CONCENTRIC CHAMBERED PRESTRESSED UNIT

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The invention relates to prestressed units either closed or formed with small apertures, such units forming, for example, caissons, containers, or tanks.

The invention also relates to the method of producing such units.

Conventional prestressing processes generally comprise tensioning the reinforcements by traction at their ends, or at intermediate points, and then prestressing by applying compressive agents disposed at intervals between their ends and acting perpendicularly to the reinforcements.

With such processes said elements are tensioned either individually—the elements being tensioned consecutively—or by separate zones. These processes are slow, require extensive equipment, and during prestressing they introduce compression variations and hence considerable heaving in the concrete, so that numerous precautions are required for the performance of the operations.

An object of this invention is to eliminate these drawbacks and enable the prestressing to be perfectly distributed in a single operation.

The invention provides a prestressed unit comprising a substantially closed concrete inner chamber, a plurality of metal reinforcements surrounding the chamber and spaced therefrom, means connected with the reinforcements for defining a fluid tight cavity substantially surrounding the inner chamber, and a product under pressure in the cavity.

The invention also provides a method of producing a prestressed unit, which comprises erecting a substantially closed concrete inner chamber, disposing a plurality of metal reinforcements around the chamber and spaced therefrom to define a cavity substantially surrounding the inner chamber, sealing the cavity and injecting a fluid under pressure into the fluid tight cavity.

The invention will now be described with reference to examples of embodiments illustrated by way of example in the accompanying drawings of which:

FIGURE 1 is a section of a substantially closed prestressed concrete unit in accordance with the invention;

FIGURE 2 is a section showing an alternative embodiment of the invention.

The prestressed concrete unit shown in FIGURE 1 consists essentially of two parts, the concrete inner chamber and a covering, and essentially by a network of stretchable steel reinforcements 3 and 4, said reinforcements being embedded in a thickness of concrete 2 which encloses a cavity 5 surrounding the inner chamber 1.

Such network of reinforcements could also be outside the thickness of concrete 2.

The inner chamber 1 and the outer covering 2 are separated by the continuous cavity 5, the thickness of the latter being substantially constant and small. Said cavity 5 is connected to a device 6 adapted to inject a fluid into the cavity and maintain it at a given pressure; such fluid may be an ordinary liquid or a setting liquid such, for example, as a cement-based injection slurry, or a polymerizable resin, a molten metal, or any other substance according to the conditions to be satisfied.

The injection of this pressure fluid into the intermediate cavity 5 compresses the inner chamber 1 and the network of reinforcements 3 and 4 is stretched. The concrete of the inner chamber can thus be prestressed and the rods or cables embedded in the outer thickness 2 or surrounding the latter can be stressed by the selection of an appropriate value for the injection pressure p.

The pressure p can be kept constant through the agency of a pump controlled by a manometer, or alternatively—if a suitable fluid is used—the unit can be maintained in a certain state of stress by causing the injected liquid to set. Shortly after the application of pressure a creep effect occurs in the concrete and occasionally in the steel, depending upon the stressing applied, and this effect partially cancels out the prestressing. It would therefore be advantageous generally to carry out the pre-stressing in two stages; a first stage during which the pressure is kept constant in the fluid filling the intermediate cavity 5 and during which the majority of the creep effect will occur, and a second stage during which the prestressing liquid is modified or replaced for setting, thus enabling the stresses to be determined exactly both in the inner chamber and in the tensed elements.

Known devices, for example, re-injectable valves, will enable the prestressing to be re-established by injection if desired.

The steel used for the prestressing may be the conventional form of hard steel wires, but may also be more simply in the form of mild or semi-mild steel as is generally used in reinforced concrete, and if these steel elements are embedded in the thickness 2 of concrete, the continuity of the tension between the steel elements can be ensured as in the case of reinforced concrete simply by adhesion and overlapping, which is not possible when pre-stressing cables or wires are used.

If a liquid under pressure is used to produce prestressing for a relatively long period, the cavity 5 must be tightly sealed and to this end said cavity will advantageously be made by metal sheets forming the outer surface of the inner chamber and the inner surface of the thickness 2, wedges being disposed between the two surfaces to maintain spacing.

The prestressed chamber 1 may have one or more apertures as shown in FIGURE 1.

The inner chamber 1 has a mouth 7 forming an aperture 8 opening through the thickness 2, and the cavity 5 is sealed by a gasket 9 of metal for example.

In some cases it may be advantageous to separate the inner space into two or more intermediate chambers, and this gives a number of intermediate cavities in which the pressures may be different or equal; an arrangement of this kind is shown in FIGURE 2, which shows an intermediate chamber 10 disposed between the inner chamber 11 and the thickness of the reinforced concrete 12.

Such an arrangement may prevent some stresses being transmitted from one chamber to the other, particularly if the prestressing in the intermediate cavity 13 is produced by means of a fluid under a constant pressure; abnormal forces occurring inside the inner chamber (abrupt variation in temperature or pressure) have no repercussions on the outer chambers. The cavity 13 may also be used for the circulation of a cooling fluid thermally insulating the covering 12 from the chamber 11.

The invention is naturally not limited to the above details of embodiment, which may be modified without departing from the scope of the invention.

What is claimed is:

1. A prestressed unit comprising a substantially closed concrete inner chamber, a plurality of metal reinforcements surrounding the chamber and spaced therefrom, a concrete shell covering said reinforcements and defining a cavity around the inner chamber, a fluid tight layer engaging said shell in the cavity and a product under permanent pressure in the cavity.

2. A prestressed unit comprising a substantially closed...
concrete inner chamber, a plurality of metal reinforcements embedded in an outer concrete shell surrounding the chamber and spaced therefrom to define a cavity around the chamber, a fluid tight layer engaging said concrete shell in the cavity and a product under permanent pressure in the cavity.

3. A prestressed unit comprising a substantially closed concrete inner chamber, a plurality of metal reinforcements embedded in a concrete shell surrounding the chamber and spaced therefrom to define a cavity around the chamber, a sheet metal surface in contact with the concrete shell in the cavity and a product under permanent pressure in the cavity.

4. A prestressed unit comprising a substantially closed concrete inner chamber, a plurality of metal reinforcements embedded in a concrete shell surrounding the chamber and spaced therefrom, and defining a cavity around the inner chamber, a fluid tight layer engaging said shell in the cavity at least one intermediate concentric chamber containing said inner chamber and within said shell to define a plurality of cavities around the inner chamber, and a product under permanent pressure in at least one of the concentric cavities.

5. A method of producing a prestressed unit, which comprises erecting a substantially closed concrete inner chamber, disposing a plurality of metal reinforcements in a concrete shell around the chamber and spaced therefrom to define a cavity substantially surrounding the inner chamber, mounting a fluid tight layer in the cavity engaging the shell, sealing the cavity and injecting a fluid under permanent pressure into the cavity.

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