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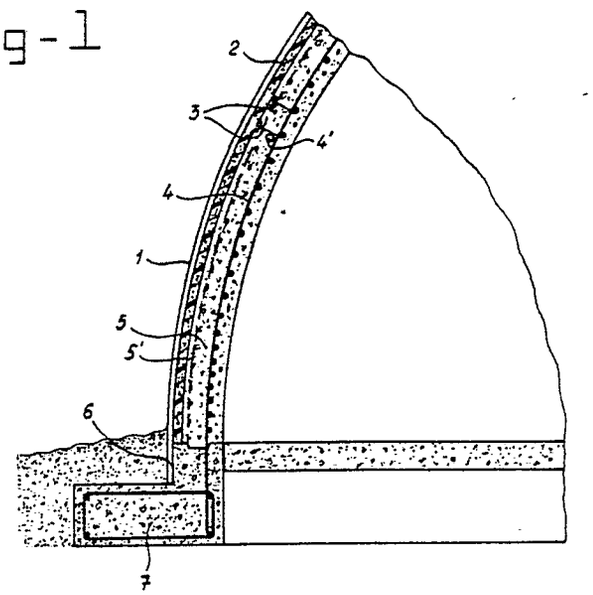
(54) Method for manufacturing a building structure.

(57) Method of manufacturing a building structure by spraying synthetic foam and concrete against the innerside of an inflated form with anchors for reinforcing rods attached to the foam layer which attachment of the anchors takes place by provinding the anchors with parts which can be inserted into the completed foam layer whilst the application of the concrete layers, which takes place layer by layer, is performed in such a way that at least one layer is applied over the basis of the anchors prior to attaching the reinforcing rods of the concrete to said anchors.

fig-1



EP 0 357 151 A2

Method of manufacturing a building structure.

The invention relates to a method of manufacturing a building structure in which an inflatable form which has been provided with an entrance lock is mounted in an air-tight manner on a base or foundation which form by means of suitable devices is inflated and after having obtained its correct shape by inflation a foam resin layer is sprayed upon the innerside of the form on which layer plate shaped feet are placed and attached of inwardly directed anchoring rods to which reinforcing rods are attached after spraying a first layer concrete upon the form layer.

A method of this kind is known from US-A-4.155.967.

According to set known method the foam layer is applied layer by layer and the foot plates of the anchors are attached by means of adhesive to the first foam layer. This attachment is insufficient. Many anchors fall down under the influence of the forces which occur during spraying. Even after surrounding the anchor feet by the next foam layer applied over said feet said anchors are not capable to take up the loads which occur during attachment of the reinforcing rods and during spraying of the concrete.

Purpose of the invention is to provide a method by means of which the progress of the work is not disturbed by anchors which do not maintain their proper position.

According to the invention this purpose is achieved in that primarily the foam resin layer is manufactured until its final required thickness is obtained, that only thereafter the anchor rods are placed and fixed to the foam layer by inserting bent portions of the plate shaped feet and that the first concrete layer is sprayed over the feet of said anchors which lie against the innerside of the foam layer.

By the fact that the foam layer has obtained its final thickness prior to mounting the anchors it is possible to insert the bent over parts of the feet of the anchors into the foam layer. Due to this the anchors are already more rigidly attached.

By the fact that moreover the first concrete layer is sprayed over said feet and covers said feet, a hard layer is obtained which holds the anchors in a manner such that they can no longer loosen and are capable to carry the weight of the reinforcing rods and are capable to withstand the forces which occur during spraying of the concrete on the anchors and reinforcing rods, including the weight of not yet completely hardened concrete parts.

Preferably the reinforcing is one which at least in horizontal planes is pretensionable. This is made possible by the rigid attachment of the anchors.

From US-A-4.155.967 mentioned above it is known for the manufacturing of window frames and the like to place frames which are attached by the spraying of the concrete layer. This however has the result that the window frames have to been cleaned as far as this is possible at all whereas corrections of the position, necessary in case the frame is displaced by the spraying forces is not possible.

According to the invention temporary frames are placed and they are placed upon the finished foam layer which frames after being fixed by the concrete layer are removed as well as the foam layer and part of the form at the location of said frames, which frames then are replaced by the final window frames.

In some cases the form can be replaced by a special covering layer or coating. The form can be removed and used elsewhere. This will do as well for the fans or the like because the building structure need not to be maintained anymore in the blown up position. This only is necessary during the manufacturing process during which however the pressure to be delivered by the fan has to be higher than is usual for blown halls.

Spraying of the resin can be performed such that the entire innerside of the form is covered so that a building structure is already obtained from resin such as a resin dome.

It is also possible to spray part of the height with resin and to start spraying the concrete already whilst the spraying of the resin proceeds upwardly towards the top.

Mounting of the reinforcing rods can take place such that the reinforcing is completed first prior to applying the further concrete layers. One however can also perform the work in such a way that said concrete layers are applied after mounting part of the reinforcement in which case the mounting of the reinforcing rods proceeds upwardly followed by the application of the concrete, which application of the concrete of course starts at the basis.

The synthetic form can remain in place of be removed respectively. For performing the work use can be made of a movable platform lifting device having at the outer end of a swingable and extendable arm a work platform from which any position inside the blown form can be reached with spraying devices.

With the invention it is possible to manufacture building structures of preferably dome shaped configuration in a simple manner. They can have a circular basis and be part spherical. They however may have as well an oval basis or even a rectangu-

lar basis.

The invention concerns as well an anchor for applying the method according to the invention which anchor as known from US-A-4.155.967 has a perforated footplate to which a rod is attached which anchor according to the invention may have tongues which are cut free from the plate and bent into a position perpendicular to the plane of the plate and turned away from the rod.

Said anchor has a shape such that it can be inserted with said tongues into the foam layer.

The invention will be further illustrated with reference to the drawings.

Figure 1 shows part of a building structure according to the invention.

Figure 2 shows a possible embodiment of the anchor.

Figures 3a to f inclusive show different phases of the method according to the invention.

The building structure which can be obtained with the invention has a form 1 which by blowing is brought into the proper shape and is made from plastic. Against the innerside a foam synthetic layer 2 is applied by spraying. The anchors 3 are fixed upon said layer and reinforcing rods 4 are attached to said anchors. For mounting the anchors use can be made of an auxiliary reinforcement 4′ such as rods which support the anchors for and during performing further operations. The space around said reinforcing rods which is defined outwardly by the foam synthetic layer 2 is filled with concrete 5 by spraying. Prior to building the concrete layer 5 layer by layer a first layer 5′ is sprayed over the feet 8 of the anchors. The plastic form 1 is connected in an air-tight manner at 6 to a prefabricated foundation 7.

The anchors may have the form shown in figure 2 comprising a perforated footplate 8 having bent over tongues 9, which can be pressed into the foam synthetic layer 2 and with an outwardly extending rod or arm 10 serve for connecting to them the reinforcing rods. By applying the first concrete layer 5′ said anchors are well held in place sufficiently to carry the reinforcing rods.

Figure 3 showns in figure 3a diagrammatically a part of an annular foundation 7 which has to be provided.

Figure 3b shows the application of the form 1 in the not yet inflated condition.

Figure 3c shows the inflation by means of fans 11. The inflated hall is provided with an air lock 12 known in itself.

Figure 3d shows the inflated hall in a cut-open way. Present in the hall is a working device 13 having a working platform 14 by means of which through a supply conduite 15 synthetic foam, such as polyurethane can be supplied by the schematically shown device 16 and sprayed upon the inner-side of the inflated form 1.

Figure 3e shows the mouting of horizontal annular reinforcing rods as well as reinforcing rods extending in vertical planes, after which, as shown in figure 3f, by means of the device 13 concrete 5′ and 5 respectively can be sprayed.

The hall obtained finally no longer needs the fans and entrance lock respectively.

In case windows are needed auxiliary frames can be placed with the aid of anchors upon the synthetic foam layer 3 as schematically indicated at 17 in figure 3d. After completing the building structure, which means after hardening of the concrete, which concrete surrounds the auxiliary frames, the plastic layer of the form and the foam layer can be cut away and a real window frame with or without glass can be placed in the opening obtained therewith.

Claims

1. Method for manufacturing a building structure in which an inflatable form which has been provided with an entrance lock is mounted in an air-tight manner on a base or foundation which form by means of suitable devices is inflated and after having obtained its correct shape by inflation a foam resin layer is sprayed upon the innerside of the form on which layer plate shaped feet are placed and attached of inwardly directed anchoring rods to which reinforcing rods are attached after spraying a first layer concrete upon the foam layer characterized in that primarily the foam resin layer is manufactured until its final required thickness is obtained, that only thereafter the anchor rods are placed and fixed to the foam layer by inserting of bent portions of the plate shaped feet and that the first concrete layer is sprayed over the feet of said anchors which lie against the innerside of the foam layer.

2. Method according to claim 1, characterized in that the reinforcement at least in horizontal planes is a pre-tensionable reinforcement.

3. Method according to claim 1 or 2 in which for the manufacturing of window frames and the like frames are placed which are fixed by the spraying of the concrete layer, characterized in that the frames are temporary frames of which form and dimension correspond to the form and dimension of the final window frames, which frames are placed upon the foam layer and after the application of the concrete, form material and foam are removed at the location of the frames and said frames are removed and replaced by the final window frames.

4. Anchor for use in the method according to one of more of the preceding claims comprising a

perforated foot plate to which a rod is attached, characterized in that said plate has tongues which are cut free from the plate and bent over into a position perpendicular to the plane of the plate.

Fig - 1

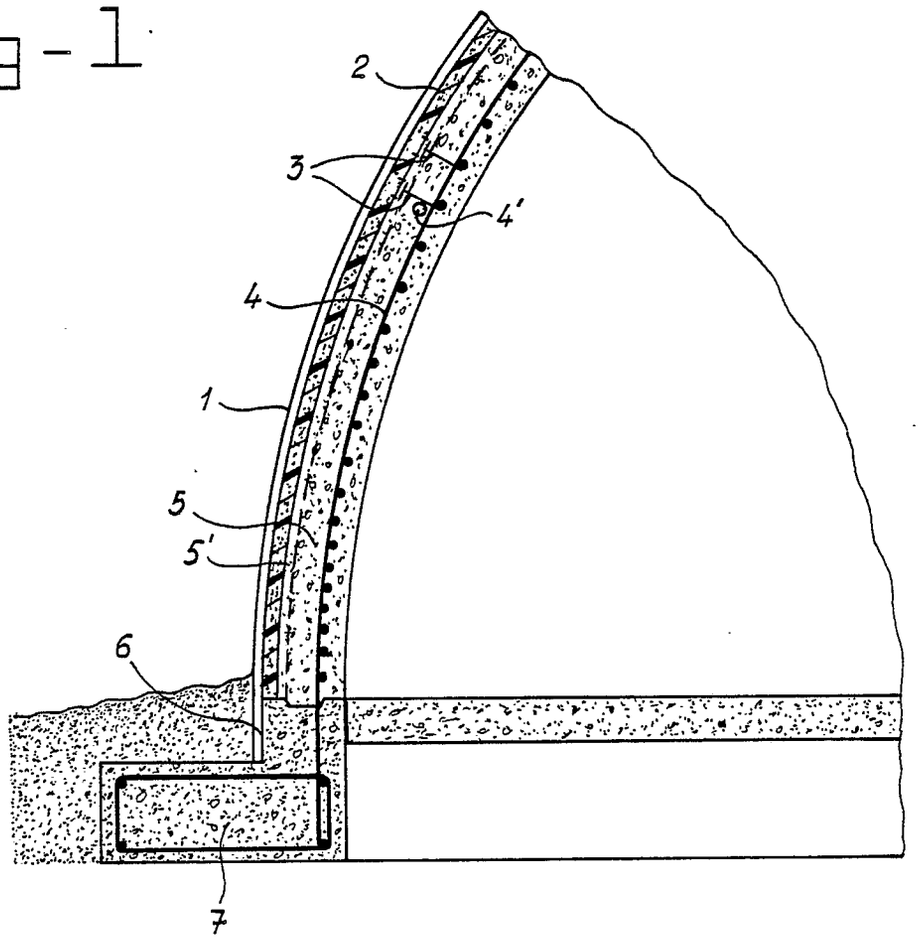


Fig-2

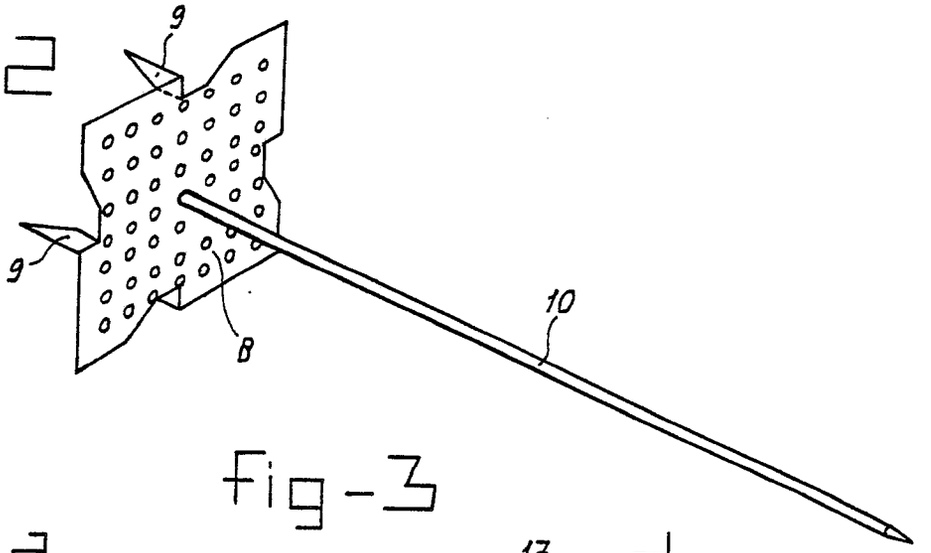
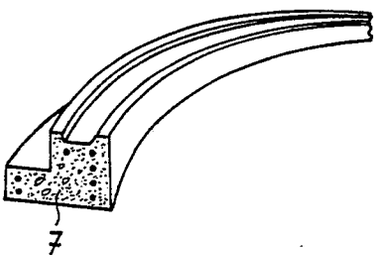
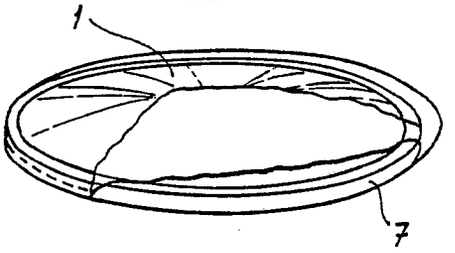


Fig-3

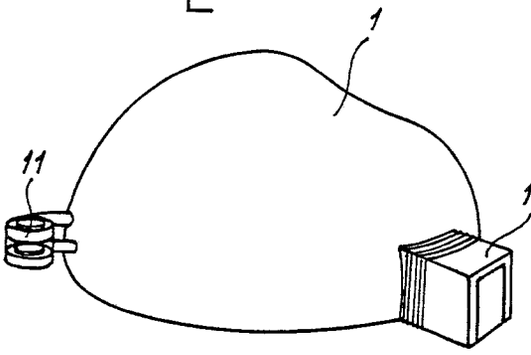
a



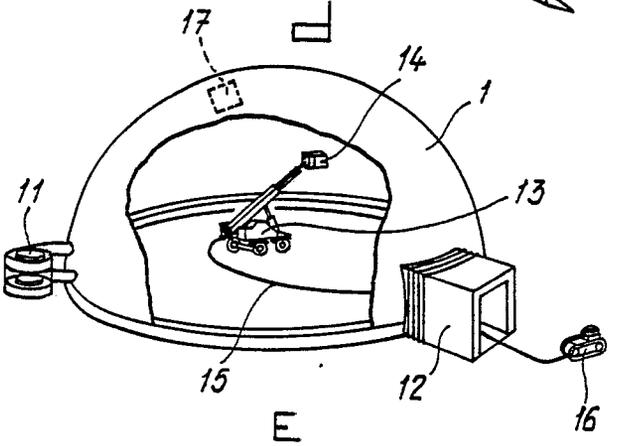
b



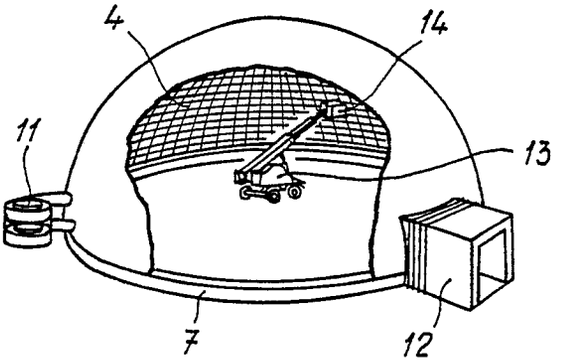
c



d



e



f