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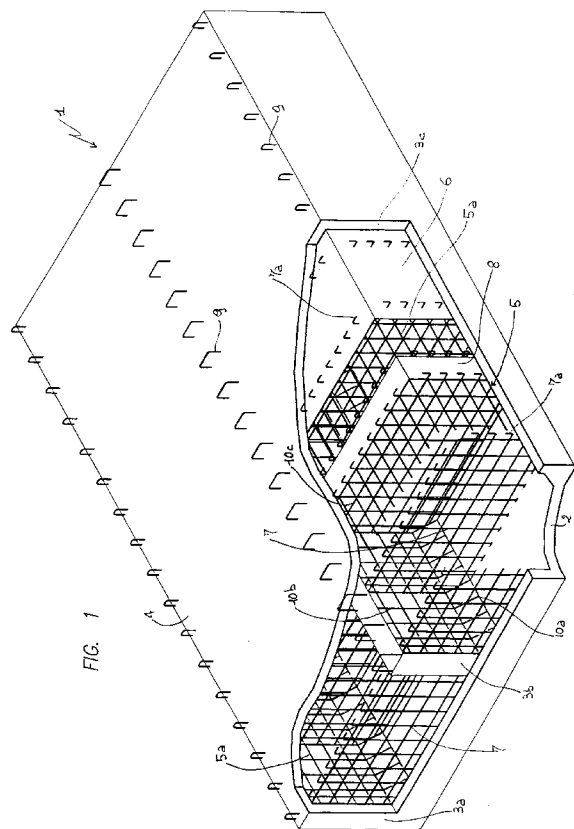
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(54) **Process for carrying out box-like prefabricated reinforced concrete manufactured articles and manufactured article produced thereby.**

(57) It is described a process for carrying out reinforced concrete box-like manufactured articles and a manufactured article produced thereby. The process comprises a plurality of steps, among them there is the step of locating inner form elements with their anchoring and stiff blocking in a bed element, of casting concrete for completing the manufactured article levelling the upper surface. Moreover, it is of interest the step of preparing the inner form elements. The reinforced concrete box-like manufactured article comprises a bed plate-like element (2), at least a rib (3) which raises from the element (2), a covering plate-like element (4) and a inner form element (5) substantially formed by a strong structure (5a) having a prefixed shape according to the manufactured article (1) to obtain, provided with a plurality of crosspieces (7) and with a plurality of anchoring elements (10) arranged to engage, in a fixed way, the plate-like element (2), the ribs (3), and the plate-like element respectively.



The present invention relates to a process for carrying out box-like prefabricated reinforced concrete manufactured articles and manufactured article produced thereby, particularly, for forming beams, bent tiles for covering attics, elements for bridges and for galleries, etc..

It is known that there are several prefabricated manufactured articles of the box-like kind which are basically formed by a first generally rectangular slab-like bed element, at least two substantially element rise form this element which are closed by a second slab-like element.

The manufactured articles described above are now carried out by different constructive methods.

A first constructive method provides the making of a concrete casting in a form having a metal inner form that is taken away from the top after the setting of the same casting. Then, the final casting is carried out to form a slab closing the box-like manufactured article.

The above just mentioned method shows some shortcomings. One of these is due to the fact that in a building yard there is the necessity to have many forms having different sizes and shapes in order to start up manufactured articles of different sizes with very expensive plants, materials and equipments, and moreover it is also necessary a large room for storing the forms.

Another constructive method, similar to the previous one, provides the insertion of a disposable inner form made of polystyrene or other light material. However, also this constructive method shows different disadvantages. In fact, polystyrene members are particularly expensive, it is not possible to get rid of their residuals and in case of fire the polystyrene expands therefore causing dangerous stresses in the structure. Moreover, the polystyrene crumbles rather easily, so that small polystyrene pieces enter the concrete casting impairing the strength. Another very important disadvantage is due to the fact it is very difficult to hold the polystyrene inner form since during the forming of the casting, the inner form receives a thrust equal to the weight of the concrete displaced.

A third method for forming manufacturing articles is an extrusion processing that allows to produce finished elements, however, this method can be used for carrying out small size manufactured articles (generally having an height of 30-40 cm) but very heavy.

A fourth method provides the use of a metal inner stiff inner form, that after the forming of the casting it shrinks so it can be taken away.

This constructive method has also shown some disadvantages. For example, there is the necessity to have the availability of several forms having different sizes and shapes with corresponding preparation costs and there is the necessity to provide rooms for storing them. In fact, the forms used in this method are very expensive and the manufacturing and the

forming of the casting are somewhat difficult.

Besides that, another method provide the use of metal disposable pipings connected by different means to the form. This method is widely used for producing large manufactured articles, however it shows some disadvantages.

Among the different problems, the most troublesome is the difficulty of securely holding the pipings during the forming of the concrete casting. In fact, the pipes are subjected to a strong thrust directed to the top that is equal to the weight of the displaced concrete.

It is an object of the present invention to solve the problems of the prior art, providing reinforced concrete box-like prefabricated manufactured articles by means of a manufacturing process that allows the possibility to vary continuously either the height or the width dimension of the manufactured article without detectable cost variations and to limit the manufacturing time, moreover this method being easy to carry out.

Another object of the present invention is to avoid, thanks to this method, noxious pollutants contrary to the prior art that was not able to get rid of the polystyrene.

Another object of the present invention is to obtain manufactured articles having different geometrical and static features without the necessity to change the forms structure.

Moreover, the present method allows to insure a correct positioning of the inner forms during the casting forming contrary to the prior art.

A further object of the present invention is to carry out a manufactured article having improved structural characteristics with an increased strength ability to withdraw stresses.

A still further object of the present invention is to build such manufactured articles having limited plant and equipment costs, reduced storing rooms, shorter manufacturing times and high flexibility of use.

These and further objects, which will be more apparent from the following present description, are substantially met by a process for carrying out reinforced concrete box-like prefabricated manufactured articles and the corresponding manufactured article produced thereby as claimed.

Further features and advantages will be more apparent from the detailed description of a process for carrying out reinforced concrete box-like prefabricated manufactured articles and of the corresponding manufactured article obtained according to the present invention described as follows with reference to the accompanying drawings given only as illustrative and therefore they are not intended to be limiting, wherein:

- figure 1 is a prospective schematic view of manufactured article obtained by the process of the present invention;

- figure 2 schematically shows one of the operative steps of the process for obtaining the manufactured article of figure 1;
- figure 3 schematically shows another operative step of the process of the invention;
- figure 4 schematically shows another operative step of the process for obtaining the manufactured article;
- figure 5 shows a longitudinal section of the manufactured article of figure 1;
- figure 6 schematically shows another manufactured article obtained by the process of the present invention;
- figure 7 schematically shows a plurality of assembled manufactured articles of figure 6.

Referring to the above mentioned figures and particularly to figure 1, numeral 1 generally shows a box-like manufactured article produced according to the process of the present invention.

The manufactured article is basically formed by a first bed plate-like element 2 suitably reinforced in a substantially known way and anyhow according to the strength characteristics required by its final use, at least one suitably reinforced rib which raises from the bed element 2 and a second covering plate-like element 4 which is also suitably reinforced. The manufactured article 1 of the embodied described example shown in figure 1, is provided with vertical ribs 3a, 3b and 3c.

The manufactured article 1 comprises an inner form element 5 which is substantially formed by a strong structure 5a having a preestablished shape according to the shape of the manufacturing article to be obtained. Even more particularly stated, the inner form element 5 is not a disposable element or an element to be reused for other manufactured articles, as it usually happens in the prior art, because it cooperates with the structure of the manufactured article and it is an integral part of it.

According to the present embodiment, the strong structure 5a is formed by an electro-welded lathing that can be galvanized or coated with epoxy resin to improve the strength characteristics also in particularly corrosive environments. Advantageously, the strong structure 5a can be made by metal or plastic elements which are suitably shaped and connected together.

According to the present invention, around the structure there is a membrane 6 covering the same structure in order to make the structure waterproof. In particular, the membrane 6 is made of a thermoretractable material in order to better adhere to the strong structure and to act as a barrier for the concrete during the casting, behaving as a baffle to keep out and to protect from the external agents, e.g. steam. Obviously, other several kinds of material can be used for carrying out the membrane 6, such metal sheet, rubber, aluminium, and like. In case the strong

structure 5a shows an outer surface that is compact enough, it is possible to avoid the covering membrane 6 (for example when the electro-welded lathing has very dense meshes or when the structure is formed by plates).

Even more particularly stated, the strong structure 5a shows a plurality of elements 10a, 10b and 10c anchoring the same structure, these elements are fixed to the plate-like element 2, the ribs 3a, 3b and 3c and the second plate-like element 4 respectively. Moreover, the inner form element 5 is equipped with a plurality of crosspieces 7 provided for strengthening the strong structure 5a and also the manufactured article in case it is necessary. Also the crosspieces 7 shows anchoring element 7a which are embedded in the concrete of the bed element 2, of the ribs 3a, 3b and 3c and of the covering element.

In addition to that, still according to the present invention, it is possible to carry out cross ribs 8 in the manufactured article by simply using inner form elements 5 having a reduced length in order to leave some space between an element 5 and the following one. With such an arrangement of the inner form element 5, when it is formed the concrete casting, the spaces obtained with the concrete are filled by the concrete carrying out the cross ribs 8 which made much more resistant the manufactured article to certain stresses.

The manufactured article 1 is provided with plates and/or attaching means 9 for transporting and storing the same manufactured article.

After having given a mainly structural description, the process for carrying out the manufactured article is as follows.

The present process provides a plurality of steps, some of these steps are substantially known, such as the arrangement of a form by cleaning and coating it with oil for the following dismantling, the placing of a plurality of strands for prestressing and tensioning the same and the placing of a metal reinforcement which is necessary for the bed element forming the lower slab of the manufactured article.

The following steps of process provide the arrangement of a metal reinforcement for the ribs, the concrete casting and a corresponding vibration for obtaining the bed element, as illustrated in figure 2.

At this point, the process provides the arrangement of the inner form elements which are anchored to the bed element by dipping the lower anchoring elements in the green concrete mass. As the time goes by, it is obtained the hardening of the concrete and the total consequent blocking of the inner form element as shown in figure 3.

Then, more concrete is casted to complete the manufactured article levelling the upper surface for carrying out the ribs and the covering element, as it can be seen from figure 4. According to the present process, it is provided a step for laying the reinforce-

ment of the covering element in case it is necessary.

After the insertion of the plates or of the attaching means in the covering element or in the ribs there is a second curing of the manufactured article and the final dismantling of the form.

Specifically, a very important step is the arrangement of the inner form elements which are prepared every time depending on the characteristics of the manufactured article to carry out.

Particularly, the arrangement step of the inner form elements comprises a step of preparing the strong structure by, for example, the bending of the electro-welded lathing depending on the shaping of the manufactured article to obtain. As soon as the bending step has been completed, the structure, obtained in this way, is stiffened by adding crosspieces which are welded to the same lathing and the anchoring elements are arranged. Then, the strong structure is coated by the membrane which is heated to adhere to the electro-welded lathing making the inner form element waterproof.

In a different way, in case the inner form element has a strong structure comprising metal or plastic elements, as previously described, there is only the step of shaping the same strong structure because it is not necessary to cover it by the membrane.

Therefore, the present invention meet the objects cited above.

In fact, thanks to the present process it is possible to carry out a plurality of manufactured articles having different geometrical and size characteristics thanks to the flexibility and the practicality of using the inner form elements according to the present invention.

Advantageously, the present invention avoid the necessity of having the several forms, the room necessary for stacking them and the cost for their preparation.

According to the present process it is possible to manufacture at the same time more than one manufactured article on just one prestressing bench or track differently from the prior art where the possibilities were limited by the necessity of taking away the inner form used. In this way, it is possible to considerably reduce the manufacturing times since the necessary stoppage for assembling the molds are eliminated, etc., therefore it is possible a continuous manufacture.

All this involve remarkable savings of the operating costs.

Advantageously, the invention can be used to change the number of ribs present in the manufactured article besides the presence of cross ribs having also different heights for producing manufactured articles having a certain slope since it is sufficient to insert many inner form elements suitably shaped.

With regard to this, it is pointed out that it is particularly advantageous the improved flexural and

shearing strength thanks to the presence of the inner form elements. Further, it has been found out the inner mold element partially absorbs the stress caused by moving the manufactured article in the factory and during the storing and transport.

Moreover, there is the possibility to connect stiffly either element components or manufactured articles with a consequent structural cooperation of the component casted afterwards.

It is also noticed the possibility to carry out stiffenings of the ends or of the continuous cross section which are almost unlimited and without substantially increasing the costs.

According to the present process it is very simple to carry out the ends of the manufactured article, in fact it is sufficient to prepare two cross ribs.

Obviously, one can add to the present invention several modifications and variations which are considered within the scope of the inventive step that characterize them.

Claims

1. Process for carrying out a reinforced concrete box-like manufactured article comprising the steps of:

- preparing a form by cleaning and coating it with oil for its dismantling,
- laying a plurality of strands for prestressing and tensioning the same,
- laying a metal armature for a bed element,
- laying a metal armature for vertical ribs,
- casting concrete and corresponding vibrations for said bed element,
- curing the manufactured article, and
- dismantling the form,

characterized by the fact that the process further comprises the steps of:

- arranging inner form elements with their anchoring to said bed element,
- curing with stiff blocking of the inner form to the concrete of the bed element,
- casting the concrete to complete the manufactured article levelling the upper surface.

2. Process according to claim 1, characterized by the fact it comprises a step of preparing said inner form element every time depending on the characteristics of the manufactured article to carry out.

3. Process according to claim 1, characterized by the fact it comprises a step of laying a metal reinforcement for a covering element.

4. Process according to claim 1, characterized by

the fact that it comprises also a step of inserting plates, attaching means, etc., in correspondence of the upper surface of said manufactured article.

5. Process according to claim 2, characterized by the fact that said step of preparing said inner form elements comprises a step of:
 - preparing a strong structure,
 - arranging metal crosspieces suitably arranged inside the strong structure,
 - arranging anchoring elements to the strong structure.

6. Process according to claim 5, characterized by the fact said step of preparing said strong structure comprises the step of:
 - bending an electro-welded lathing depending on the shape of the manufactured article to obtain,
 - positioning crosspieces provided for further strengthening said strong structure,
 - coating said electro-welded lathing by a membrane,
 - arranging said metal anchoring elements in the bed element, in the ribs and in the covering element.

7. Process according to claim 2, characterized by the fact said step of preparing said strong structure comprises a step of:
 - assembling metal or plastic elements by connection to one another for obtaining said strong structure, and
 - arranging metal anchoring elements.

8. Process according to claim 2, characterized by the fact it comprises a step of heating said membrane to adhere to the electro-welded lathing.

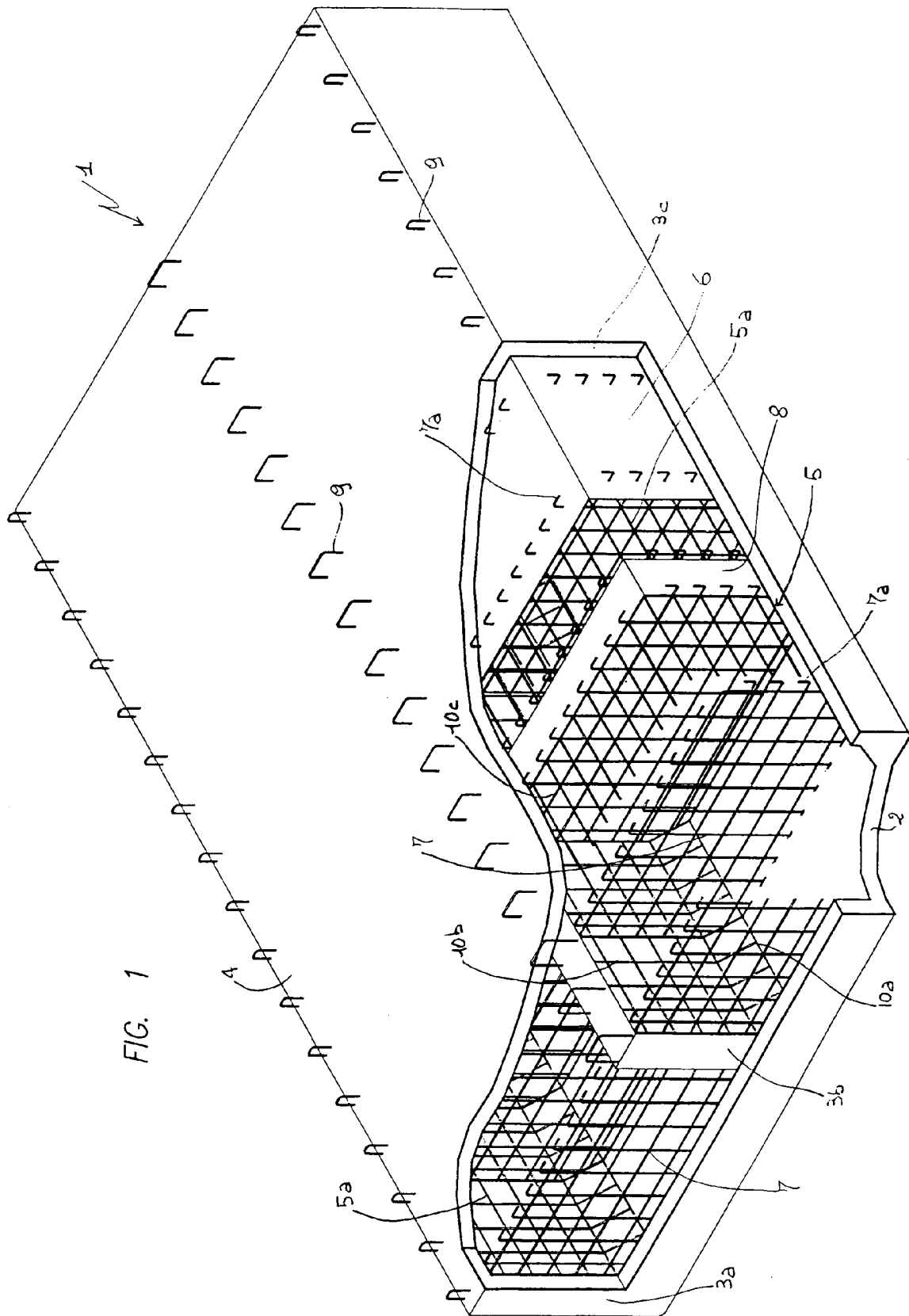
9. Reinforced concrete box-like manufactured article comprising:
 - a bed plate-like element (2) suitably reinforced,
 - at least a rib (3) which raises from said bed element (2), said rib being suitably reinforced,
 - a covering plate-like element (4) suitably reinforced,
 characterized by the fact it further comprises an inner form element (5) substantially formed by a strong structure (5a) having a prefixed shape according to the manufactured article (1) to be obtained, provided with a plurality of crosspieces (7) and a plurality of anchoring elements (10) arranged to engage, in a fixed way, the plate-like element (2), the ribs (3), and the plate-like element respectively.

10. Reinforced concrete box-like manufactured article according to claim 9, characterized by the fact said strong structure (5a) is carried out by an electro-welded lathing.

11. Reinforced concrete box-like manufactured article according to claim 9, characterized by the fact said strong structure (5a) is made of a plurality of metal or plastic elements stiffly connected to one another.

12. Reinforced concrete box-like manufactured article according to claim 9, characterized by the fact said strong structure (5a) is covered by a covering membrane (6) provided for waterproofing said strong structure.

13. Reinforced concrete box-like manufactured article according to claim 9, characterized by the fact said covering membrane is made of a thermo-retractable material.



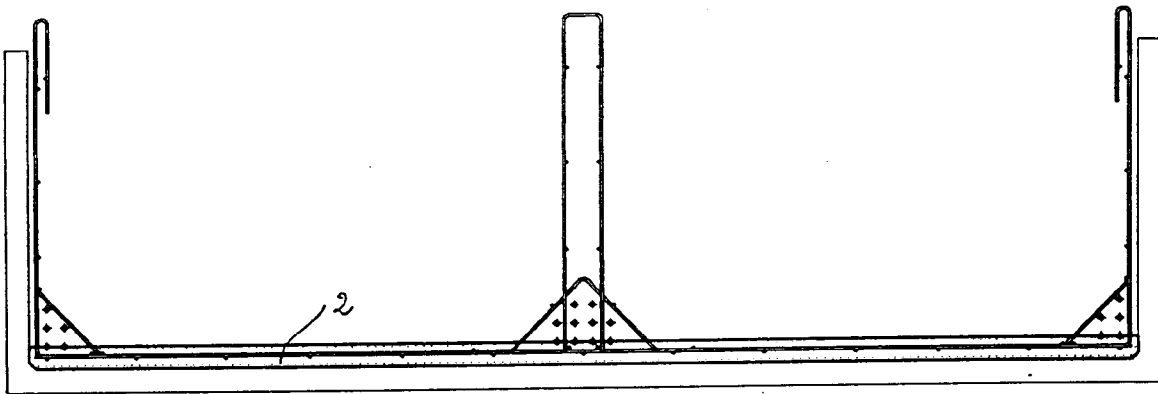


FIG. 2

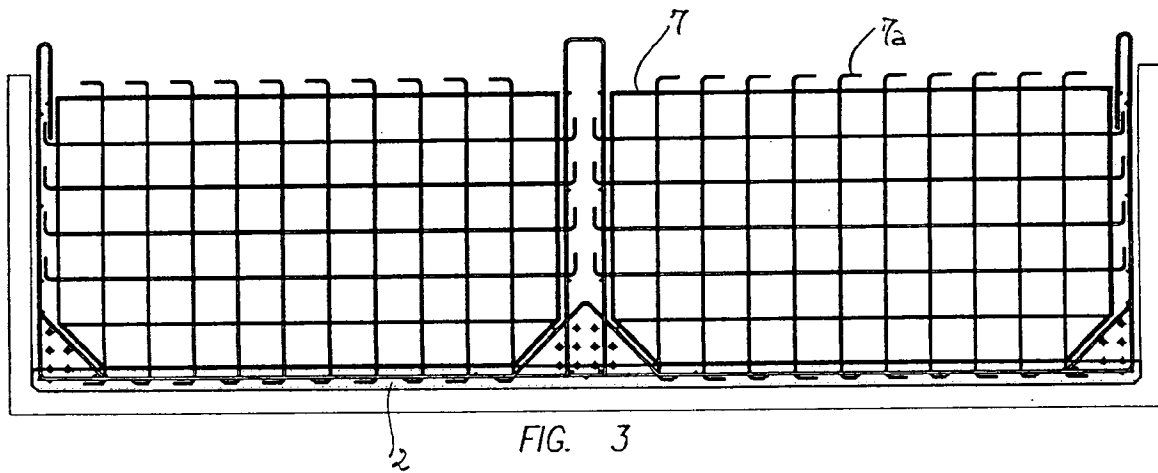


FIG. 3

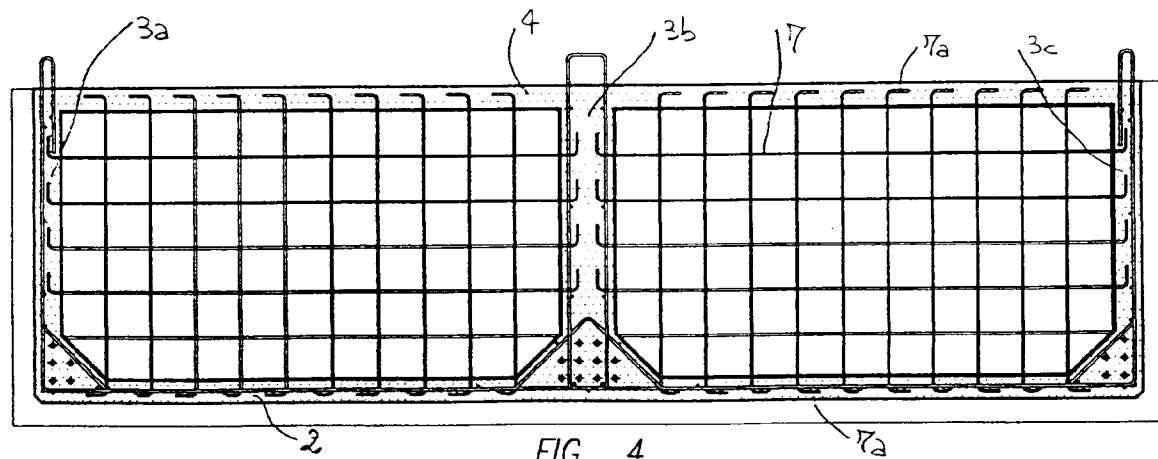
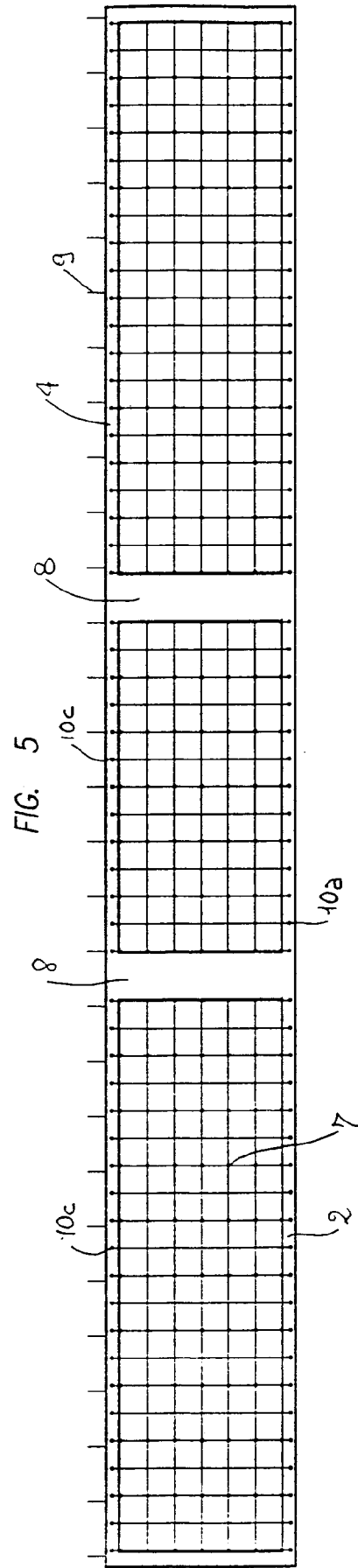


FIG. 4



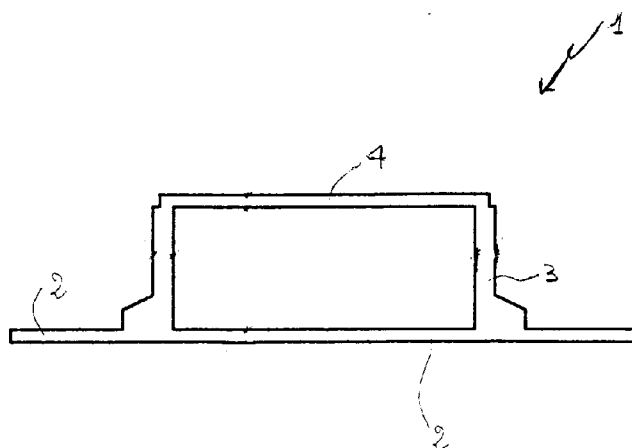


FIG. 6

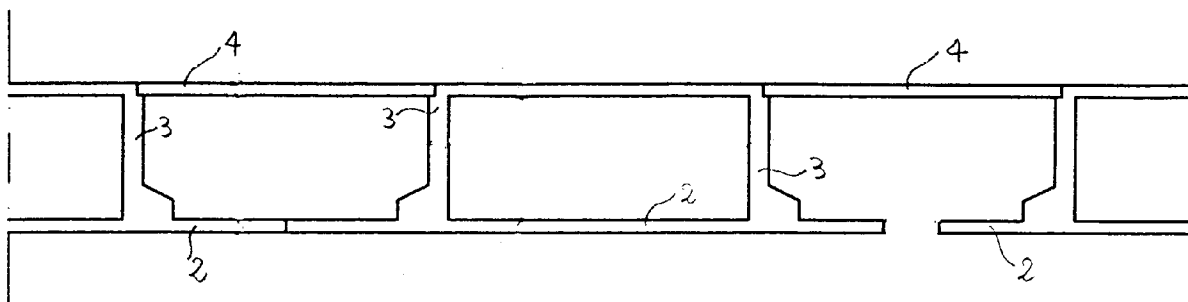


FIG. 7



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0503

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.6)
Y	US-A-4 372 906 (J. L. DEL VALLE) * the whole document * ---	1-13	B28B7/22 B28B19/00
Y	EP-A-0 299 226 (PECA-VERBUNDECHNIK GMBH) * the whole document , in particular column 1 , line 23 - column 1 , line 29 * ---	1-13	
A	FR-A-2 022 380 (ROBINSON BUILDING TECHNIQUES LIMITED) * the whole document * ---	1-7,9,12	
A	DE-A-34 36 690 (H. CARL) * the whole document * ---	1-13	
A	DE-U-87 09 148 (H. HIENDL) * the whole document , in particular page 1 , line 3 - page 1 , line 9 * ---	1-13	
A	DE-A-18 11 186 (H. SCHMIDT) * the whole document * ---	1-3,5-7, 9,12	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	FR-A-2 673 437 (B. - P. VARENNE) * the whole document * -----	1-13	B28B E04G E04B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 February 1995	Examiner Gourier, P
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			

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