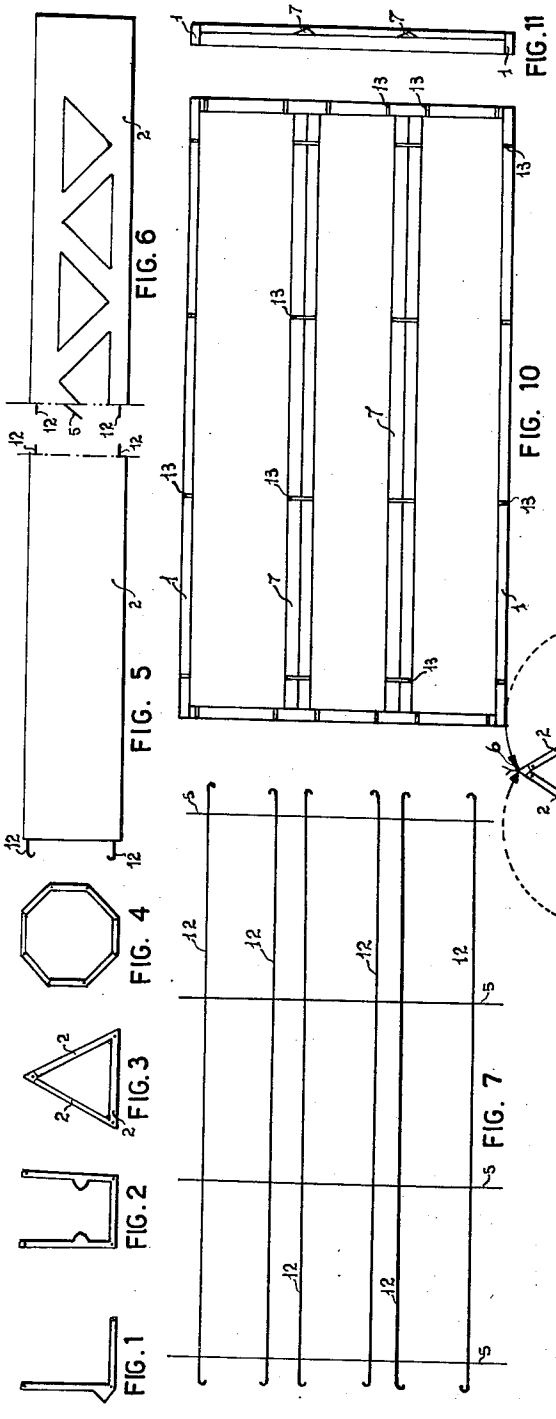
Feb. 19, 1952 F. ANTONELLO 2,586,413

PROCESS AND DEVICE FOR MAKING CONCRETE STRUCTURES

Filed June 7, 1947 2 SHEETS—SHEET 1

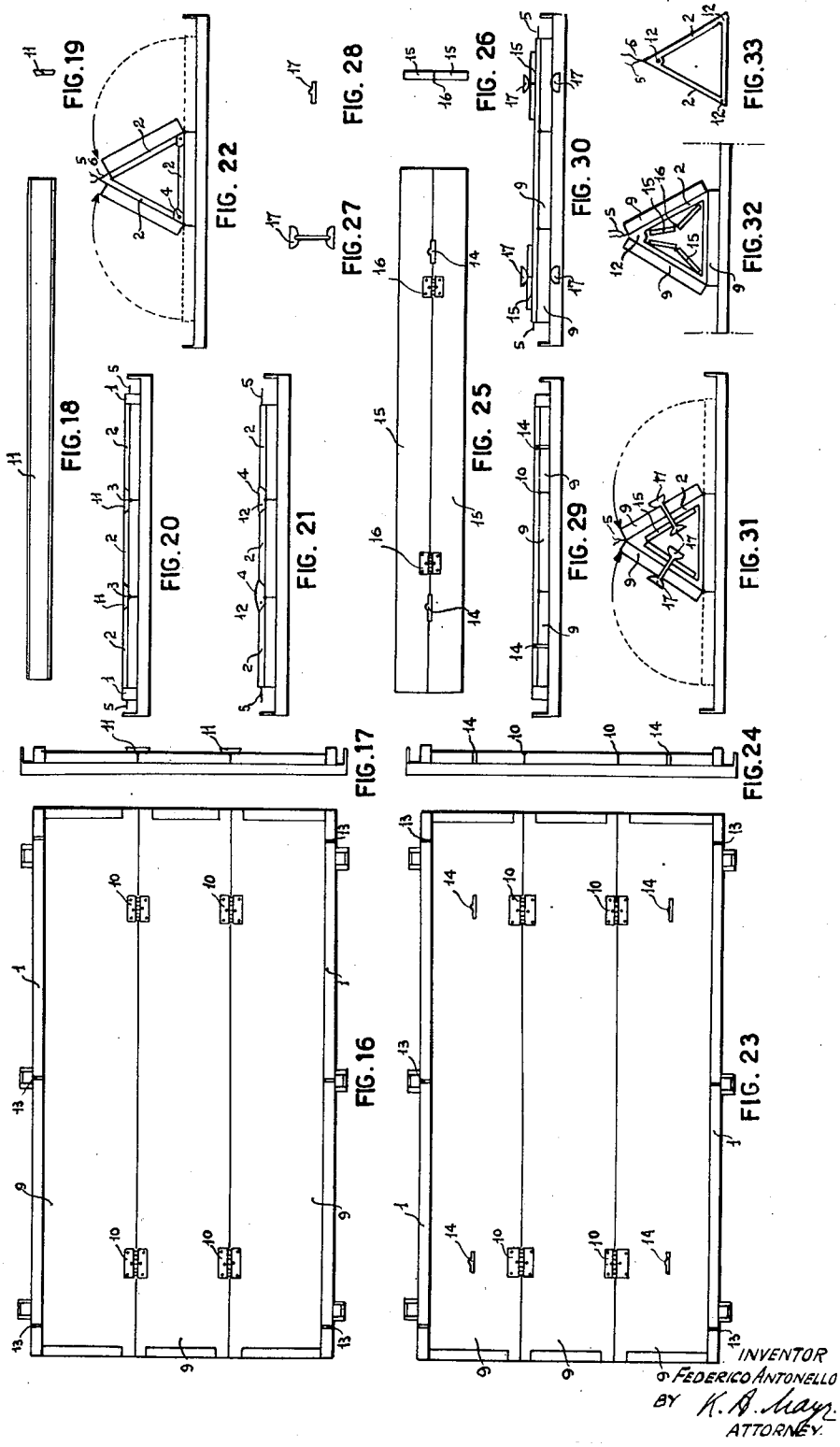


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PROCESS AND DEVICE FOR MAKING CONCRETE STRUCTURES

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PROCESS AND DEVICE FOR MAKING CONCRETE STRUCTURES

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For the construction of underground ways, prefabricated pillars, piles, beams for reinforced concrete floors, boards, wall elements and so forth constituted of tubular reinforced concrete structures with thin wall full or pierced or trellised and with transverse section substantially of the shape of a polygon, closed or open, it is generally necessary to employ drums which are so complicated that the use of same is rendered very difficult and expensive.

This invention relates to a proecss for the production of such articles consisting of reinforced concrete based upon the fact that such articles are constructed by placing firstly the concrete for the walls in a thin layer upon a level floor and after allowing to stand for a short time such walls are folded over one towards the other, then cement paste is used to seal along the corners formed by the folding; or else using suitable moulds and counter-moulds, by placing the concrete in a thin layer upon a surface without discontinuity for the whole development of the walls of the product and then by proceeding rapidly with the packing in such manner as to obtain a monolithic product which in correspondence with the edges offers no discontinuity for soldering.

Figs. 1, 2, 3, 4 show a few sections of products obtainable with the present invention.

Figs. 5 and 6 show two types of faces one flat, one with trellis.

Fig. 7 shows the metallic armouring arranged flat.

Figs. 8 and 9 represent one of the methods of procedure.

Figs. 10 and 11 repersent in plan and in section, a flat mould.

Fig. 12 shows the casting in the said mould.

Fig. 13 shows the casting reversed upon a support capable of deformation.

Figs. 14 and 15 show respectively a mould partly folded and its method of use.

Figs. 16 and 17 represent a plan and a side view of a mould in unfolded position.

Figs. 18 and 19 show in plan and in section a fillet for obtaining the groove (channel).

Figs. 20–21–22 show the method of using such a mould.

Figs. 23 and 24 show in plan and in section another type of mould.

Figs. 25 and 26 show in plan and in section a "holding-up tool."

Figs. 27 and 28 are two views of a clamping means for connecting envelope means with concrete holding means.

Figs. 29, 30, 31, 32 illustrate a device having

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envelope means and holding means in different operating positions.

Fig. 33 is a section of the product obtained by the method of procedure according to Figs. 29, 30, 31, 32.

The type of section of the products made according to the present invention may have uniform wall thickness (Figs. 3 and 4) and although the article itself may present "tracings" or swellings towards the outside (Fig. 1), or towards the inside (Fig. 2) arranged in any manner.

It may be desired for example to construct the tubular product with more simple section, that is with closed triangular section with full walls and uniform thickness (Figs. 3 and 5).

Such a casting may be made firstly on a flat surface in three elements 2 connected (Fig. 8) contained by fillets 1.

Such connected element 2 will constitute the walls of the product and in correspondence with the future verticals a suitable furrow is left 3 to allow of later packing.

Such future walls 2 are furnished with a metallic armouring which may be of the type shown in Fig. 7 in which the bars 12 are arranged longitudinally to the product and the bars 5 represent transversal attachments although this may be constituted of a metal network covering all three of the elements 2, although the three elements 2 may be cast separately but with metallic armouring constructed in such manner as to allow the positioning of the irons 5 projecting from the elements before the packing.

After sufficient hardening of the concrete of the walls 2, along the furrows 3 or resulting from the approximation of the three elements 2 cast separately but provided with armouring, cement paste 4 is run and successively the lateral walls 2 are packed on the element 2, lower element, making a pivot at 3 in such manner as to close the triangular element (Fig. 9).

The corner of the top part formed by the walls 2, after the fastening of the irons 5 projecting from the elements, must be sealed with cement paste 6 (Fig. 9).

The triangular section product may be more suitably made with the help of the appropriate mould (Figs. 10 and 11) in which the furrows 3 are drawn in the casting of the projection 7 of the mould itself.

Once the casting is made after the hardening (Fig. 12) it is reversed (Fig. 13) and with the aid if required of shaken-out moulds (Fig. 14) may be furnished with suitable hinges 8 and the packing is done with sealing of the corners with

paste 4 as described for the production without the use of special moulds (Fig. 15).

An improvement in the moulds which may be indispensable for the construction of products which are less simple than those with triangular section, although the walls may be trellised or may be of such consistency as to render the packing difficult without prejudicing the integration of the elements 2, is indicated in Figs. 16 and 17. In these figures the mould (provided that the element is still constructed with triangular section as in Fig. 3) is divided into three parts 9 provided with hinges 10.

When the elements 2 are placed over the same, considering the new particular shape of the mould and its manner of operation, the furrow 3 between the walls may be left fairly large without, during the packing, any displacements being able to take place which could prejudice the consistency and integration of the product which it is desired to construct.

In order to obtain the furrow 3 in such moulds fillets 11 are provided before the casting (Figs. 18 and 19).

Such a mould as the preceding one is constructed so as to allow the inclusion of iron armouring parts 5 and the longitudinal bars 12 which for reasons of resistance and production must be included.

Systemising such fittings (armourings) in the moulds requires suitable furrows 13 to be provided.

When the casting is made as shown in Fig. 20 and is left to stand for a short time corresponding to the furrows 3, obtained with the use of the fillets 11, then as usual cement paste 4 is applied and longitudinal bars 12 may be provided and then the mould is packed upon the same (Fig. 22) the top corner being suitably sealed with paste 6 for the fitting of the lateral walls.

After the hardening of the cement paste introduced between the cast walls the product may be shaken out of the mould.

A mould which has more recently been perfected and which allows of obtaining a monolithic reinforced concrete structure is shown in Figs. 23 and 24 equipped with the "holding-up" tools resulting from Figs. 25, 26, 27, 28.

The mould (Fig. 23) is identical with that described previously, that is, is divided into three parts 9 furnished with hinges 10 except in this case, in the lateral parts 9, apertures 14 are left to allow of the passage of wedges (Figs. 27 and 28).

Once the casting is made without any discontinuity in correspondence with the corners, the longitudinal and transversal armourings 12 and 5 are provided and metal network as previously described (Fig. 29) over the casting itself corresponding to the two lateral walls, is provided and two "holding-up" tools 15 are provided. These, shown in Figs. 25 and 26 are constituted of one or more elements consisting of wood or other material eventually provided with hinges 16 through which are left apertures 14 corresponding to those provided in the lateral walls 9 of the arrangement.

Such "holding-up" tools are supported on the casting and are fixed through the apertures 14 with clamps 17 shown in Figs. 27 and 28.

When this last operation is completed the lateral walls of the envelope 9 and of the casting contained between the same and the "holding-up" tools are folded back as shown in Fig. 31.

The concrete, still fresh, along the lower corners is shaken out and the upper corner, by contact and pressure of the lateral walls 2 is automatically soldered.

Once the casting is made and when the concrete is hardened, the wedges or clamps 17 are removed and the "holding-up" tools 15 are extracted for if they are shaken out they may be caused to fall inside the hardened product as indicated in Fig. 32 in order readily to be shaken out.

The lateral walls 9 of the envelope are then opened and the casting is liberated from the molding device. The element thus constructed (Fig. 33) is monolithic and its construction is more economical than when using the moulds and manufacturing system previously described.

The production of castings with triangular sections and the special examples referring to the same have now been described, but it will be readily apparent to one skilled in the art that with suitable modifications by means of this manufacturing process, products with closed or open polygonal section with two or more sides or with continuous curve, may be constructed.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:

1. The process of producing longitudinal hollow concrete elements, comprising pouring a plurality of flat concrete slabs placed in spaced relation alongside one another, allowing the concrete to set, pouring cement paste into the spaces between the slabs, folding the resultant flat body by bending the cement paste in the spaces between the slabs, and allowing the cement in said spaces to harden.

2. A device for producing box-shaped concrete elements having open ends, said device comprising enevelope means consisting of a number of first panels having adjacent edges and hinge means interconnecting the adjacent edges, said envelope means being placed in a plane for pouring a flat layer of concrete thereupon, an equal number of second panels smaller than and of a shape similar to that of said first panels and placed on top of the concrete individually opposite the first panels, and removable clamping means for clamping two opposite panels together, said envelope means being folded about its hinge means for bending the concrete held thereto by the first panels to the desired configuration.

3. A device for producing laterally closed, box-shaped concrete elements having open ends, said device comprising envelope means consisting of a plurality of panels having edges hinged together and two extreme lateral free edges, said envelope means being placed in a plane for pouring a flat layer of concrete thereupon, collapsible holding means placed on top of the concrete individually opposite said panels, and removable clamping means for individually clamping the holding means in uncollapsed condition to its opposite panel, said envelope means being folded about its hinged edges for bending the concrete to the desired configuration and bringing the free edges together, and said clamping means being removed for collapsing said holding means and withdrawing same through an open end of the finished concrete element.

4. A device as defined in claim 3, said holding means each consisting of two panels having two adjacent lateral edges and having together, in a plane position, a shape similar to and a size

smaller than that of the opposite panel of the envelope means, hinges connecting the adjacent lateral edges and permitting folding of the panels of the holding means from plane position to one side only, and said clamping means extending between said adjacent edges.

5. The process of producing a hollow longitudinal concrete element having an angular cross-section and open ends, comprising the steps of pouring a flat layer of concrete on a flattened foldable mold having longitudinally hinged panels, placing longitudinal flat holding panels on the concrete opposite the mold panels in parallel relation to and laterally spaced from the longitudinal hinges of the mold, connecting opposite panels through the concrete layer, folding the mold and the concrete therewith, allowing the concrete to harden, disconnecting the holding panels from the mold panels, removing the holding panels through an open end of the finished element, and unfolding and removing the mold.

6. The process of producing a hollow longitudinal concrete element having an angular cross-section and open ends, comprising the steps of pouring a flat layer of concrete on a flattened foldable mold having longitudinally hinged

panels, placing longitudinally foldable longitudinal holding panels in unfolded condition on the concrete opposite the mold panels in parallel relation to and laterally spaced from the longitudinal hinges of the mold, folding the mold and the concrete therewith, allowing the concrete to harden, folding the holding panels and removing them from the concrete element through an open end thereof, and unfolding and removing the mold.

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