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EXPANSIBLE MOLD FOR CASTING CONCRETE BEAMS

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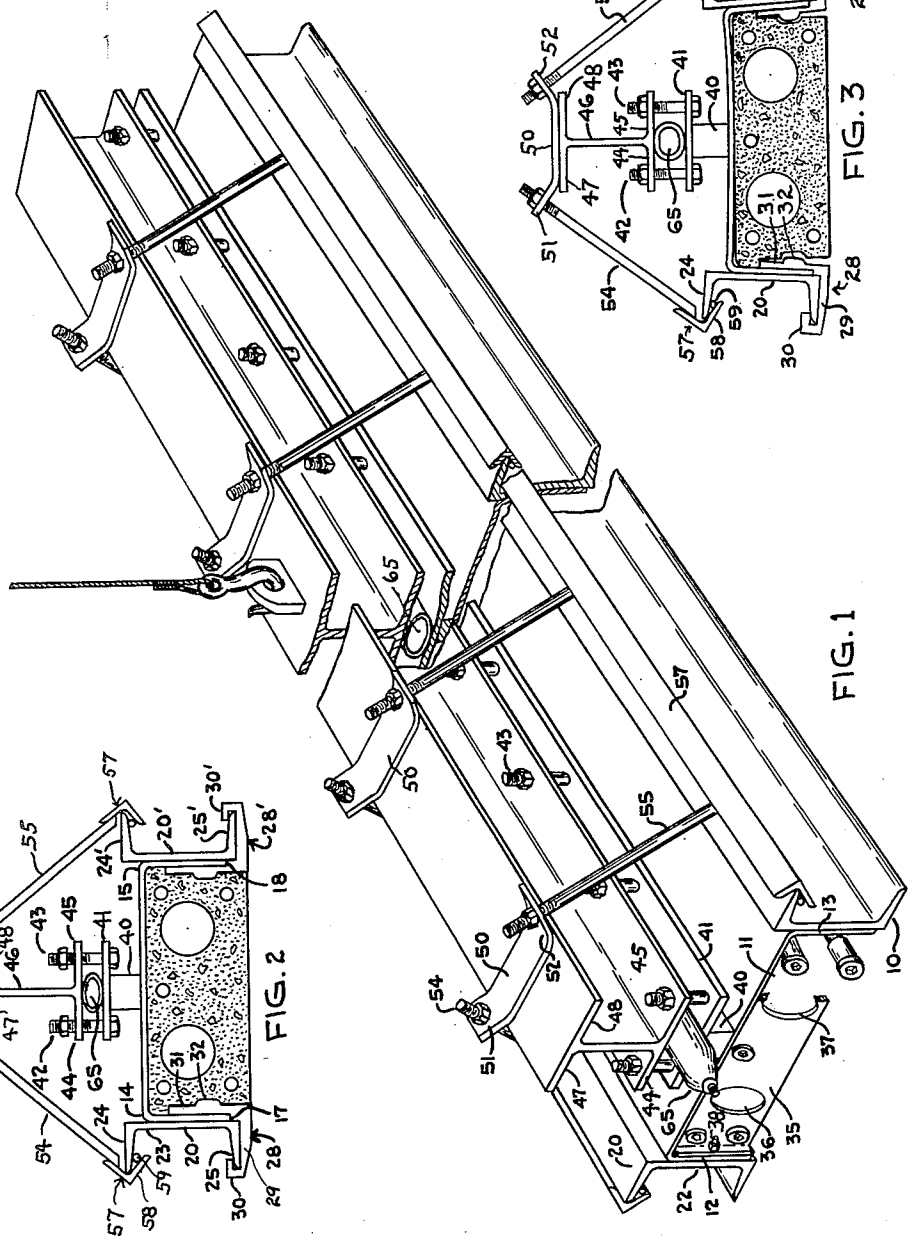


FIG. 1

FIG. 3

FIG. 2

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EXPANSIBLE MOLD FOR CASTING CONCRETE BEAMS

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This invention relates to a means for making concrete beams. In United States Patent 2,299,070 there is disclosed and claimed a concrete beam having spaced longitudinal passages and provided with a plurality of prestressing rods for determining desirable stress conditions within the beam. In Patents 2,299,072 and 2,299,111 means for and methods of making such beams are disclosed. While the means and methods disclosed in such patents are effective, I have discovered certain improvements that permit the manufacture of such prestressed concrete beams in quantity at lower cost than has hitherto been possible. Furthermore, I have discovered that economy in equipment has also resulted from the application of this invention.

It is important to provide means and apparatus for readily manufacturing such beams and it is essential that such apparatus may be readily transportable where desired so that such apparatus may be used on location.

Another advantage accruing from the invention hereinafter described, results in a greater uniformity of product and a greater ease in handling of materials. Other advantages will occur in connection with the description.

The invention in general provides a trough-shaped form within which may be disposed the raw materials for the manufacture of a beam. The trough-shaped form has a generally U-shaped section. This form is endowed with sufficient flexibility and means are provided so that the form may be sprung to a limited extent. The springing of the form is controlled and directed so that the opposed form sides may diverge just enough to release the beam after the concrete has set. The means for accomplishing the springing of the forms will be described in detail in connection with the invention but in general such means are designed so that the springing of the forms is limited and controlled to the desired degree for effecting release of the concrete beam.

For a more detailed description of the invention, reference will now be made to the drawing. Figure 1 shows an isometric view of a structure embodying the invention with parts broken away.

Figure 2 shows a transverse section of the apparatus of Figure 1 with a concrete beam in place.

Figure 3 is similar to Figure 2 but shows the apparatus sprung to release a beam.

Referring now to the drawings, 10 indicates a form within which a concrete beam may be made. Form 10 is of steel having bottom portion 11 and sides 12 and 13 respectively. The form is preferably shaped to provide rounded corners at 14

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and 15 where the sides and bottom join. The dimensions of bottom 11 and sides 12 and 13 may be selected to suit required conditions and preferably the dimensions are so selected as to accommodate the largest size beam that may be desired.

As will be described later, smaller size beams may be made within this form. Sides 12 and 13 of the form terminate at 17 and 18 respectively. Welded to sides 12 and 13 on the outer surfaces thereof are channel beams 20 and 20'. Beam 20 has web portion 22 extending along form side 12. Web portion 22 of the channel beam is preferably larger (in the direction between flanges) than the corresponding dimension along side 12 so that portion 23 of the web projects beyond bottom 11 of the form. Beam 20 has flange portions 24 and 25 respectively extending away from form 10.

Channel beam 20' is preferably similar to beam 20 and has corresponding portions similarly located, these corresponding portions carrying corresponding primed numbers.

It will be observed that flange 25 of beam 20 is disposed substantially near end 17 of the side of the form. This, however, may be varied to suit requirements.

The lengths of form 10 and channel members 20 and 20' are preferably equal and may be as great as the longest beam which may be desired. Where beams shorter in transverse dimensions or smaller in length than the total form dimensions are required then the following additional elements may be used. Thus cooperating with either one or both of flanges 25 and 25' are rubber liners 28 and 28'. Each liner 28 has portion 29 overlying the flange side, in this instance flange 25, and has preformed claw-shaped portion 30 adapted to slip over the free edge of the flange. Liner 28 has portion 31 extending along the inside face of a form side, in this instance side 12. The distance that portion 31 extends along the form side toward the form bottom may be as desired and may be the full depth of the form. The thickness of portion 31 of the liner may be as desired and, in practice, liner 28 will have ridge 32 of predetermined extent so that a corresponding groove will be formed along the beam side as disclosed in Patent 2,299,070. This ridge however is not essential and the liner may have any desired contour. In practice, a variety of liners may be available so that different sizes of beams may be made.

Preferably, though not necessarily, flange 25' may have liner 28' generally similar to liner 28 and having the various details described in connection with liner 28. Inasmuch as concrete does not adhere to rubber, it will be found that

the rubber liners may be stripped from the finished concrete beam with ease.

End plates 35 (only one appears in Figure 1) are provided. These plates have apertures 36 and 37 therein which are adapted to accommodate inflatable forms used in making the passages within the beams, this being more fully disclosed and claimed in the aforementioned patents. Thus plates 35 will function as end walls for maintaining the concrete in position until the same has set.

Elongated steel rods used for reinforcing the concrete beam are disposed in position in the form prior to filling with concrete mix. These rods are preferably threaded and pass through the end plates and tensioned by nuts and washers against the end plates as disclosed in the above mentioned patents. The end plates are bolted to the form sides, one such bolt being indicated at 38. In general, the accessories, such as end plates and the like, as disclosed in Patent 2,299,111, may be used in form 10 and the form itself is generally similar except for the fact that sides 12 and 13 are joined to bottom 11 by curved hinge-like portions 14 and 15. Form 10 is so designed that bottom 11 has sufficient flexibility so that it may be arched inwardly to cause sides 12 and 13 to flare outwardly. The amount of arch and flare need not be great but is sufficient to release a beam after the concrete has set. It may, of course, be necessary to disengage claw portions 30 and 30' of the rubber liners to permit the liners to come out with the beam. Usually the weight of the beam is sufficient to pull the rubber liners off. It is understood that the forms are not inverted as shown in the drawing until after the concrete has set.

In order to provide means for springing the form, rod 40 is positioned along the outside center portion of bottom 11 of the form. Rod 40 may consist of a heavy square steel rod extending the full length of the form. It may be round if desired. Rod 40 is attached to plate 41 extending on opposite sides beyond rod 40. Plate 41 has one series of bolts 42 extending lengthwise of the form and a second series of bolts 43 also extending lengthwise of the form, the two series of bolts being disposed on opposite sides of rod 40. Bolts 42 and 43 extend through flanges 44 and 45 of I beam 46. Beam 46 has flanges 47 and 48 to which is welded or otherwise secured, plates 50 having curved sides 51 and 52 as shown. Curved sides 51 and 52 extend outwardly away from flanges 47 and 48, the angle of curvature generally being apparent as the description proceeds.

Curved sides 51 and 52 of plates 50 are apertured and have two series of bolts 54 and 55 respectively. The bolts in the two series carry angle irons 57 at the ends thereof, the angle irons having portion 58 provided with steel rod 59 welded thereto at the inside surface thereof. Portions 58 of the angle irons pass around channel sides 24 and 24' of the form, rod 59 serving to engage a portion of the flange. If desired, a rod 59 may be replaced by a shaped block having a base for engaging an extended area of the channel side. As will be observed from the drawing, the angle of bolts 54 and 55 is such as to provide for a snug claw-like engagement of the angle irons and channel sides.

Disposed in the space between plate 41 and flanges 44 and 45 of I beam 46 is elongated inflatable tube 65 generally similar to the inflatable tube used in the manufacture of the concrete beam as described in the above mentioned patents, the inflatable tube being preferably similar to that disclosed in the patent to Lindas 1,949,650.

In the use of the apparatus, tube 65 may have air under pressure supplied thereto. As the air pressure increases, force will be exerted upon the I beam and plate. Preferably the series of bolts 42 and 43 have ample clearance in both plates 41 and flanges 44 and 45 so that the plate and flanges may separate in response to the air pressure within tube 65. It will be apparent that the tendency of plate 41 to separate from the I beam flanges will cause bottom 11 to buckle or spring inwardly of the form while sides 12 and 13 are sprung outwardly. It is preferred to have this springing just sufficient to provide clearance to remove the finished concrete beam. By controlling the maximum air pressure available to tube 65, it will be evident that excessive force upon the form will be avoided and thus any tendency to permanent deformation will be eliminated.

Preferably during the time when tube 65 is being inflated, the entire form and springing means is in the position shown in Figure 3 namely with the form inverted. By having the form a short distance above the floor or by resting the form on the floor, it is possible to raise the entire form after it has been sprung and leave the concrete beam on the floor.

If desired, suitable means as shown in Patent 2,299,111 for vibrating the concrete prior to setting may be employed.

After the form has been cleared of the set beam, the tube may be deflated whereupon the form and associated springing mechanism will return to a normal condition in preparation for a new cycle of operation.

It will be evident that the invention makes it possible to make precast concrete beams in a simple and effective manner. Thus the form need only be filled with concrete and the tensioning rods be located in a proper position. Thereafter the form may be vibrated or not as desired and the concrete permitted to set. After the beam has set, inflation of tube 65 will cause the form to spring and release the beam. By virtue of this, the preparation of the form for receiving the concrete as well as opening the form for discharging the finished beam are facilitated and simplified with a resultant saving in time. The apparatus is readily transportable.

What is claimed is:

1. An apparatus for making elongated precast concrete beams, said apparatus comprising a flexible form having a generally U-shaped section, rigid means extending from the sides of the form back toward the bottom of the form, said rigid means being disposed outside of said form, and expansible means disposed between said rigid means and the bottom of said form for exerting force to buckle the bottom and spread the sides whereby a finished beam may be released from the form.

2. An apparatus for making precast beams, said apparatus comprising an elongated generally U-shaped form of flexible material having a flat bottom and parallel sides terminating in free edges, rigid means engaging the free edges of said form sides and extending around the outside of the form to a position opposed to the outer surface of the form bottom and pneumatic means disposed between the form bottom and said rigid means for exerting force tending to buckle said form bottom inwardly and spring said form sides

outwardly whereby a finished concrete beam may be readily removed.

3. The structure according to claim 2 wherein the pneumatic means comprises an inflatable tube.

4. An apparatus for making precast beams, said apparatus comprising an elongated generally U-shaped metal form having a flat bottom and parallel sides terminating in free edges, claws engaging said free edges along the length of the form, said claws extending toward the back of the form to a region opposite to but spaced from the bottom of said forms, an elongated plate rigidly coupled to said claw means, a second plate parallel to said first plate, means connecting said second plate and a central region along the bottom of the form, and pneumatic means for operation between said two spaced plates to spread said plates apart and buckle the form bottom and spread the form sides whereby a finished concrete beam may be readily released.

5. The apparatus according to claim 1 wherein liners are provided for the sides only of said form, said liners being adapted to remain free of the concrete after the same has set and being adapted to slip out of the form with slight buckling.

6. An apparatus for the manufacture of elongated concrete beams, said apparatus comprising a straight flexible channel-shaped metal form, rigid reinforcement for the two sides of said form throughout the length thereof, said reinforcement providing a web along the outside near each channel edge, a rigid elongated member disposed along the outside of the form substantially along the longitudinal center thereof, said elongated member having a small transverse dimension relative to the transverse dimension of the form, said form being adapted to contain a concrete mix in preparation for setting, and means for exerting force on said elongated member and on said side reinforcements for buckling the bottom of the form transversely of the form only so that the form sides tend to diverge, and release the concrete beam.

7. An apparatus for the manufacture of elongated concrete beams, said apparatus comprising a straight flexible channel-shaped form, rigid reinforcement for the two sides of said form throughout the length thereof, said reinforcement providing a web along the outside near each channel edge, a rigid elongated member disposed along the outside of the form substantially along the longitudinal center thereof, said elongated member having a small transverse dimension relative to the transverse dimension of the form, and means for applying force at

longitudinally spaced points to the reinforced sides and substantially over the entire length to said elongated member for buckling the form transversely thereof only with the bottom of the form being pushed inwardly and the sides diverging, said form being adapted to contain a concrete mix in preparation for setting and having such a shape that a finished beam will not readily separate from the side in its normal shape whereby when said form is buckled said beam is released.

8. An apparatus for making precast beams, said apparatus comprising a straight flexible metal channel-shaped form, rigid metal channels rigidly joined to the form sides at the outside thereof, a rigid elongated member disposed along the outside of the form substantially along the longitudinal center thereof, said elongated member having a small transverse dimension relative to the transverse dimension of the form, said rigid channels having the webs extending outwardly away from the form, said form as a whole being rigid with respect to its longitudinal axis but being flexible transversely of the form between the reinforced form sides and bottom, and means engaging the sides and elongated member for buckling the form transversely thereof, said form normally being adapted to contain a quantity of concrete mix in preparation for setting and having such a shape that the finished concrete beam will not readily come out from the form whereby when the form is buckled the sides diverge outwardly and the bottom curves inwardly to release the beam.

9. The structure according to claim 8 wherein each rigid side reinforcing channel is wider than the form sides with the form edges being aligned with reinforcing channel webs and the remaining reinforcing channel webs extending beyond the form bottom.

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