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E. EDWIN ET AL
PROCESS FOR THE PRODUCTION OF TUBULAR
OBJECTS OF PRESTRESSED CONCRETE
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Fig. 1.

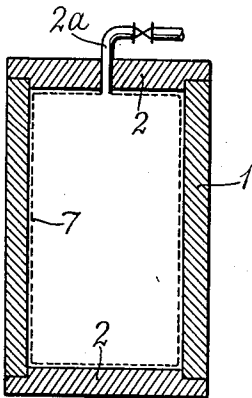


Fig. 2.

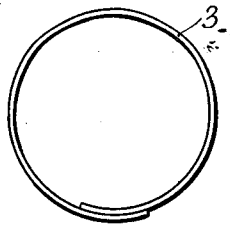


Fig. 2a.

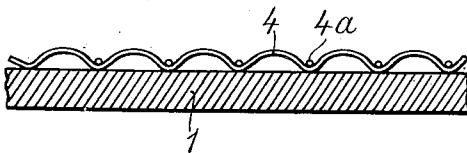
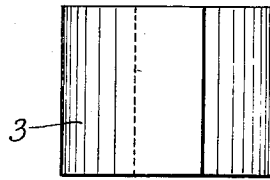
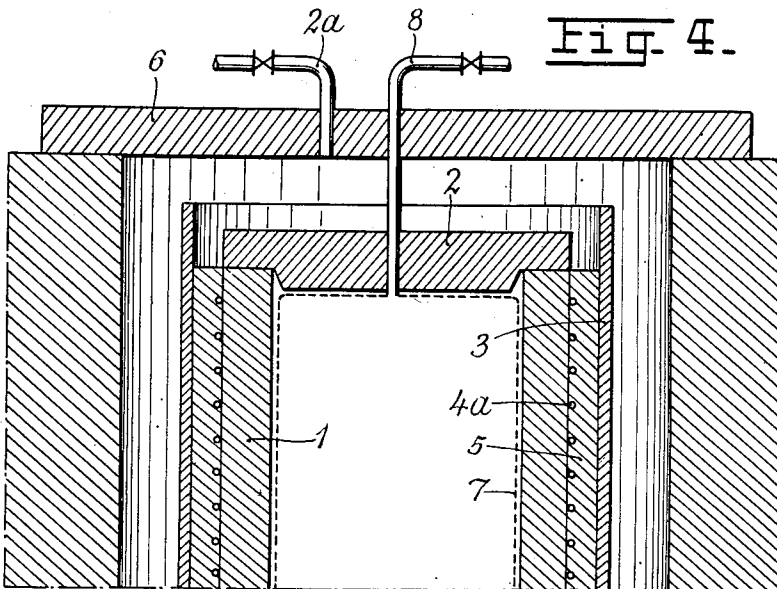


Fig. 3.

Fig. 4.



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PROCESS FOR THE PRODUCTION OF
TUBULAR OBJECTS OF PRESTRESSED
CONCRETE

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2 Claims. (Cl. 25—154)

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In the production of prestressed concrete, i. e. concrete to which by means of a highly prestressed reinforcement a certain internal compressive stress is imparted beforehand, one meets, when dealing with curved, for instance tubular objects, with considerable practical difficulties of construction. Especially in this kind of concrete a reinforcement of steel wire, as for instance hard drawn wire, piano wire and the like with an ultimate stress of up to 30,000 kg./cm.² is used and the product is then called "Stahl-seitenbeton" or in Swedish "strengbetong."

The present invention relates to the production of tubular objects, especially water conducting tubes, turbine-pipes and the like. The prestressing in the longitudinal direction of the tube is easily obtained by simply imparting the necessary prestress to the wire before casting the concrete round it. On the other hand the question as to the much more important peripheric transverse stress is rather more difficult to deal with. Here the peripheric reinforcement in the concrete cannot be given any prestress before casting. In such case a finished concrete tube had first to be cast and then the wire wound round it with high tension, but if the concrete were cast round the wound tube, then this part of the concrete would still be unstressed after hardening, while the tube first cast would be highly prestressed and receive the total tension of the wire. On account of shrinkage the exterior tube would probably be filled with fissures. Apart from the fact that a quick corrosion of the comparatively thin reinforcement in such tube must be taken into account, such a tube with a large stress difference between the outer and inner material would constitute a building element quite unfit for technical purposes.

Different arrangements have been proposed for producing prestressed tubes with homogeneous conditions, as regards stresses including those in which the prestress is obtained by means of pressure or in other manner, while the concrete is still in a semi-plastic or semi-solid condition. However, the present invention is based on the principle above named to provide a concrete tube unreinforced beforehand with a winding, and then by the special process characterising the invention to place an exterior concrete tube cast around the first one in such a way that after the hardening the tube as regards the stress condition becomes homogeneous and the prestress becomes the same in the exterior and the interior tube.

In the drawings:

Figure 1 shows a diametrical section through

a primary concrete tube and the means for applying outward radial pressure thereon. Fig. 2 shows a top plan view of a cylindrical casting mold plate for the outer or cast on concrete tube. Fig. 2a is a side elevation of the mold plate shown in Fig. 2. Fig. 3 shows an axial section of the primary tube with the reinforcing wires in position thereagainst. Fig. 4 shows the mold arrangements for imparting pressure to both the interior and the exterior of the composite molded concrete tube.

The drawing shows a mould arrangement for imparting pressure to both the interior and the exterior of the composite mould concrete tube. The finished cast primary concrete tube or core 1 which preferably is made of concrete of high quality is tightened in one way or another so that a certain inside pressure p_1 may be maintained. In the figure the tightening is obtained by placing a lid 2 on each end of the tube core, through the axis of which an inlet 2a for pressure water or pressure gas is found. This primary tube is now wound with a suitable reinforcement wire 4a in such a way that the tension in the wire during the winding is maintained constant substantially at its maximum (for piano wire up to 20,000 kg./cm.²). The diameter of the wire and the number of windings per meter are determined in such a way that a high peripheric compressive stress σ_1 for instance 150 kg./cm.² results in the primary concrete tube core 1.

The finished wound concrete primary tube 1 is then surrounded by a casting-mould, which preferably is made in a way to yield somewhat when subjected to pressure for instance by the overlapping of an elastic steel-plate 3.

The characteristic feature of the invention consists in, that before the exterior tube or covering 5 is cast around tube 1, the latter is subjected to the pressure p_1 above named from the inside. This pressure is regulated in such a manner that the stress σ_1 in the concrete be approximately 0, or in case a strongly shrinking concrete mass for the exterior tube is used, p_1 is chosen so high that σ_1 will be slightly negative, i. e. the tube 1 is subjected to a small peripheric tension corresponding to that engendered in the exterior tube after hardening. It is a matter of course that this peripheric tension must be less than the tensile strength of the concrete mass used. The inside pressure p_1 —and for this preferably water is used—may be applied directly, but it will be suitable to arrange a waterproof bag 7 inside the tube, so that the bag, when subjected to water pressure, will adhere tightly to the concrete wall. Hereby it can be prevented that water penetrates

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into the primary concrete tube and eventually presses the still unhardened concrete mass of the outer tube away from the tube core 1.

The exterior concrete mass or covering 5 is now cast into the mould provided by the exterior of the primary tube core 1 and the plate 3 by ramming or vibration and the hardening takes place in a natural way or is eventually accelerated by heating. Hereby the pressure p_1 is maintained constant. When the hardening is finished the pressure in the composite tube is released and a homogeneous stress of

$$\sigma_2 = \frac{\sigma_1 \cdot s_1}{s_1 + s_2}$$

where s_1 is the thickness of the tube, s_2 is the thickness of the tube 5 and σ_2 is the average peripheric stress in the composite tube in the finished state.

We claim:

1. A process for imparting peripheric, compressive prestress to a tubular object of concrete which comprises imparting compressive stress to a prehardened concrete tube by winding therearound a highly prestressed wire in direct contact with the concrete tube, casting around said wire-stressed tube a second tube of concrete and, during the hardening of said latter tube, subjecting the bore of the inner tube to a controlled, outwardly-directed pressure of a magnitude such that after hardening of the exterior tube and releasing the outwardly-directed pressure from the interior tube, each of the tubular elements of the composite tubular object will be under a peripheric compressive prestress which is substantially homogeneous throughout the composite wall of the tubular object.

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2. A process for imparting peripheric, compressive prestress to a tubular object of concrete which comprises imparting compressive stress to a prehardened concrete tube core by winding therearound a highly prestressed wire in direct contact with the concrete tube, casting around said wire-stressed tube core and in contact therewith a tube covering of concrete adhering to the core and subjecting and maintaining during the hardening of the covering, the bore of the inner tube core to a controlled, outwardly-directed pressure of a magnitude such that after hardening of the adhering exterior tube covering and subsequent releasing the outwardly-directed pressure from the interior tube core, each of the tubular elements will constitute in a free state an integral composite tubular object under a peripheric compressive prestress which is substantially homogeneous throughout the composite wall of the tubular object.

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