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MANUFACTURE OF HOLLOW ROUNDED ELEMENTS OF PRESTRESSED CONCRETE

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Fig. 1

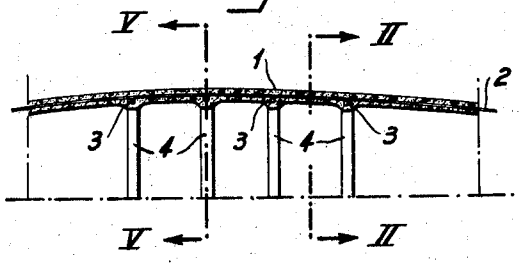


Fig. 2

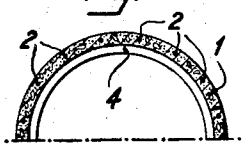


Fig. 3

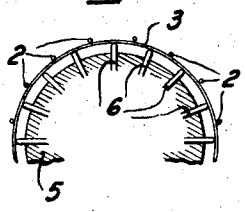


Fig. 4

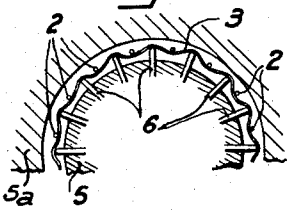


Fig. 5

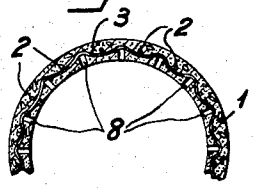


Fig. 6

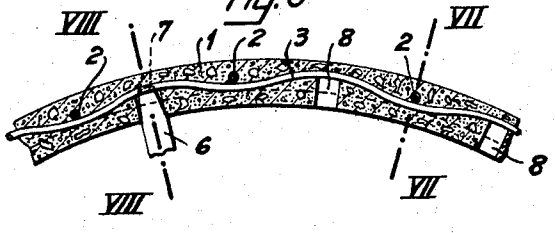


Fig. 7

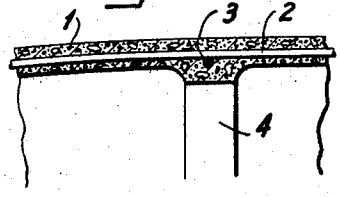
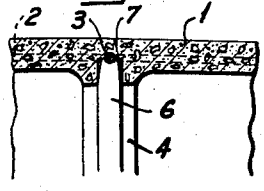


Fig. 8



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Fig. 9

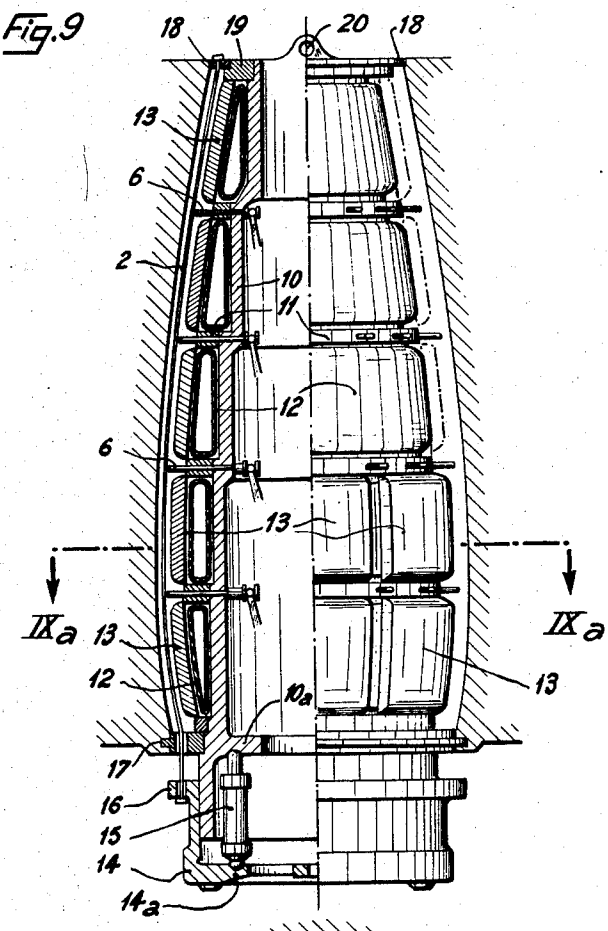
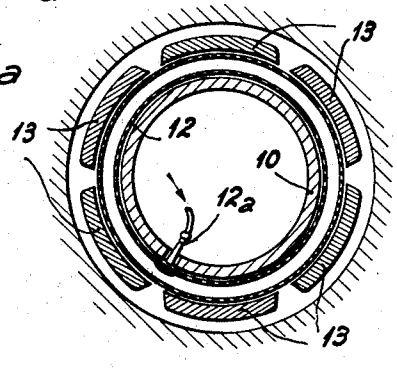


Fig. 9a



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Fig. 10

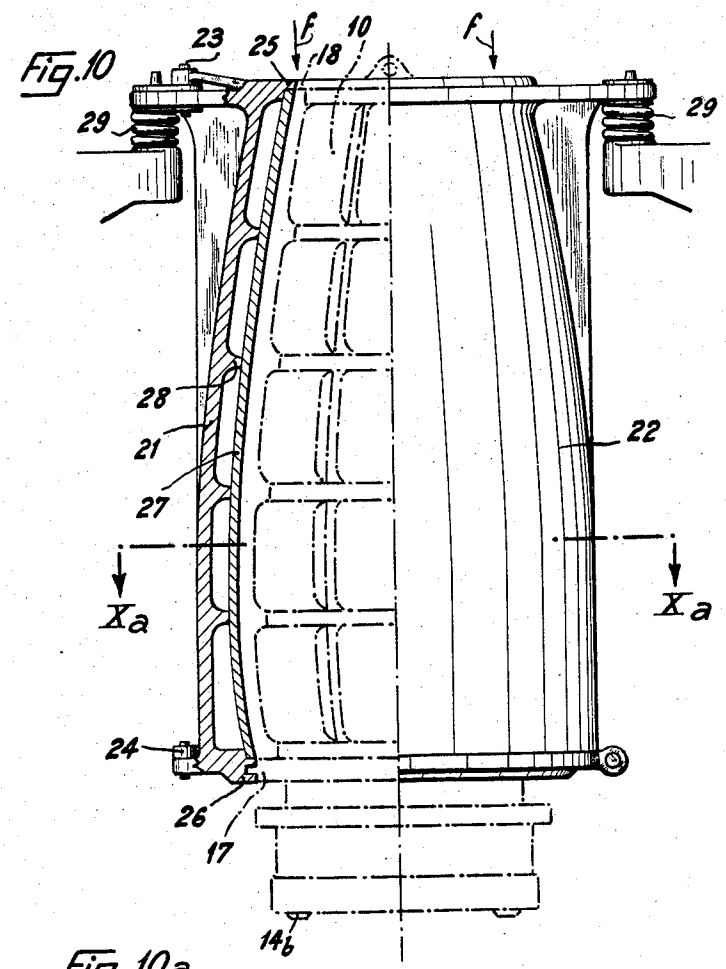
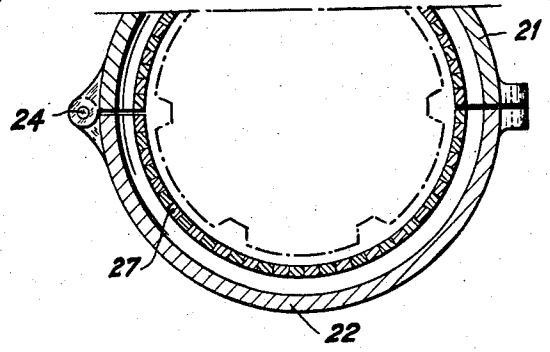


Fig. 10a



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Fig. 11

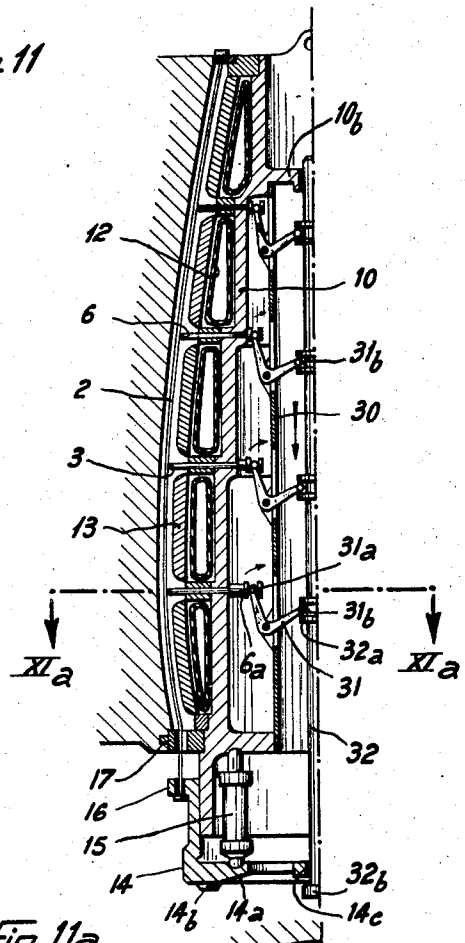
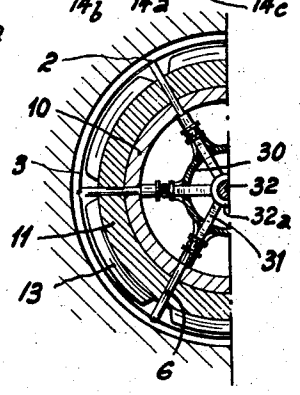


Fig. 11a



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MANUFACTURE OF HOLLOW ROUNDED ELEMENTS OF PRESTRESSED CONCRETE

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Application December 8, 1953, Serial No. 396,911

Claims priority, application France December 10, 1952

3 Claims. (Cl. 25—127)

The present invention relates to an improvement in the manufacture of hollow rounded elements of pre-stressed concrete, more particularly with a view to the application of pre-stressed concrete to the manufacture of aircraft parts such as hulls and fuselages.

According to the invention, in order to enable the reinforcements tensioned before the casting of the concrete, to follow the rounded profile of the element to be manufactured, two systems of reinforcements are provided, to one of which (called the main system in the present specification) the pre-stressing tension is directly applied, while the other (called the secondary system) is intended to provide for the first system points of support judiciously distributed in the element to be manufactured.

The reinforcements of the secondary system remain supported from the outside until the concrete has attained sufficient hardness. They are automatically placed under tension when the main system receives the pre-stressing tension, the value of their tension being greater in proportion as the rounding of the profile of the elements is more pronounced.

In an element of elongated form, such as a hull or fuselage of an aircraft, the main reinforcements are disposed longitudinally and the secondary reinforcements form transverse supporting frames for the reinforcements of the main system.

The invention further concerns an apparatus for the manufacture of elements of the aforesaid type, as also the said elements themselves.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a fragmentary longitudinal section through an aircraft hull;

Figure 2 is a section on the line II—II of Figure 1;

Figures 3 and 4 are diagrammatic views, taken in the plane V—V of Figure 1, showing the arrangement of the main and secondary reinforcements before and after the tensioning thereof;

Figure 5 is a section on the line V—V of Figure 1;

Figure 6 is a fragmentary view of a detail similar to Figure 5, on a larger scale;

Figure 7 is a section on the line VII—VII of Figure 6;

Figure 8 is a section on the line VIII—VIII of Figure 6;

Figure 9 is an elevational view, partly in section, of the core employed for the casting of the elements;

Figure 9*a* is a section on the line IX*a*—IX*a* of Figure 9;

Figure 10 is an elevational view, partly in section, of the mould corresponding to the core;

Figure 10*a* is a section on the line X*a*—X*a* of Figure 10;

Figure 11 is a sectional view of the core, showing a device for the removal of the supports of the secondary reinforcements, and

Figure 11*a* is a section on the line XI*a*—XI*a* of Figure 11.

In the embodiment illustrated in Figures 1 and 2, a hollow rounded element such as an aircraft element, for example a hull or fuselage of an aircraft, comprises a wall **1** of concrete (or similar material) provided on the one hand with main longitudinal reinforcements **2**, which in the present example are disposed regularly along the periphery of the hull, and on the other hand with secondary reinforcements **3**, which are here disposed in transverse ribs **4** on the hull and form supporting frames for the main reinforcements.

In order to construct a hollow body of this type, the main and secondary reinforcements of which are both pre-stressed, the following procedure may be followed (Figures 3 to 8):

A row of projections or pins **6** are radially distributed along the periphery of the core **5** at the position to be occupied by each rib **4**. The pins **6** are formed with notches **7** (Figure 6) in their ends to receive the secondary reinforcements **3**, which are disposed around the core **5** and attached at their ends. At the intervals of the pins **6**, the main reinforcements **2** (Figure 3) are disposed on the secondary reinforcements **3**.

The main reinforcements **2** are thereafter tensioned. Owing to the rounded form of the hollow-element to be produced, there are set up at the points of contact of the main and secondary reinforcements, radially directed reactions which produce a deformation as well as a tensioning of the secondary reinforcements, the latter supporting at the same time the reinforcements of the main system.

The core thus reinforced is covered by an outer mould **5***a* (Figure 4) and the casting of the concrete is then effected.

At the time of the stripping of the mould, the pins **6** are extracted, whereby a series of small holes **8** (Figure 5) is left in the rib **4**.

Figures 6, 7 and 8 show on a larger scale a hull section manufactured in the manner hereinbefore described.

Figures 9, 9*a*, 10, 10*a*, 11 and 11*a* show how the core, the mould and the various accessories thereof may be designed in order to construct an aircraft fuselage section of circular cross-section.

The hub (Figures 9 and 9*a*) comprises a central core of body **10** (consisting, for example, of cast iron or of assembled tubes or metal sections), on which are mounted rings **11**, formed in one or more parts, which guide the pins **6**. The latter also extend through the body **10** in which they are maintained by a suitable securing device, for example that hereinafter described with reference to Figure 11.

Rubber air chambers **12** provided with valves **12***a* are disposed between the rings **11**, and sectors **13** (produced, for example, on a lathe and then divided into sections) are placed on the chambers **12**.

The core **10** also has, on its lower part, a cover **14** which can be slid with the aid of jacks **15** bearing on the one hand on the end **14***a* of this cover and on the other hand on a flange **10***a* on the core.

The cover **14** is provided with a flange **16** permitting of attaching the main reinforcements **2**, a corresponding ring **17** on the core serving as a guide for the said reinforcements. The latter are attached at their other end to another ring **18** intended to form an integral part of the hull and supported by a ring **19** on the core **10**.

The core **10** comprises in addition an eye **20** to permit transport thereof.

When the reinforcements **2** and **3** have been positioned in the manner already described, the said reinforcements are tensioned by means of the jacks **15**, which are preferably of the hydraulic type, and which are held fast when the desired tension is attained.

It is to be noted that the assembly and tensioning

of the reinforcements take place on the core, independently of the mould, which permits of production in series and simultaneous preparation of any desired number of cores.

When prepared, the core can be transported, for example by means of a crane, towards the mould (Figures 10 and 10*a*).

This last mentioned mould consists of two half-shells **21** and **22** articulated together at **23** and **24** and adapted to fit on to rings **17** and **18** on the core by means of appropriate bearing surfaces **25** and **26**.

In the present example the shells **21** and **22** are internally lined with contiguous longitudinal bars **27** bearing on peripheral ribs **28**.

The mould and the core together are resiliently suspended at **29**. When the core has been positioned, the filling is effected, for example through the top as indicated by the arrows *f*, and the concrete is vibrated with the aid of an apparatus (not shown) attached at **14***b* to the cover **14** of the core. After filling, air under pressure is passed into the chambers **12** through pipes connected at **12***a* (Figure 9*a*).

When the concrete has set, the mould is opened and the core bearing the hull or other manufactured element is removed.

Figures 11 and 11*a* illustrate an example of a device for maintaining the pins **6** in position and extracting them from the hull in order to enable the core to be removed therefrom.

The body **10** of the core contains a tube **30** of large diameter which serves as a support for bell crank levers **31**, of which one end **31***a*, which is fork-shaped, engages in a groove **6***a* in the corresponding pin, while the other end **31***b* is disposed in a groove **32***a* in a central push rod **32**, which is adapted to be longitudinally locked by means not shown. The said push rod is guided at one end in an upper web **10***b* of the body **10** and in a hole **14***c* in the cover **14**, while it terminates at its lower end in a head **32***b*.

In order to extract the pins **6** when the main reinforcements **2** have been severed between the flange **16** and the ring **17**, and the push member released, it is sufficient to actuate the jacks **15** in order to force the cover **14** in the direction of the arrow. This cover then carries the push rod **32** with it, whereby the pins **6** are extracted.

From this instant, it is possible to remove the core from the hull. The central body **10**, the air chambers **12**, and the rings **11** are first removed, some of the said rings having been formed in a number of parts for this purpose, whereafter the sectors **13** are removed.

The manufactured hull comprises a number of circular ribs carrying the secondary reinforcements, and longitudinal ribs, due to the spaces existing between the sectors **13**. Consequently, an internal reinforcing system having rectangular projections is produced, which stiffens the wall of the hull.

What I claim is:

1. Apparatus for manufacturing hollow tubular elements of pre-stressed concrete having an arcuate shape both longitudinally and transversely and containing longitudinal reinforcements and transverse reinforcements, comprising in combination a mould, a core in said mould, the said core being provided with a plurality of series of circumferentially spaced radial holes in different transverse sections of said core, radial members slidably mounted in the said holes and adapted to support the said transverse reinforcements, a push-rod slidably mounted longitudinally in the said core and bell-crank levers pivoted on said core and engaging said push-rod and said radial members respectively, for displacing said radial members, means for supporting said longitudinal reinforcements between said core and mould in regular distribution along the periphery of said core, and means for tensioning the said transverse reinforcements by a tensioning of the longitudinal reinforcements.

2. The combination of claim 1 wherein the said means for tensioning the longitudinal reinforcements comprise a cover slidably mounted at one end of said core and adapted to support the corresponding ends of the said longitudinal reinforcements, and jacks mounted between said cover and core whereby said cover may be displaced axially relatively to said core.

3. The combination of claim 2 wherein said push-rod is extended through said cover and provided with a head outside of said cover, said cover being adapted to act on the said head for displacing the said push-rod.

References Cited in the file of this patent

UNITED STATES PATENTS

1,103,270	Cronholm	July 14, 1914
1,431,565	Buente	Oct. 10, 1922
1,485,142	Mitchell	Feb. 26, 1924
1,499,762	Conradi	July 1, 1924
1,624,191	Venzie	Apr. 12, 1927
1,843,853	Underwood	Feb. 2, 1932
2,001,237	Bille	May 14, 1935
2,048,253	Freyssinet	July 21, 1936
2,165,671	Ward	July 11, 1939
2,170,188	Cobi	Aug. 22, 1939
2,196,874	Ruegg	Apr. 9, 1940
2,353,492	O'Connor	July 11, 1940
2,378,584	Schorer	June 19, 1945

FOREIGN PATENTS

468,550	Germany	Nov. 15, 1928
955,533	France	June 27, 1949
71,548	Netherlands	Jan. 15, 1953