March 13, 1962 E. A. SHUXTEAU ET AL 3,024,513

VOID-FORMING CONSTRUCTION FOR PRE-CAST BEAMS

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Fig. 1

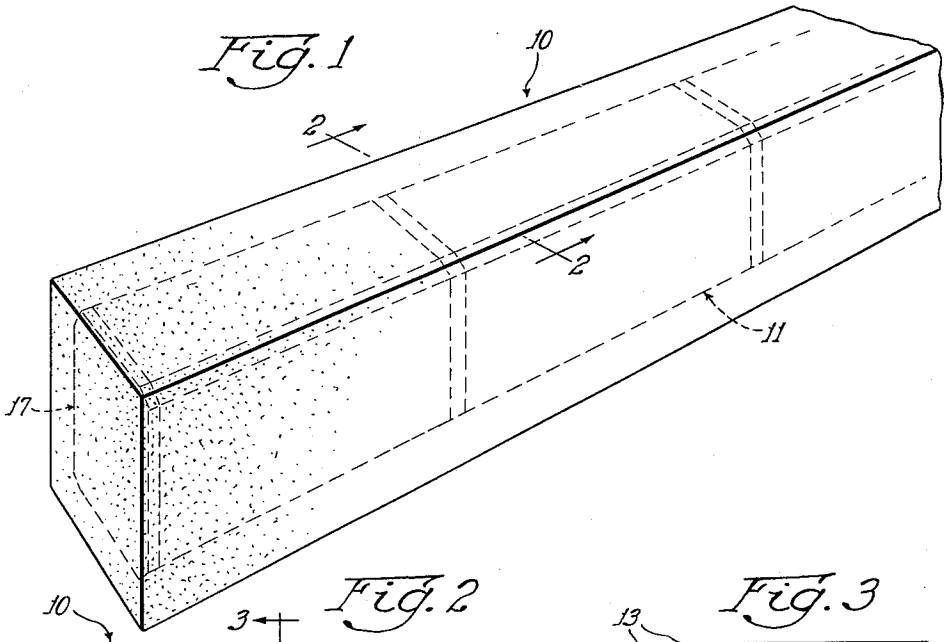



Fig. 2

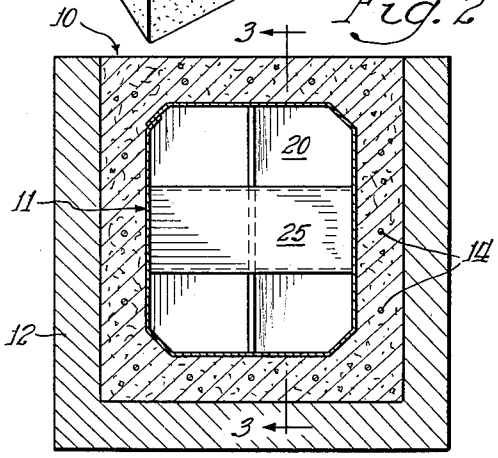



Fig. 3

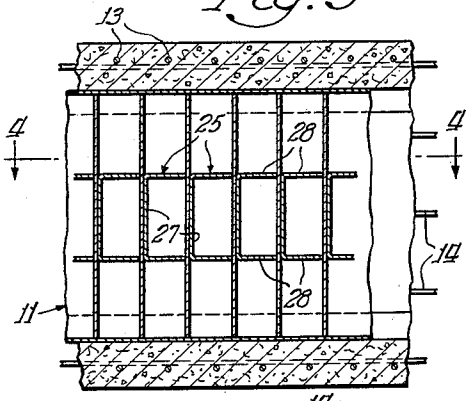



Fig. 5

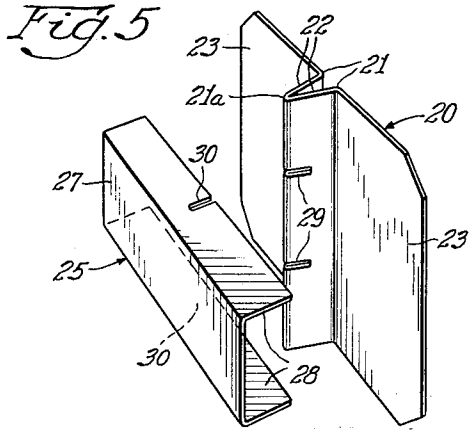
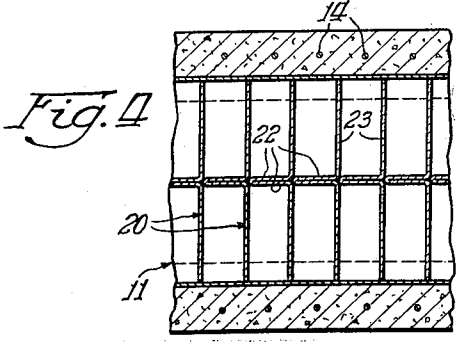



Fig. 4




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Fig. 6

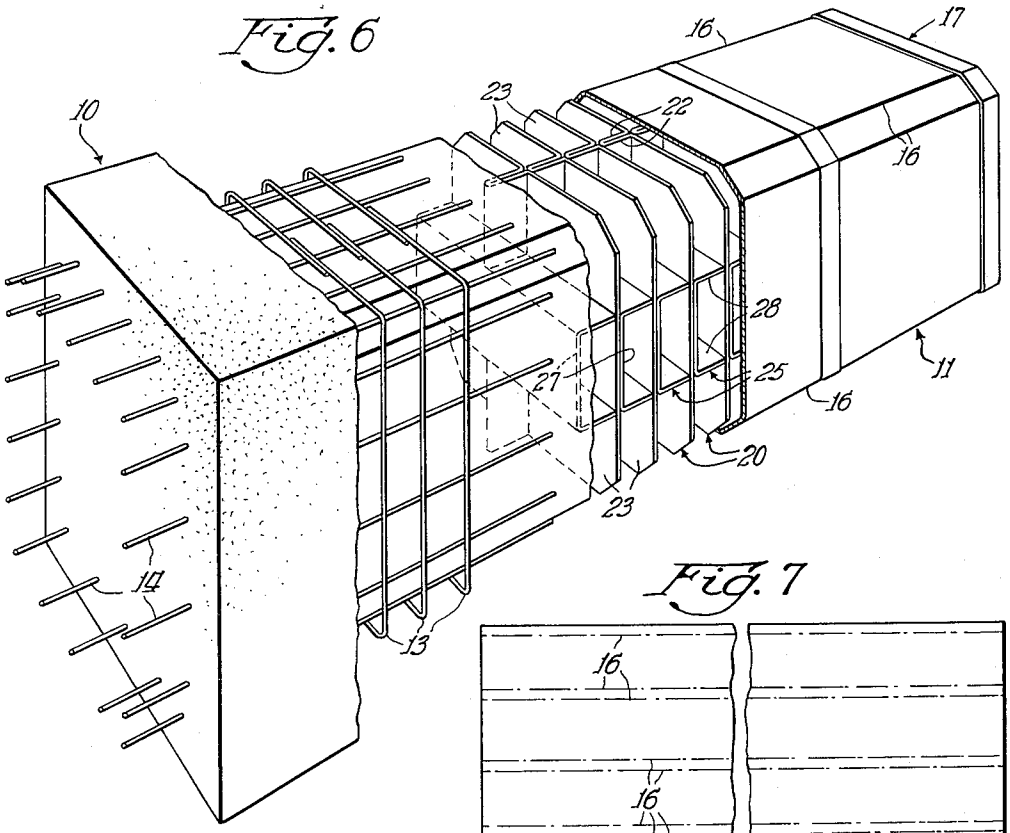



Fig. 7




Fig. 8

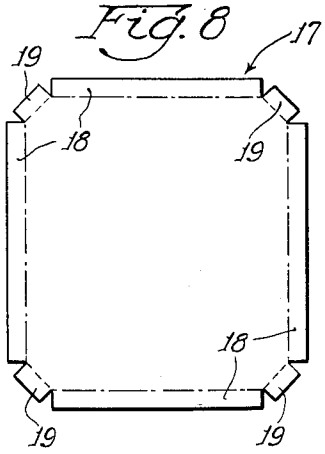



Fig. 9

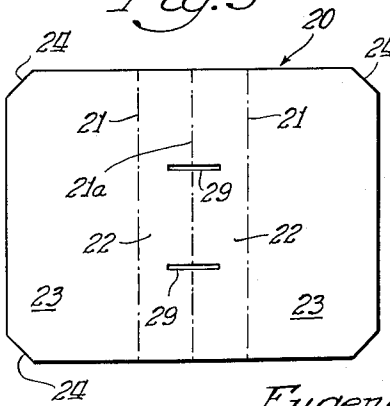
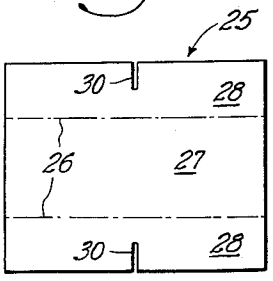



Fig. 10




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# 3,024,513 VOID-FORMING CONSTRUCTION FOR PRE-CAST BEAMS

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3 Claims. (Cl. 25—128)

The present invention relates to the internal supporting means for use in the manufacture of pre-cast, hollow, concrete beams.

Among the important objects of the invention are the provision of effective and easily handled parts, formed of sheet material which may be prepared in flat, compact form, which may readily be shaped or folded into interlocking groups and quickly and easily assembled within a hollow, void-forming member designed to be disposed longitudinally of a casting form and enclosed within a concrete beam which is formed around the void-forming member.

In the manufacture of pre-cast, hollow concrete beams an important consideration is to provide a void-forming member of light, strong and inexpensive material, capable of withstanding the weight of wet concrete when poured around the void-forming element, and also to provide a construction sufficiently sturdy to resist accidental deformation due to the use of tampers, vibrators and other tools employed in removing air pockets from the concrete while the beams are being poured.

In the drawings, illustrating a preferred embodiment of the invention—

FIG. 1 is a perspective view of a portion of a hollow concrete beam indicating in broken lines a void-forming member enclosed within the beam;

FIG. 2 is a somewhat enlarged, cross-sectional view, taken along line 2—2 of FIG. 1, as respects the beam, but additionally showing the beam enclosed on three sides by a hollow form within which the beam may be cast, and showing the internal reinforcing parts for the void-forming member;

FIG. 3 is a fragmentary sectional view, taken along line 3—3 of FIG. 2, omitting the hollow form, and showing the void reinforcing elements at right angles to their position illustrated in FIG. 2;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an exploded perspective view showing two companion reinforcing parts for the void-forming member as such parts appear when about to be placed in assembled relation;

FIG. 6 is a perspective view with parts broken away, showing one end portion of a completed hollow concrete beam, showing a section indicating the relationship of the reinforcing rods to the void-forming member, and another section which illustrates the relationship of the void-forming member and its reinforcing elements;

FIG. 7 is a plan view on a somewhat reduced scale of the blank from which the tubular void-forming member may be constructed;

FIG. 8 is a plan view of a form of closure for closing the ends of the tubular void-forming member; and

FIGS. 9 and 10 are plan views respectively of the blanks from which the companion reinforcing elements may be formed.

Essentially the void-forming construction comprises a multi-walled, tubular member of foldable sheet material, such as corrugated paperboard, which is adapted to be placed in a suitable form into which is poured wet concrete to surround the void-forming member and form a hollow beam. A plurality of reinforcing elements are



fitted within the tubular member. These reinforcing elements may be of any suitable sheet material, such as corrugated paperboard, and are preferably formed of a number of pairs of companion elements. One of the elements is in the form of a flat panel the central portion of which is folded against itself to form an outstanding rib. The other element is preferably folded to assume a channel shape which provides a flat central portion and two edge flanges. These flanges are preferably notched and fitted over the rib on the first element, such rib also being notched whereby the edges of the flanges may bear upon the flat panel portions of the first element and the free edge of the rib will bear against the flat central portion of the second element. The edges of both elements preferably are in contact with the interior surface of the tubular member when in assembled relation to serve as an effective support to resist any tendency of the tubular member to collapse under the weight of the wet concrete during formation of the hollow beams.

Referring more particularly to the drawings, the complete hollow concrete beam is indicated as a whole at **10**. See FIGS. 1 and 6. The void-forming tubular member, indicated as a whole at **11**, occupies a central position within and extends longitudinally of the beam. In the process of manufacture a trough shaped casting form, indicated at **12** in FIG. 2, may be provided. A group of U-shaped reinforcing rods **13, 13** will be placed upright in the form, followed by the insertion of a group of longitudinal reinforcing rods **14, 14**. After wet concrete is placed in the form to the proper level a plurality of tubular members **11, 11** will be placed upon this layer of concrete. Additional longitudinal reinforcing rods and U-shaped transverse rods are now placed within the form, surrounding the tubular member. The form is then completely filled with additional wet concrete. When the concrete has become set the beam will be removed from the form and transported to the place of use. It is to be understood that the formation of the hollow concrete beam is generally conventional and forms no part of the present invention.

The tubular member **11** may be of any convenient length. In practice, several of such tubular members, placed end to end, are utilized in the preparation of a concrete beam. The blank for the tubular member, shown in FIG. 7, may comprise a sheet of corrugated paperboard scored longitudinally as indicated at **16, 16** to provide widened or blunt corners. See FIGS. 2 and 6. The scores adjacent the longitudinal edges of the blank provide sections which are arranged to overlap and may be attached to each other as by means of gummed tape, stapling or gluing. See FIG. 2.

Closure elements, such as indicated at **17** (see FIGS. 6 and 8) are provided to close the ends of the tubular members. The central panel of the closure is shaped to conform with the outside contour of the tubular member. Flap extensions **18, 18** are provided on the sides and narrow flap extensions **19, 19** are provided to conform to the widened or blunt corners of the tubular member. The closures may be assembled in place by gluing or by sealing the flaps flat against the outside of the tubular member by strips of gummed tape.

The inner reinforcing parts for the tubular member may be formed as companion pairs of elements and are preferably constructed from blanks cut and scored as illustrated in FIGS. 9 and 10. The element **20**, shown in FIG. 9, has a central portion defined by score lines **21, 21** and **21*a*** to provide two adjacent narrow panels **22, 22** and two side panels **23, 23**. The panels **22, 22** are capable of being folded out of the plane of the panels **23, 23** so as to contact each other face to face and together form what may be termed a stiffening rib. When

the narrow panels **22, 22** are folded together the outer edges will approach each other and the contour which the element will then assume substantially conforms to the inner periphery of the tubular element. As shown in FIGS. 2, 3, 4 and 6, the element **20** thus set-up provides reinforcing panels **23, 23** in aligned relation, which disposed within tubular member **11** extend transversely of the tubular axis thereof. It is to be noted that the outer corners of panels **23, 23** are cut diagonally, as indicated at **24, 24**, to conform with the widened corners of the tubular member.

The element **25** shown in FIG. 10, may be formed as a rectangular blank, scored at **26, 26** to provide a central panel **27** and two edge panels **28, 28**, foldable at right angles to the central panel to form stiffening flanges.

For the purpose of assembling the elements **20** and **25** into a single supporting and reinforcing unit the rib formed by narrow panels **23, 23** is preferably slotted at **29, 29** to receive the edge portions of the narrow panels or flanges **28, 28**. The slots **29** are preferably formed of a length equal to about one-half the width of the rib and slots **30, 30** are formed in the panels or flanges **28** extending about half way of their width whereby the two sets of cooperating slots allow the free edges of flanges **28** to come to rest against the surface of the element **20**. The free edge of the rib formed by panels **23, 23** will likewise be brought into contact with the inner face of central panel **27**. The two companion elements, when thus assembled, form a relatively rigid unit and present edge portions which may bear against the inner faces of the walls of the tubular member to resist effectively any inward collapsing movement of such walls. As best illustrated in FIGS. 2 and 6, the opposite ends of the element **25** and adjacent edges of the panels **23** are in contact with the inner surfaces of two opposite walls of the tubular member. Likewise the ends of the stiffening rib formed by panels **22, 22** and the adjacent edges of panels **23, 23** are in contact with the inner faces of the other two opposite walls of the tubular member.

By filling the tubular member with the joined companion elements **20** and **25** it is obvious that the tubular element, when employed within the beam casting form, will have a high degree of resistance to the pressure of the wet concrete.

While both the flanges **28** and the projecting rib section on element **20** have been shown as slotted it is apparent that deeper slots may be formed in the rib section so as to receive the full width of the flanges **28**, in which case such flanges need not be slotted.

The blanks for the tubular member and the reinforcing elements **20** and **25** may be shipped in flat form to the point of use and there set up as needed, preferably by employing gummed tape to secure together the free edges of the blank of the tubular member and to secure the flaps of the closure to the ends of the tubular member side walls. After the tubular member has been set up and a closure applied to one end a sufficient number of the companion reinforcing elements **20** and **25** will be assembled and inserted into the tubular member until it is completely filled. The other end closure will then be secured on the tubular member after which it may be placed within the form. As soon as a sufficient number of completed tubular members in end-to-end relation have been placed in the form the necessary reinforcing rods may be secured in place, followed by completion of the filling of the form with wet concrete.



For the purpose of preventing undue absorption of moisture by the void-forming parts, they are preferably manufactured from corrugated paperboard which has been suitably coated or impregnated with water repellant material, such as size or wax.

While the present description sets forth a preferred embodiment of the invention, various changes may be made in the construction without departing from the spirit of the invention, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

We claim:

1. An expendable enclosed cellular reinforced collapsible core device formed of paperboard and adapted to be permanently positioned within a mass of concrete to form a void in an elongated hollow precast concrete beam, comprising: an elongated tubular casing having end closures at opposite ends thereof to define a closed cavity; and a plurality of cellular reinforcing members arranged in continuous abutting sandwiched relationship throughout the length of the cavity between said closures; each of said cellular reinforcing members including a panel element disposed to extend transversely of the cavity in a direction normal to the longitudinal axis of the cavity and having substantially the same area as the cross-sectional area of the cavity, a rib element integral with and projecting from one side of the panel element and extending transversely of the cavity parallel to the panel element and normal to the longitudinal axis of the cavity, and a channel element also extending transversely of the cavity normal to the longitudinal axis of the cavity and including a generally flat center web extending parallel to the panel element and having projecting therefrom integral flange means disposed in interlocking engagement with said rib element.

2. A core device according to claim 1, wherein said rib element and said channel element flange means have mutually facing notches which afford said interlocking engagement.

3. A core device according to claim 1, wherein said panel element and said channel element are each formed of a single sheet of foldable paperboard which has been cut, scored, and folded to provide the respective rib and flange means.

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