould is then subjected to a first - very intense but short - vacuum step intended to remove the air which occupies the spaces between the granules of stone material and is retained therein.

[0004] During a second step, the mix is subjected to a vibratory movement under a vacuum which is less intense than that of the previous step.

[0005] The purpose of these two different degrees of vacuum is to prevent the mix water from boiling and therefore generating steam which would hinder a perfect compaction.

[0006] This step is then followed by the slab setting and hardening steps.

[0007] It is clear from the preceding short notes that the tray-like mould is subject to significant stresses during application of the vibratory movement, so that hitherto it has been made of metallic materials of considerable thickness, which obviously results in drawbacks in particular with regard to handling.

[0008] In addition, it must be pointed out that, for the industrial implementation of the setting and hardening steps, which are of a relatively long duration, a considerable amount of tray-like moulds must be made available.

[0009] Finally, the tray-like moulds must be made of material which does not absorb the water from the "green" (i.e. not yet hardened) slabs which are formed therein, since the slab would thus have an insufficient water content with harmful effects on the mechanical properties of the end product. In fact, it should not be forgotten that, in the method outlined above, the mix has a water content which is strictly controlled and slightly greater than the theoretical quantity required for the setting and hardening reactions.

[0010] During implementation of the method in question it is essential that the "green" (i.e. not yet hardened) slab or tile, at the end of the compaction step, should not lose moisture, with the result that hitherto the individual tray-like moulds have been introduced into a steam-saturated curing chamber and kept there for 24 hours.

[0011] It is worth mentioning a number of prior documents representing the state of the art.

[0012] EP-A-0 461 331 discloses a mould used in the manufacture of items where concrete needs to be aerated during the drying (setting) step. The mould is made of plastic material with a flat bottom and the side walls defining the cavity externally provided with vertical wings which are adapted to abut on the peripheral edge of another mould when several moulds are vertically stacked.

[0013] DE-A-2 909 491 discloses a mould used to make thin items of concrete, such as wall tiles. It is made of plastic foam and has a peripheral edge consisting of two portions with staggered heights to permit various moulds to be vertically stackable.

[0014] BE-A-0 537 141 discloses a mould used to make items of concrete. The mould cavity has a number of internally directed ribs which correspond to an extensive portion of the bottom wall and have a not negligeable height with respect to the side walls of the mould.

[0015] In view of these problems and drawbacks, the present invention provides a solution which not only is able to achieve the substantial elimination thereof, but also provides undoubted advantages from a technical and industrial point of view.

[0016] The present invention consists of a tray-like mould for the manufacture of concrete slabs having a bottom wall and a plurality of side walls and is obtained from a plastic material with good mechanical strength properties and impermeable, so as to prevent the absorption of even a small amount of water from the concrete mix in contact with the said walls and characterized in that it is provided at the outer surface of said bottom wall with several stiffening ribs and is furthermore provided with a peripheral edge shaped so as to allow several tray-like moulds to be stacked on top of each other in a steam-tight manner.

[0017] In the preferred embodiment, the bottom of the tray is provided with zones which are depressed by a predetermined amount so as to produce in the resulting slab a plurality of projections acting as supporting feet for the subsequent processing operations, in particular during the sizing step of the rough-formed slab.

[0018] Still with reference to the preferred embodiment, devices for stacking and simultaneously centring the individual tray-likes with respect to those located immediately above and below are associated with the outer edges of the tray-like moulds.

[0019] The particular aspects and advantages of the present invention will emerge more clearly from the detailed description which follows, with reference to the accompanying drawings in which :

Fig. 1 is a top plan view of a tray-like mould according to the invention;

Fig. 2 is a bottom plan view of the tray-like mould;

Figs. 3 and 4 are cross-sectional views along the planes indicated by III-III and IV-IV in Fig. 1;

Fig. 5 is an enlarged cross-sectional view of the detail shown encircled in Figures 3 and 4;

Figs. 6 and 7 are cross-sectional views along the planes indicated by VI-VI and VII-VII in Fig. 2;

Fig. 8 is a cross-sectional view of three tray-like moulds when in the stacked condition;
Fig. 9 is an enlarged cross-sectional view of the detail shown encircled in Fig. 8.

[0020] With reference first of all to Figures 1-4, a tray-like mould according to the present invention has a bottom wall 10 and four side walls 12 which define an internal moulding cavity 14.

[0021] The outer surface of the bottom wall 10 is provided with projecting stiffening ribs 16 (A, B and C), of which the ribs 16A and 16B are arranged perpendicular to each other (namely parallel to the side walls 12 of the mould), as can be easily understood from Fig. 2, while the ribs 16C are arranged diagonally. In this way the mould has a high mechanical strength and at the same time is sufficiently lightweight to allow handling thereof during the various processing steps.

[0022] The arrangement of the ribs is also so designed to allow the penetration of the forks of forklift trucks for handling operations. However, the outer edge also has a form which allows manual gripping.

[0023] In fact, as can be readily seen from Figures 3 and 4, the external edge 18 of the tray-like is suitably shaped so as to allow both stacking and the above mentioned gripping.

[0024] With reference to Figures 8 and 9, the first of these figures shows three tray-like moulds stacked on top of each other, while the second one shows a partially sectioned and enlarged detail of the stacked and centred arrangement of the tray-like moulds.

[0025] In particular from Figures 8 and 9 it can be seen that the edge 18 consists of two portions 20 and 22 which have staggered heights so that, during stacking, the bottom of the overlying tray-like mould is arranged in the outer area defined by the portion 20 and is enclosed by the portion 22.

[0026] It is worth noting that, during manual stacking onto the last tray-like, a lid (which may also consist of an empty tray) for closing the cavity 14 is provided onto the uppermost tray-like mould.

[0027] Fig. 5 shows a particular detail of the bottom of the tray according to Fig. 1. In predefined and equidistant positions along its own periphery, the bottom wall 10 of the tray-like mould has a depression 21 with a height which is very small but sufficient to form in the final slab a plurality of projections that are able to act as supporting feet for the rough-formed slab when the latter is transferred (after the hardening step) to the stations for the subsequent processing step, in particular during the sizing step.

[0028] In the embodiment shown in Fig. 1, the depressions 21 are eight in number, namely two on each side of the bottom wall 10 of the tray-like mould. From Fig. 1 it can also be seen that these depressed zones have a circular shape so that the resulting projections in the final rough-formed slab have the shape of true supporting feet.

[0029] Preferably the tray-like mould is obtained by injection-moulding from a suitable plastic material such as polyurethane or ABS resin having the desired technical characteristics.

[0030] By way of conclusion, with the tray-like mould according to the invention the following advantages may be achieved:

- lightness
- rigidity
- low cost
- resistance to the action of atmospheric agents, in particularly to oxidation
- durability
- non-absorption of water
- impact resistance
- resistance to temperatures above room temperature

[0031] In particular the ability of staking and of providing a sealing action against undesirable water evaporation, especially during the setting step of the mix, are to be appreciated.

[0032] It is understood that mechanically equivalent modifications and variations are possible and may be envisaged within the coverage of the appended claims.

[0033] In particular, modifications shall be expected as regards the arrangement of the reinforcing and stiffening ribs and the shape of the edges so as to allow stacking and simultaneous sealing of several tray-like moulds.

Claims

1. Tray-like mould obtained from a plastic material for the manufacture of slabs by means of a process comprising submission to a vibratory movement under vacuum and a subsequent hardening of a mix of granulated stone material and cement binder, the mould having a cavity (14) defined by a bottom wall (10), a plurality of side walls (12) and a peripheral edge (18) shaped so as to allow several tray-like moulds to be stacked on top of each other, **characterized in that**. in order to ensure that the mix does not lose moisture prior to said setting step when several moulds are stacked, the mould is provided with several stiffening ribs (16A, 16B, 16C) projecting from the outer surface of said bottom wall (10) and the plastic material from which the mould is obtained is of good mechanical strength properties and impermeable to water contained in the concrete mix.

2. Tray-like mould according to Claim 1, **characterized in that** said ribs are arranged parallel (16A, 16B) to the said perpendicular side walls (12) and diagonally (16C) thereto.

3. Tray-like mould according to Claim 1, **characterized in that** in predefined and equidistant positions along its own periphery its bottom wall (10) is provided with

depressions (21) of a very small height with respect to the side walls (12) so as to produce in the resulting slab a plurality of projections acting as supporting feet for the subsequent processing operations.

4. Tray-like mould according to Claim 1, **characterized in that** the edge (18) consists of an inner and an outer portion (20, 22) of staggered heights so that, when several moulds are stacked on top of each other, the lowermost end of the side walls (12) of an overlying tray-like mould is arranged in said inner portion (20) and is enclosed by the outer portion (22) of the underlying mould.

5. Tray-like mould according to Claim 1, **characterized in that** said plastic material is chosen from polyurethane or ABS resin.

Patentansprüche

1. Aus einem Kunststoffmaterial erhaltene tablettartige Schalungsform zur Herstellung von Platten mittels eines Verfahrens, das ein Aussetzung einer Vibrationsbewegung unter Vakuum und ein nachfolgendes Härten einer Mischung aus granuliertem Steinmaterial und Zementbinder beinhaltet, wobei die Schalungsform einen Raum (14) aufweist, der begrenzt ist durch eine Bodenwand (10), eine Mehrzahl von Seitenwänden (12) und einen peripheren Rand (18), welcher so geformt ist, dass er das Aufeinanderstapeln von mehreren tablettartigen Schalungsformen gestattet, **dadurch gekennzeichnet, dass** zum Sicherstellen, dass die Mischung nicht vor dem Abbindeschritt Feuchtigkeit verliert, wenn mehrere Schalungsformen gestapelt sind, die Schalungsform mit mehreren Versteifungsrippen (16A, 16B, 16C) versehen ist, die von der äußeren Oberfläche der Bodenwand (10) hervorstehen und das Kunststoffmaterial, aus dem die Schalungsform erhalten wird, gute mechanische Festigkeitseigenschaften aufweist und undurchdringlich für Wasser ist, das in der Betonmischung enthalten ist.

2. Tablettartige Schalungsform nach Anspruch 1, **dadurch gekennzeichnet, dass** die Rippen parallel (16A, 16B) zu den senkrechten Seitenwänden (12) und diagonal (16C) dazu angeordnet sind.

3. Tablettartige Schalungsform nach Anspruch 1, **dadurch gekennzeichnet, dass** an vorbestimmten Stellen gleichen Abstandes entlang ihrer eigenen Peripherie ihre Bodenwand (10) mit Vertiefungen (21) einer sehr geringen Höhe bezogen auf die Seitenwände (12) versehen ist, zum Erzeugen einer Mehrzahl von Vorsprüngen in der resultierenden Platte, die als Stützfüße für die nachfolgenden Bearbeitungsvorgänge fungieren.

4. Tablettartige Schalungsform nach Anspruch 1, **dadurch gekennzeichnet, dass** der Rand (18) aus einem inneren und einem äußeren Abschnitt (20, 22) mit gestuften Höhen besteht, so dass, wenn mehrere Schalungsformen übereinarider gestapelt werden, das unterste Ende der Seitenwände (12) einer darüberliegenden tablettartigen Schalungsform in dem inneren Abschnitt (20) angeordnet ist und von dem äußeren Abschnitt (22) der darunterliegenden Schalungsform (22) umschlossen wird.

5. Tablettartige Schalungsform nach Anspruch 1, **dadurch gekennzeichnet, dass** das Kunststoffmaterial aus Polyurethan oder ABS-Harz ausgewählt ist.

Revendications

1. Moule de type à plateau obtenu à partir d'un matériau synthétique pour la fabrication de dalles au moyen d'un procédé comprenant la soumission à un mouvement vibratoire sous vide et un durcissement consécutif d'un mélange de matériau rocheux granulé et d'agglomérant, le moule ayant une cavité (14) définie par une paroi inférieure (10), une pluralité de parois latérales (12) et un bord périphérique (18) formé de manière à permettre que plusieurs moules de type à plateau soient empilés les uns au-dessus des autres, **caractérisé en ce que**, afin d'assurer que le mélange ne perde pas d'humidité avant ladite étape de durcissement lorsque plusieurs moules sont empilés, le moule est pourvu de plusieurs nervures de renfort (16A, 16B, 16C) faisant saillie depuis la surface externe de ladite paroi inférieure (10) et le matériau synthétique à partir duquel le moule est obtenu a de bonnes propriétés de résistance mécanique et est imperméable à l'eau contenue dans le mélange de béton.

2. Moule de type à plateau selon la revendication 1, **caractérisé en ce que** lesdites nervures sont agencées parallèlement (16A, 16B) auxdites parois latérales perpendiculaires (12) et diagonalement (16C) par rapport à celles-ci.

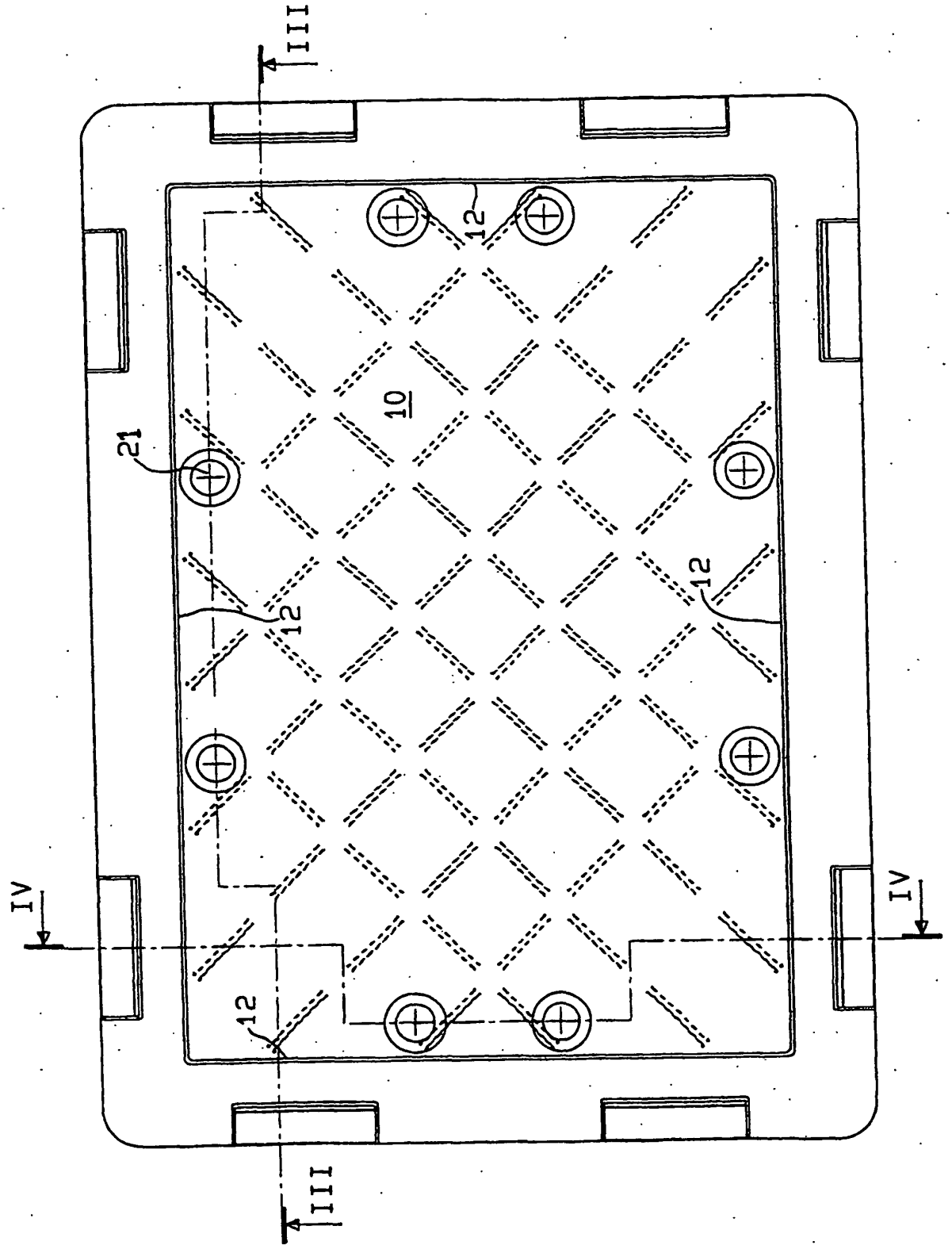
3. Moule de type à plateau selon la revendication 1, **caractérisé en ce qu'**à des positions prédéfinies et équidistantes le long de sa propre périphérie sa paroi inférieure (10) est pourvue de dépressions (21) d'une très faible hauteur par rapport aux parois latérales (12) de manière à former dans la dalle résultante une pluralité de saillies agissant en tant que pieds de support pour les opérations de traitement ultérieures.

4. Moule de type à plateau selon la revendication 1, **caractérisé en ce que** le bord (18) consiste en une partie interne et une partie externe (20, 22) de hau-

teurs échelonnées de sorte que, lorsque plusieurs moules sont empilés les uns au-dessus des autres, l'extrémité inférieure des parois latérales (12) d'un moule de type à plateau sus-jacent soit agencée dans ladite partie interne (20) et soit entourée par la partie externe (22) du moule sous-jacent.

5. Moule de type à plateau selon la revendication 1, **caractérisé en ce que** ledit matériau synthétique est choisi parmi le polyuréthane ou une résine ABS.

FIG. 1



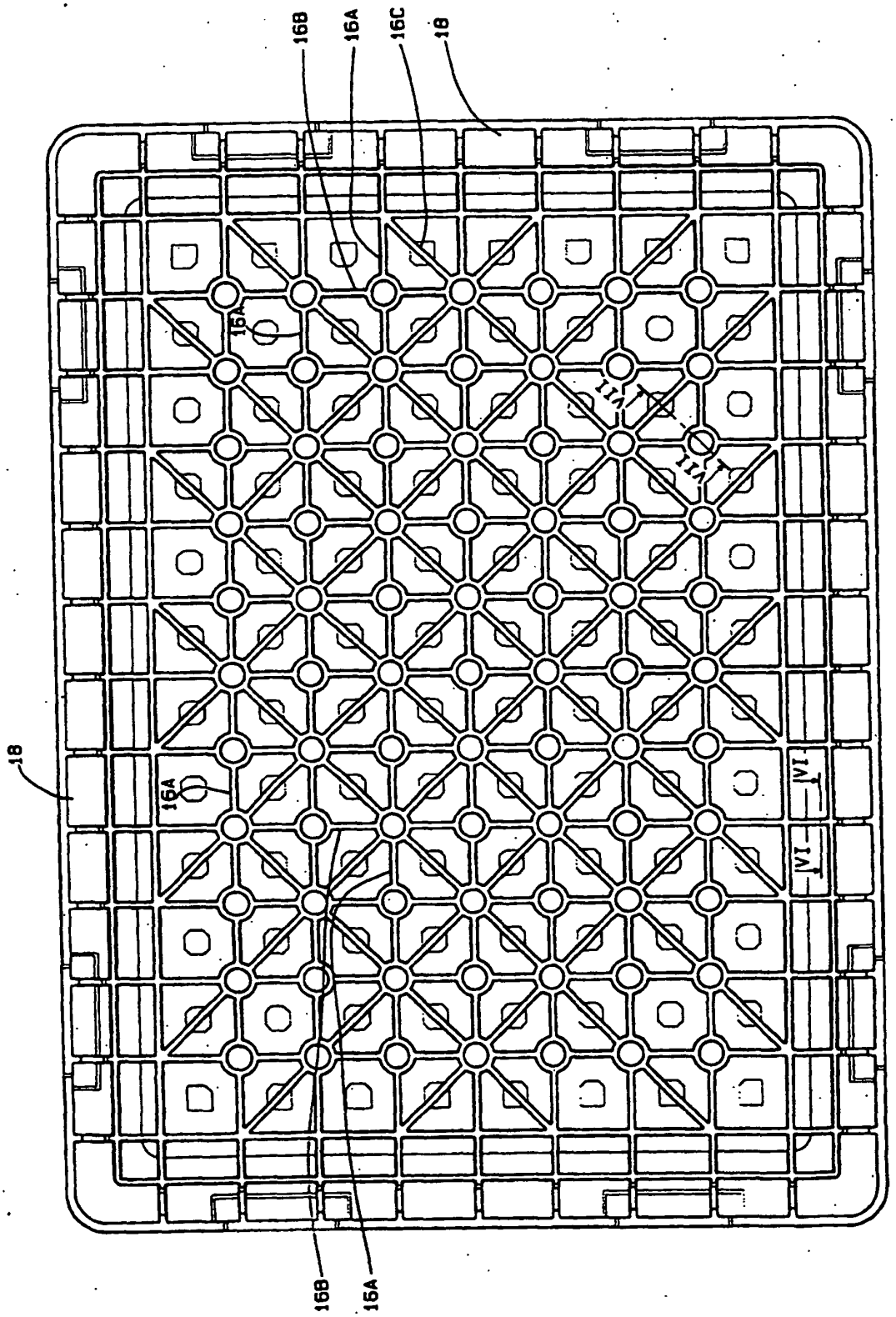


FIG. 2

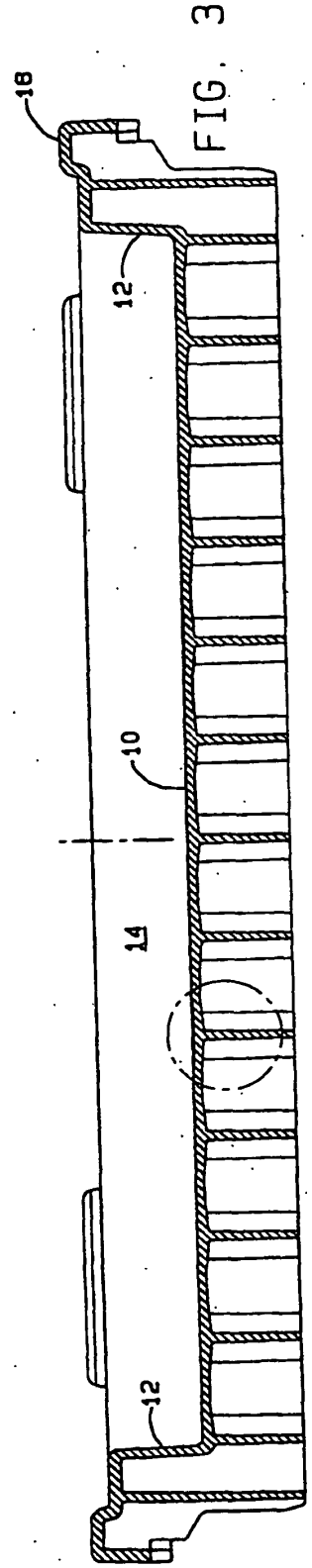


FIG. 3

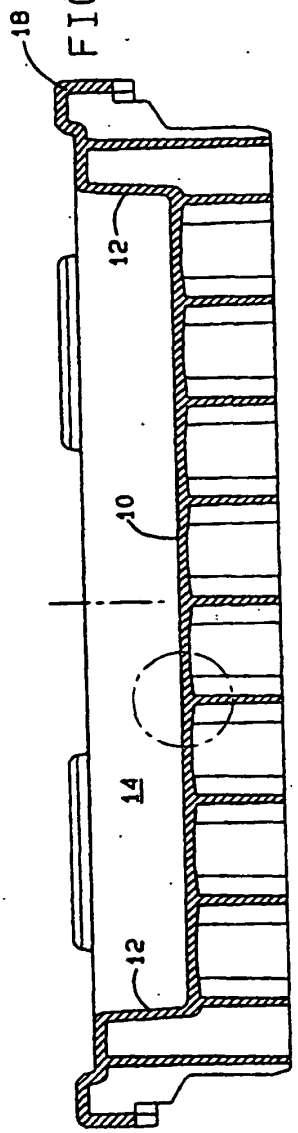


FIG. 4

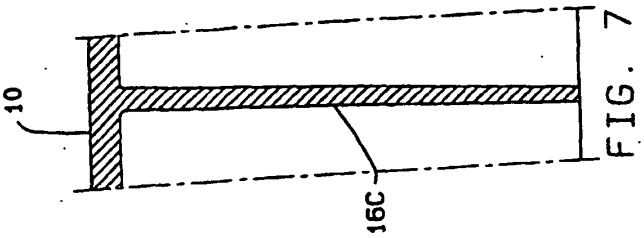


FIG. 7

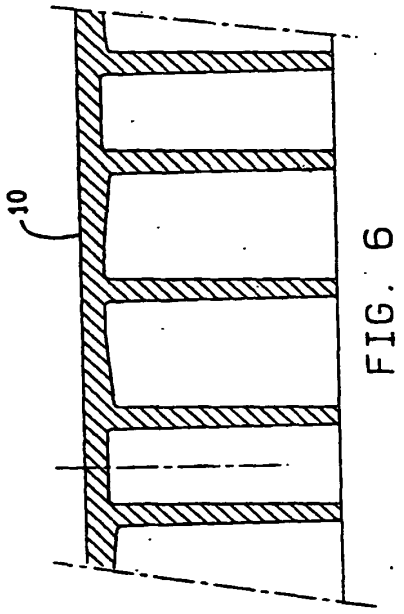


FIG. 6

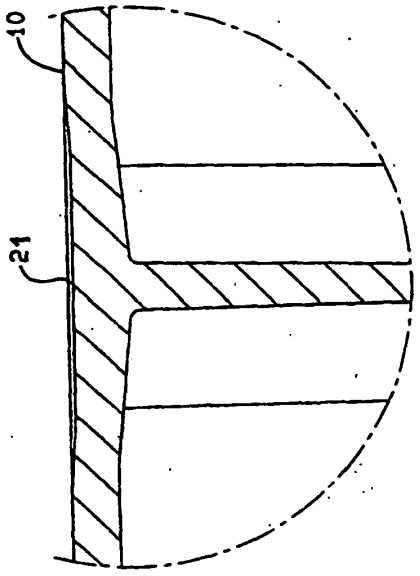
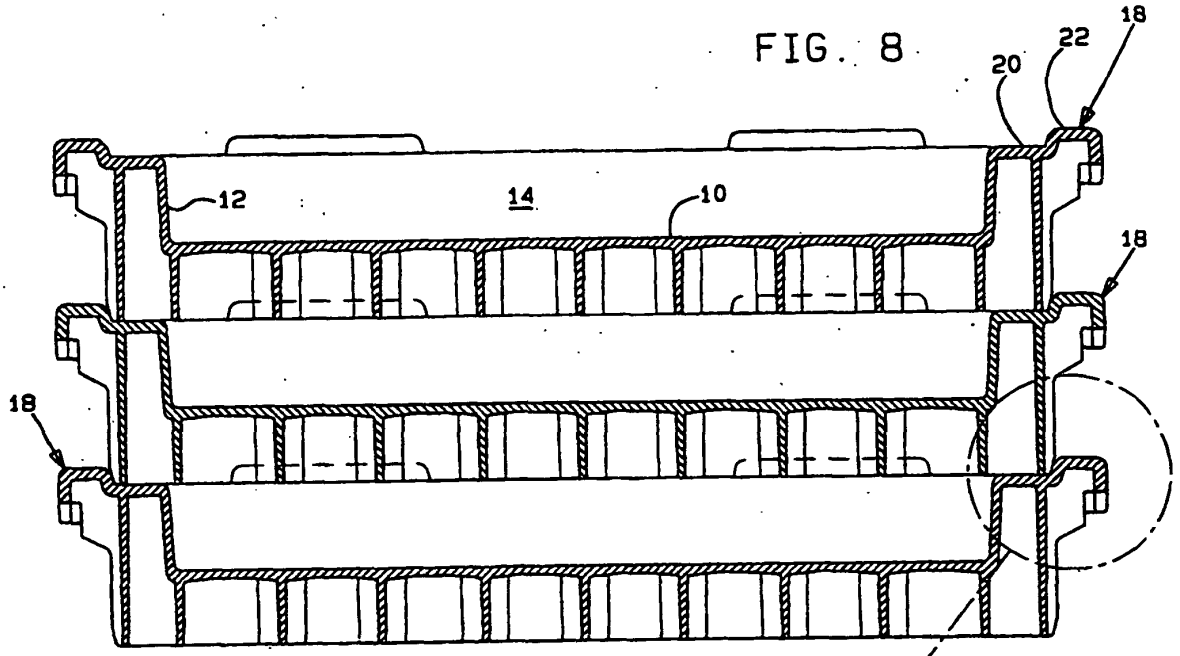


FIG. 5

FIG. 8



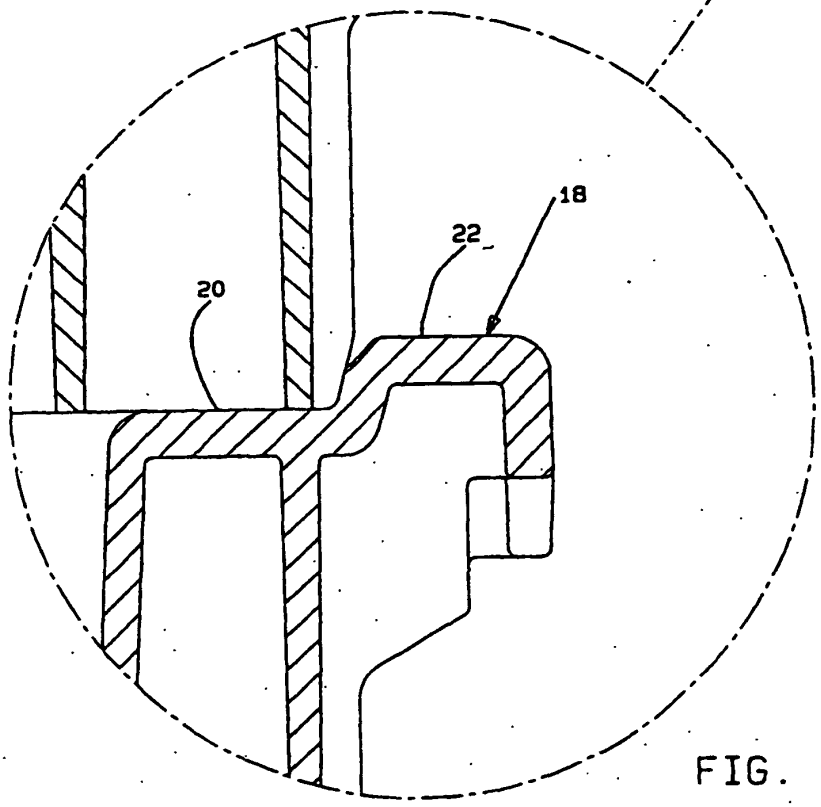


FIG. 9