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(54) IMPROVEMENTS IN AND RELATING TO AN INFLATABLE STRUCTURE FOR THE CONSTRUCTION OF HOUSES OR SIMILAR BUILDINGS

(71) We, BUBBLE SYSTEM SA, a Swiss body corporate, having a place of business at Bern, Switzerland, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:-

The invention concerns an inflatable and supporting former for the construction of houses or similar buildings.

In construction houses or similar buildings framings are used for the concrete. Different types of framings are known for casting concrete.

A particular method of construction consists in the utilization of the spraying of settable materials such as cement, plaster or concrete onto a supporting former to form the walls and the roof of the house or the building to be constructed. It has been proposed to use as supporting former for this method an inflatable former, that means a kind of envelope anchored to the ground on which the materials used for the construction are sprayed. The anchoring of the inflatable former constitutes however a big disadvantage and limits the mobility and use of this method of constructing.

The object of the present invention is to provide for the construction of houses or similar buildings an inflatable and supporting former which does not have the disadvantages of the known formers of the same type and which constitutes a stable former which does not require any anchoring to the ground and which is therefore very versatile in its utilization.

According to the invention there is provided an inflatable and supporting former structure for constructing houses or similar buildings comprising an upper membrane and a lower membrane hermetically sealed to one another so as to form a first chamber forming an inflatable envelope, a second inflatable chamber fixed to the base of said first chamber forming a common wall therewith, the upper membrane and at least a part of the lower membrane forming exterior surfaces of the structure, said chambers being formed of a material enabling their utilization as a support in the construction of houses or similar buildings of settable material such as concrete, and wherein in use said first chamber is inflated to a pressure lower than that of said second chamber.

According to a preferred embodiment of the invention said upper and inner membranes may have a substantially circular shape and said second pressure chamber may have the form of a circular hose having a circular cross-section. The shape of the membranes may be triangular, quadrilateral or polygonal. The second pressure chamber may have an annular shape similar to the shape of the first pressure chamber.

The invention will now be described with reference to the accompanying drawing representing a cross-section a preferred embodiment of the inflatable and supporting former according to the invention.

In the drawing an inflatable and supporting former structure 10 comprises an upper membrane 12 and a lower membrane 14 which are hermetically sealed to one another to form a first pressure chamber 16. Means are provided to inflate said first pressure chamber 16 and to maintain it at the desired pressure.

A second pressure chamber 18 is fixed to said first pressure chamber 16. Means are also provided to inflate said second pressure chamber 18 and to maintain it at the desired pressure. The second pressure chamber is arranged at the base of said first pressure chamber 16 and supports the same at its periphery. To this effect the upper membrane 12 is connected to said second pressure chamber along a peripheral zone or line

20 and the inner membrane 14 is connected to said second pressure chamber 18 along a peripheral zone or line 22. The upper membrane 12 and the lower membrane 14 within the line 22 form exterior surfaces of the structure.

The particular form of the pressure chambers 16 and 18 depends on the particular utilization thereof and does not form a decisive feature of the invention, but it is selected as a function of the construction to be realized and besides circular and oblong shapes, the membranes may be polygonal for example.

The material utilized for preparing the pressure chambers is not critical. It is sufficient that in constructing houses or similar buildings by using the spraying of settable materials such as cement, plaster or concrete that the membranes resist the impact of these materials, may support the load created by their accumulation on the structure and may be easily separated from said materials after setting.

The pressure chambers may be fixed to one another by methods such as bonding, depending on the materials utilized for preparing the inflatable and supporting structure.

When constructing houses or similar buildings by using the inflatable and supporting former structure according to the invention, this structure is placed on the ground 24. The first pressure chamber 16 is then inflated to the desired pressure as is also the second pressure chamber 18. The first pressure chamber 16 is inflated to the pressure P1 and the second pressure chamber 18 is inflated to the pressure P2. The pressure P2 is always higher than pressure P1. The pressure P2 in the second pressure chamber 18 acts against the pressure P1 in the first chamber and enables the utilization of the inflatable and supporting former structure according to the invention without special anchoring to the ground. Thus the desired total mobility and liberty of action are obtained.

The inflatable structures having a single pressure chamber require anchoring on the ground due to their tendency to float on the ground. The addition of a second pressure chamber at the base of the first pressure chamber creates through the cooperation of both pressure chambers inflated to different pressures stabilizes the structure on the ground and so avoids the necessity of anchoring the structure on the ground during utilization. The stabilizing effect is amplified if the fixing line or zone 20 of the upper membrane 12 to the second pressure chamber 18 is located at a certain distance from the fixing line or zone 22 of the inner membrane 14 to the second pressure chamber (the chamber forming a common wall between the zones 20 and 22) and if the dimension of the upper membrane between its fixing lines or zones 20 with the second pressure chamber 18 is larger than the dimension of the inner membrane 14 between its fixing lines or zones 22 with the second pressure chamber 18.

In the preferred embodiment of the inflatable and supporting structure according to the invention the upper and inner membranes 12, 14 have a substantially circular shape. The second pressure chamber 18 has the shape of a circular hose having a circular cross-section.

In another preferred embodiment of the invention the inflatable and supporting structure consists of a first elongated chamber 16 oblong in plan under which a second chamber having a corresponding plan form is faced so that this structure may be used to construct a tunnel.

The upper and inner membranes 12, 14 forming the first pressure chamber 16 may also have a substantially triangular, quadrilateral or polygonal shape, the second pressure chamber 18 having then the shape of a similar ring at the periphery of the first pressure chamber 16.

In summary, the shape of the first pressure chamber 16 and of the second pressure chamber 18 is not critical. A settable material such as a mixture of water and cement, plaster, and/or concrete is sprayed onto the supporting structure (obtained by inflating the pressure chambers to different pressures) until a layer of desired thickness is obtained. The layer so obtained is allowed to dry and the pressure chamber 16 and 18 of the inflatable and supporting structure are deflated after hardening and the structure is removed. Depending on the supporting structure which has been utilized, a structure, of Portland cement, plaster and/or concrete is obtained forming the roof and the walls of the house, when an inflatable and supporting structure having a circular, triangular, quadrilateral or polygonal shape is used, or a tunnel, when an oblong inflatable and supporting structure is used. So, many structural shapes may be obtained using an inflatable and supporting structure according to the invention having an appropriate shape.

It is obvious that shutter means may be used on the inflatable structures where openings are desired in the building for windows, doors, ventilation or for grouping different rooms of a housing in order to avoid the layer of cement, plaster, etc. being is formed on these places. These shutter means may be the frames of doors and windows which, after hardening of the sprayed layer, remain in the layer and are anchored therein. When constructing a house having several rooms, the same inflat-

able structure may be used for all rooms, or depending on the size and shape of the rooms, different structures may be used. The finished houses and buildings may be covered by means of soil to which a binder has been added; this forms a good insulation of the housing and adapts it to the enviroment.

The pressures utilized in both pressure chambers 16 and 18 are not critical but the second pressure chamber 18 must always be inflated to a higher pressure than the first pressure chamber 16. The absolute value of the pressures used depends on the size of the pressure chambers 16 and 18 of the inflatable structure, the construction materials sprayed on the structure to construct a house, the amount of water which has been used, the thickness of the sprayed layer, etc. These values can be easily determined by tests. It has been found that for example a pressure of 500 kg/m^2 in the first pressure chamber 16 and 2500 kg/m^2 in the second pressure chamber 18 are satisfactory for a circular structure having a diameter of 7.5 meters when concrete is sprayed.

Although the invention has been shown and described with respect to a preferred embodiment thereof, it should be understood by those skilled in the art that various changes and omissions in the form and details thereof may be made therein without departing from the scope of the invention as defined in the apppended claims.

WHAT WE CLAIM IS:-

1. An inflatable and supporting former structure for constructing houses or similar buildings comprising an upper membrane and a lower membrane hermetically sealed to one another so as to form a first chamber forming an inflatable envelope, a second inflatable chamber fixed to the base of said first chamber forming a common wall therewith, the upper membrane and at least a part of the lower membrane forming exterior surfaces of the structure, said chambers being formed of a material enabling their utilization as a support in the construction of houses or similar buildings of settable material such as concrete, and wherein in use said first chamber is inflated to a pressure lower than that of said second chamber.

2. A structure according to claim 1 wherein said upper membrane is hermetically sealed to said second chamber and said lower membrane is hermetically sealed to said second chamber so as to form said first chamber.

3. A structure according to claim 1 or claim 2, wherein said upper membrane is fixed to said second pressure chamber along a first fixing line or zone, said lower membrane is fixed to said second pressure chamber along a second fixing line or zone located at a predetermined distance from said first fixing line or zone and wherein the area of said upper membrane between its fixing lines or zones is larger than the area of said lower membrane between its fixing lines or zones.

4. A structure according to claim 1 or claim 2, wherein said second pressure chamber is annulus shaped and fixed to the periphery of said first pressure chamber.

5. A structure according to anyone of the claims 1 to 4, wherein said first pressure chamber is substantially circular in plan and that said second pressure chamber is formed of a pipe having a circular cross-section.

6. A structure according to anyone of the claims 1 to 4, wherein said first pressure chamber is oblong in plan.

7. A structure according to anyone of the claims 1 to 4, wherein said upper and inner membranes are triangular, quadrilateral and polygonal shape.

8. A structure according to anyone of the claims 1 to 7, wherein said second pressure chamber is arranged under said first pressure chamber.

9. An inflatable and supporting structure for constructing houses or similar buildings substantially as hereinbefore described with references to and as illustrated in the accompanying drawings.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*