Jan. 17, 1961 G. SCHÜTZE ET AL 2,968,082

MOLD ASSEMBLIES

Filed Feb. 15, 1957 4 Sheets-Sheet 1

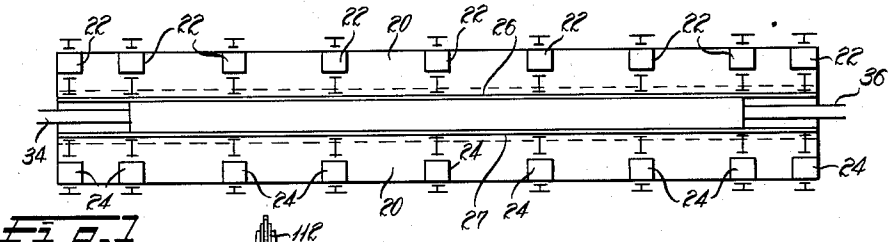

Fig. 1

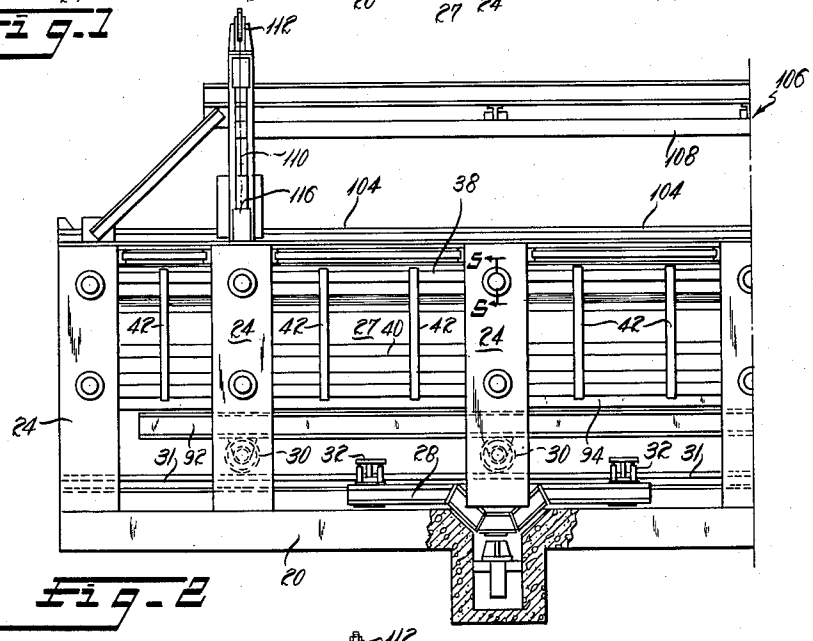

Fig. 2

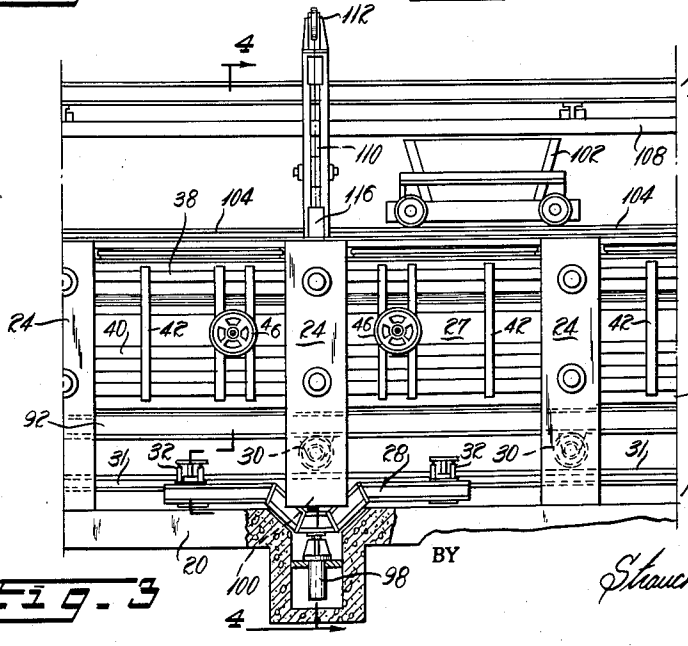

Fig. 3

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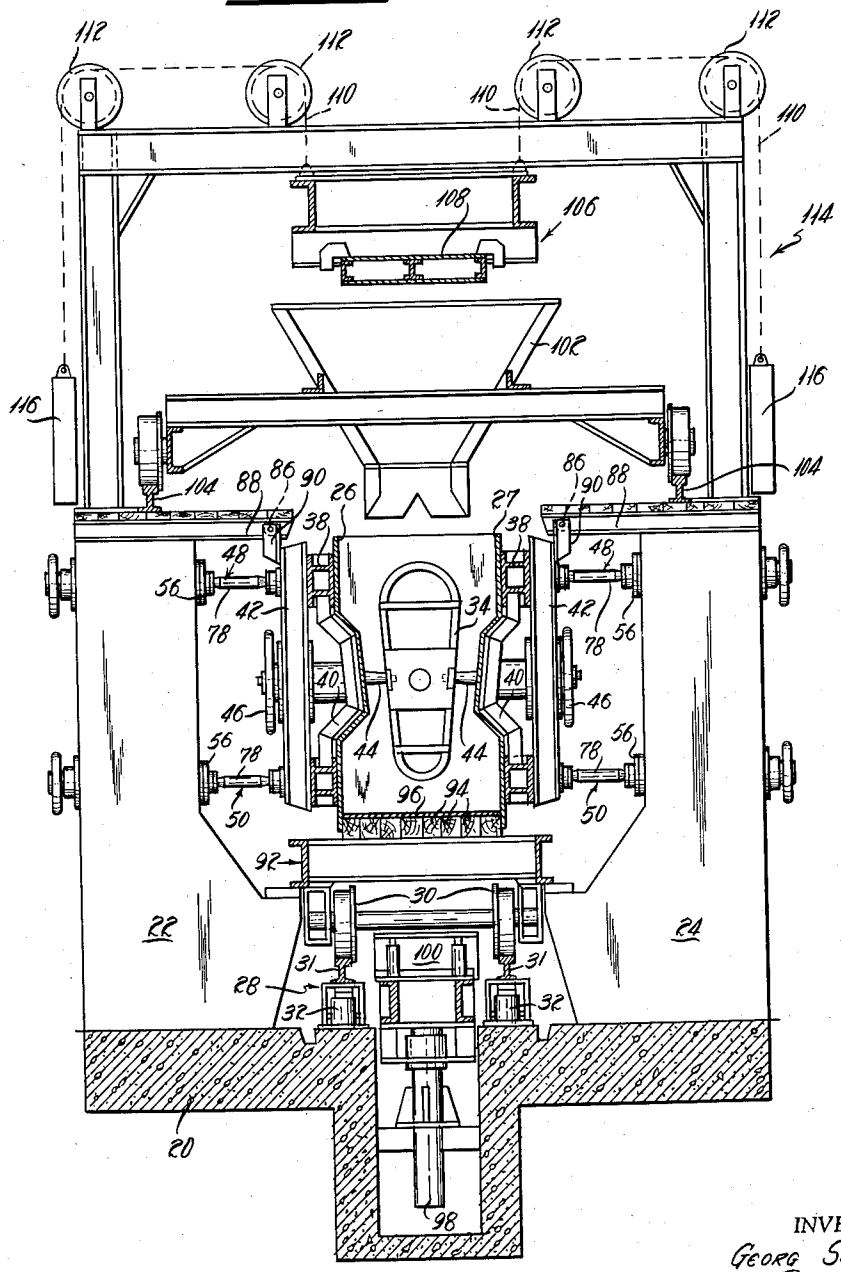
MOLD ASSEMBLIES

Filed Feb. 15, 1957 4 Sheets-Sheet 2

Fig. 4



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MOLD ASSEMBLIES

Filed Feb. 15, 1957 4 Sheets-Sheet 3

Fig. 5

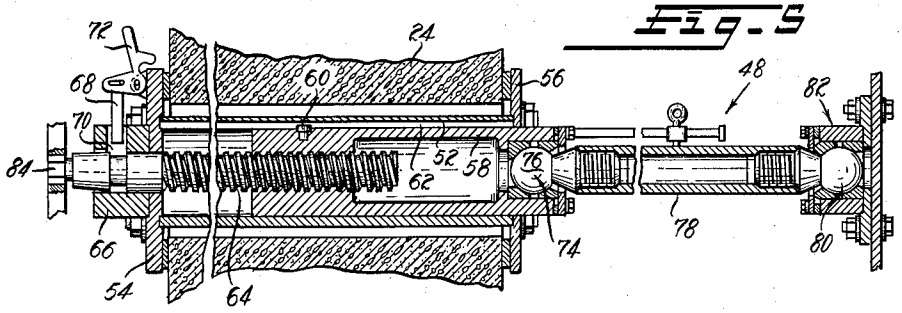
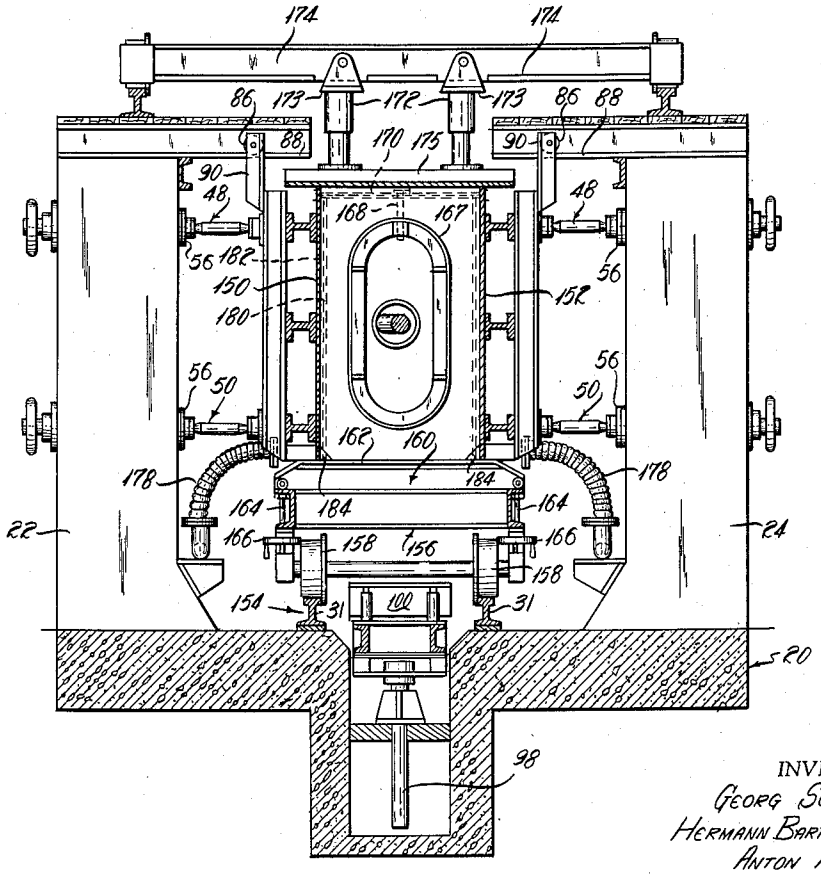


Fig. 8



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MOLD ASSEMBLIES

Filed Feb. 15, 1957 4 Sheets-Sheet 4

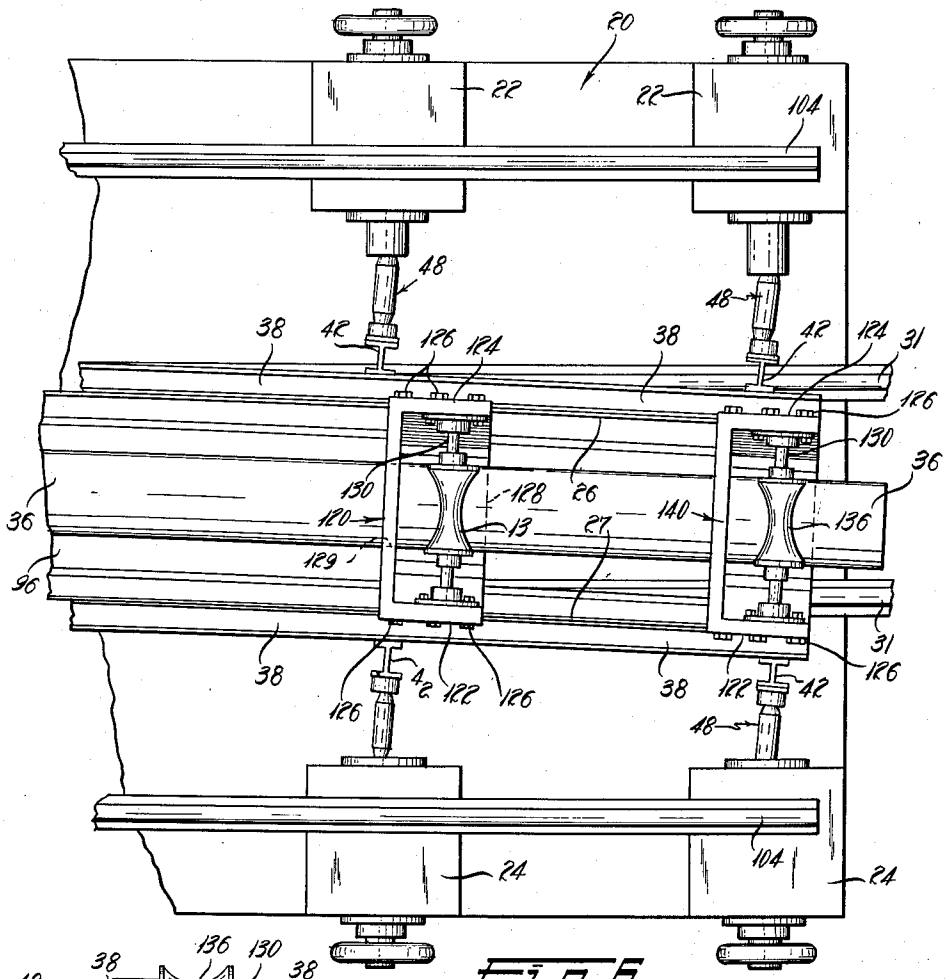

Fig. 6

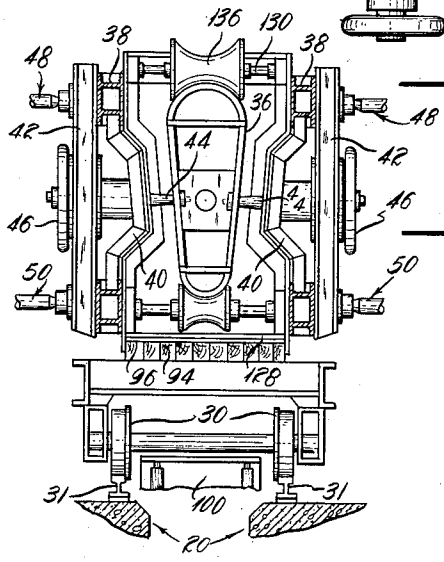

Fig. 7

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2,968,082

MOLD ASSEMBLIES

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9 Claims. (Cl. 25—121)

This invention relates to molding apparatus and more particularly to permanent apparatus for forming cast beam-shaped concrete structures for use in monobeam railway systems.

Monobeam railway systems comprise a number of beam sections, the opposite ends of each section being supported on pylons at a suitable elevation above the ground. The ends of the beam sections are joined together to form a continuous trackway which is generally of rectangular section having a top running surface for supporting the load carrying wheels of the train and upper and lower lateral running surfaces normal to the top running surfaces for supporting the side guide and stabilizing wheels of the train.

The trackway comprises four principal types of elongated beam sections, namely straight sections, simple curved sections, curved and inclined sections and transition curved sections which are used to connect inclined curved sections to straight sections or to simple curved sections.

The straight section has a right rectangular section and a straight longitudinal axis. The simple curved section also has a right rectangular section but has a curved longitudinal axis. The inclined curve beam section has a horizontal base, inclined concentric side walls and an inclined top wall normal to the side walls. The transition curve beam section has at one end a section corresponding with the end of the straight or simple curved sections which gradually changes along the length of the beam to a section corresponding to the section of the inclined curved section. All of the track beam sections are approximately three feet wide, six feet high and about sixty feet long. To reduce the weight of the sections as well as to provide an interior space for utility lines the beams are generally of hollow section. While the side walls of the beam sections may be parallel from top to bottom, the center sections of the beam may be of reduced width to reduce the weight of the beam.

It is the primary purpose and object of the present invention to provide improved molding apparatus which may be selectively used for casting each of the above-mentioned types of beam sections.

In attaining this primary object and other objects the invention provides novel molding assemblies including flexible and twistable walls and means for controlling the position of the walls easily and accurately to permit the subsequent casting of the concrete structures in the desired shape.

The invention also provides for novel means for removing the cast article from the mold before it is completely hardened to minimize the time delay between successive molding operations.

Additional objects and advantages will become apparent as the description proceeds in connection with the accompanying drawings in which:

Figure 1 is a diagrammatic top plan view of the molding apparatus of the invention arranged for the molding of a straight track beam section;

Figures 2 and 3 are enlarged side elevations of the mold assembly of Figure 1, Figure 2 showing the end of the mold assembly and Figure 3 showing the central portion thereof;

Figure 4 is a transverse section taken along line 4—4 of Figure 3;

Figure 5 is an enlarged fragmentary section taken along line 5—5 of Figure 2 showing details of the mechanism for supporting the side walls of the outer mold assembly;

Figure 6 is an enlarged fragmentary top plan view of the end of the mold assembly showing the assembly arranged for the molding of a simple curved section;

Figure 7 is an enlarged end elevation of the mold assembly of Figure 1; and

Figure 8 is a transverse section similar to Figure 4 but showing a modified form of the invention.

Referring now more particularly to the drawings, Figures 1–7 illustrate a mold assembly of the present invention arranged for molding straight beam sections having a hollow interior, parallel top and bottom surfaces, and parallel upper and lower side surface sections separated by a central section of reduced width. The mold assembly includes a heavy stationary foundation **20**, preferably of concrete and a number of opposed pylons **22** and **24**, rigid with the foundation **20** and extending upwardly from the lateral edges thereof at uniformly spaced points along the length of the foundation. The sides of the outer mold are formed by flexible sheets **26** and **27** adjustably supported respectively on the pylons **22** and **24** by means to be described. The bottom of the mold is formed by a movable base plate assembly indicated generally at **28** which extends the full length of the mold assembly and which is provided with wheels **30** adapted to run along rails **31** which can be selectively raised and lowered by hydraulic jacks **32** mounted on the foundation **20**. The inner mold assembly comprises a pair of identical straight elements **34** and **36** each extending from one end of the mold assembly to the center thereof. The mold sections **34** and **36** are preferably straight to facilitate their removal from curved cast beam sections.

The side walls **26** and **27** of the mold assembly, which is indicated above are flexible to permit deformation of these members to the extent necessary to permit formation of track beams of varying configuration, are backed up by longitudinally and vertically extending stiffening members **38** and **40**, respectively. At points near the center of the mold, additional vertical stiffening members **42** are secured to the longitudinal stiffening members **38** and are provided with plunger assemblies **44** which extend through the side plates **26** and **27** into engagement with the inner mold sections **34** and **36**. The position of the plungers **44** may be controlled by hand wheels **46** so that the interior mold sections may be accurately located from the exterior of the assembly.

The reinforced side plates **26** and **27** are supported from the pylons **22** and **24** by spaced sets of upper and lower supporting arm assemblies **48** and **50** which are pivotally secured to the mold plates **26** and **27** and project outwardly through the respective pylons **22** and **24**.

The support assemblies **48** and **50** are of identical construction, one being shown in enlarged scale in Figure 5. The assemblies each include a cylinder **52** extending through a suitable opening in the pylon and rigidly secured to end plates **54** and **56** secured by a suitable means to the outer and inner surfaces of the pylon, respectively. The cylinder **52** slidably carries a piston-like member **58**, which is locked against rotation by a pin **60** which slides in a groove **62** in the wall of the cylinder. An actuating spindle **64** projects outwardly through a bushing **66** se-

cured by suitable means to the outer plate 54. Axial movement of the actuating screw 64 through the bushing 66 may be selectively prevented or permitted by a locking rod 68 which is movable into or out of engagement with a groove 70 in the spindle by a lever 72 pivoted on the plate 54.

The inner end of the piston member 58 carries a ball socket assembly 74 in which a ball 76 rigid with the outer end of a link 78 is received. A similar ball 80 rigid with the inner end of the link 78 is received in a ball socket assembly 82 suitably secured for example by welding to the outer surface of one of the vertical stiffening members 42. When the lock 68 is released, the actuating screw piston assembly and link may move freely through the cylinder 52. However, when the lock 68 is engaged, the position of the link 78 can be adjusted only by rotation of the actuating screw 64 which may conveniently be effected by rotation of a suitably formed wrench receiving head 84 on the outer end of the screw 64.

The weight of the side mold sections is supported by rollers 86 which ride along transverse tracks 88 mounted on the tops of the pylons and which are connected by straps 90 to the upper ends of the side mold sections.

If desired, the support assemblies shown in Figure 5 may be replaced by assemblies in which the links 78 or equivalent numbers form rigid extensions of the pistons 58 and are thus capable of supporting the weight of the side mold sections. In this case the roller and track supporting assemblies may be omitted.

The bottom plate assembly 28 includes a rigid welded frame construction 92 on which a plurality of longitudinally extending wooden planks 94 are supported, the planks in turn supporting a thin sheet 96. If desired, the sheet 96 may comprise a number of small strips extending transversely of the longitudinal axis of the beam to be cast to facilitate the bending of the base plate construction necessary to cast longitudinally curved beam sections. It will be noted that the lateral dimensions of the planks 94 and the cover sheet 96 are such as to permit the assembly to fit between the lower edges of the side plates 26 and 27 with very small clearance.

Mounted beneath the bottom platform assembly 28 on suitable hydraulic jacks 98 are vibrator assemblies 100 which are adapted to engage the bottom surface of the platform assembly 28 for compacting the concrete when it is poured into the mold.

The concrete is preferably poured into the mold by a truck or dolly 102 mounted for movement along the mold on tracks 104 mounted on the tops of the pylons 22 and 24.

A top cover plate assembly 106 including a section 108 adapted to fit in close clearance relation with the upper ends of the side plates 26 and 27 is supported above the mold assembly by cables 110 which run over pulleys 112 mounted on a suitable superstructure indicated generally at 114. Suitable counterweights 116 are provided to assist in raising or lowering the assembly 106.

The end of the mold assembly is shown in detail in Figures 6 and 7, Figure 6 showing the support assemblies 48 and 50 adjusted to permit the casting of a curved beam section. The end of the beam to be cast is formed by a frame-like assembly 120 which extends vertically of the mold and is provided with upper hook-like flanges 122 and 124 which fit over the upper edges of the side mold plates 26 and 27, respectively, and are adjustably held in place along the mold members by clamp nuts 126. Frame assembly 120 is also provided with a bottom flange 128 which rests on the upper surface of the sheet 96 of the platform assembly 28. The frame assembly 120 also has a central opening 129 having the same contour as the outer surface of the inner mold section 36.

Mounted above and below the inner mold section 36 on shafts 130 and 132 secured to the side flanges of the frame assembly 120 are upper and lower rollers 136 and 138, respectively, which have concave surfaces conforming to the exterior configuration of the upper and lower surfaces of the inner mold section 36. Thus the rollers 136 and 138 support the inner mold section during the molding operation and permit withdrawal of the inner mold assemblies after the initial molding operation has been completed. An identical frame assembly, indicated generally at 140 also having the upper and lower rollers 136 and 138 is provided at the outer end of the main mold assembly to provide additional support for the inner mold sections.

Also it will be understood that additional frame assemblies corresponding to the assemblies 120 and 140 are provided at the opposite end of the main mold assembly. Accordingly, the length of a particular beam to be cast will be determined by the position of the inner end frame member assemblies 120.

To prepare the mold assembly thus far described for use, the movable platform assembly 28 is moved into position under the mold and lowered onto the fixed supporting surfaces formed on the pylons. If desired the platform assembly may be locked in position. Next the end frame assemblies are brought into position to determine the length of the beam and are temporarily secured to the platform 28. Then the inner mold sections 34 and 36 are inserted into the interior of the mold from the opposite ends of the assembly. The inner mold sections may be temporarily positioned by placing blocks beneath them. Thereafter the mold side wall sections 26 and 27 are brought together and the several stay assemblies 48 and 50 are adjusted to make the side wall sections exactly straight or to impart any desired degree of curvature to them. The spacing between the lower ends of the mold sections 26 and 27 will be determined by the end assemblies and by the planks 94 and the cover sheet 96. Temporary spacers may be inserted between the upper surfaces of the molds to assure the proper spacing at this position.

After final adjustment of the support assemblies 44 for the inner mold sections 34 and 36 the mold is filled with concrete with the use of the conveyor or truck 102. The vibrators are operated to prevent the formation of voids in the beam and the cover assembly 106 is lowered onto the mold and maintained in this position until the concrete has partially set. After a few hours the cover assembly is removed and the two halves of the two inner mold sections 34 and 36 are withdrawn slightly to facilitate their subsequent removal which is effected shortly thereafter.

Subsequently after further hardening of the concrete the outer mold sections 26 and 27 are withdrawn. Preferably this is accomplished by releasing the locks 68 which hold the stay assemblies 48 and 50 in place. Subsequently the platform assembly 28 is raised and it is moved out of the mold sections carrying the beam over external tracks not shown. The beam may be left on the platform assembly 28 until it has hardened sufficiently to be lifted from the plate. The process may then be repeated using a second movable base plate assembly 28. The use of the additional base plates facilitates the fabrication of the beams as a substantially continuous operation.

Figure 8 to which detailed reference will be made discloses a slightly modified form of the invention. The general arrangement of the mold assembly of Figure 8 is the same as that described above. However, the opposite outer mold halves 150 and 152, which are adjustably supported in the manner described above, are flat sheets to form straight sided beams.

The movable platform assembly 28 described above is replaced by a modified movable platform assembly 150 indicated generally at 154. The assembly 154 comprises a lower frame structure 156 supported for movement along the rails 31 on wheels 158 and an upper frame section 160 which forms the bottom of the mold. It will be noted that the width of the upper section is greater than the distance between the outer mold sections 150

and 152 so that the flat sheet 162 which forms the bottom of the mold does not fit between the mold sections but rather extends laterally beyond them to facilitate the casting of curved beams. The upper and lower frame sections 160 and 156 are adjustably secured together by spindles 164 which are provided with hand wheels 166 so that the upper section may be variably tilted with respect to the lower section. Several such spindles 164 are preferably provided along the length of the platform assembly 154 so that the sheet 162 may be twisted as well as inclined to facilitate the casting of beams of widely varying configuration.

In this form of the invention the inner mold assemblies 167 are adjustably supported by rods 168 from transverse cross beams 170 received in notches or openings in the upper portion of outer mold sections 150 and 152. In addition to the vibrators 100 provided at the lower side of the mold, additional vibrator assemblies 172 are provided above the mold. The vibrators 172 are mounted on cross-beams 173 which may be moved longitudinally of the assembly over rails 174 and the vibrators act on cross members 175 extending over the top of the mold. A vibrator comprising weight 176 mounted on a shaft 177 running through the inner mold section and driven by any suitable means not shown is also provided in the assembly of Figure 8.

In the apparatus in Figure 8 the top cover plate of the mold may be omitted and if desired be replaced by a scraper. The apparatus of Figure 8 also includes means for withdrawing air and water from the interior of the mold including a vacuum system having flexible intake hoses 178 leading to the bottom of the mold at spaced points along its length. The lines 178 enter the mold behind a filter cloth 180 which is positioned over a protective wire net 182.

If desired, suitable packings 184 made of rubber or the like may be installed at the junction of the bottom sheet 162 and the side mold sections 150 and 152 to provide seals at these points.

It should be understood that in all cases the surface of the beam resting on the lower movable platform assemblies 28 or 154 forms the top surface of the beam. This facilitates the formation of a smooth top beam surface which is essential to satisfactory use of the beam. For this reason the top cover plate 38 may be replaced by scraper or eliminated entirely without affecting the quality of the running surfaces of the beam.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A mold assembly for use in fabricating elongated straight, curved or twisted concrete beam structures comprising a rigid elongated foundation structure, a plurality of support members rigid with said foundation structure and extending vertically upwardly from the lateral edges of said foundation structure at spaced points along the length thereof, flexible sheet-like side mold assemblies, means supporting said side mold assemblies on said vertical support members for shifting movement toward and away from the longitudinal center of said foundation and for bending and twisting movements, a flexible bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies, tracks carried by the lower portion of said foundation structure and extending longitudinally thereof, a wheeled frame movable along said tracks, means adjustably mounting said bottom mold assembly on said frame for selective vertical shifting movement with respect thereto and end mold assemblies carried by said side mold assemblies for forming the ends of said beam structures.

2. A mold assembly for use in fabricating elongated concrete beam structures comprising, a rigid elongated foundation structure, a plurality of support members rigid with said foundation and extending vertically upward from the lateral edges of said foundation at spaced points along the length thereof, flexible sheet-like side mold assemblies, upper and lower sets of support means supporting said side mold assemblies from said vertical support members for shifting movement toward and away from the longitudinal axis of said foundation and for bending and twisting movements, a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies, means mounting said bottom mold assembly for movement longitudinally of said foundation and of said support members, end mold sections adapted to form the ends of said beams, and means for supporting said end mold assemblies from said side mold assemblies at any desired point along the length of the latter.

3. A mold assembly for use in fabricating hollow elongated fixed concrete beam sections comprising, a rigid elongated foundation structure, a plurality of support members rigid with said foundation and extending vertically upwardly from said foundation at spaced points along the lateral edges thereof, flexible sheet-like side mold assemblies, upper and lower sets of support means supporting said side mold assemblies from said vertical support members for shifting movement toward and away from the longitudinal axis of said foundation and for bending and twisting movements, a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies, means mounting said bottom mold assembly for movement longitudinally of said foundation and said support members, end frame sections adapted to form the ends of said beam sections and adjustably supported from said side mold assemblies, a pair of inner mold assemblies adapted to form the interior of said beam sections, and means supporting said inner mold assemblies on said end frame members for shifting movement longitudinally of said foundation.

4. A mold assembly according to claim 3 together with additional means extending transversely through said side mold assemblies for supporting said inner mold assemblies adjacent the inner ends thereof.

5. A mold assembly for use in fabricating elongated concrete beam structures comprising, a rigid elongated foundation structure, a plurality of support members extending vertically upwardly from said foundation at spaced points along the lateral edges thereof, flexible sheet-like side mold assemblies, transverse tracks mounted on said vertical support members, means for supporting said side mold assemblies from said tracks for shifting movement toward and away from the longitudinal axis of said foundation, upper and lower sets of adjusting means mounted in said vertical members and connected to said side mold assemblies at spaced points along their length for shifting said side mold assemblies along said tracks and for bending and twisting said side mold assemblies, a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies, means mounting said bottom mold assembly for movement longitudinally of said foundation said last mentioned means including means operatively connected to said bottom mold assembly for tilting said bottom mold assembly about an axis parallel to the longitudinal axis of said foundation, and end mold assemblies carried by said side mold assemblies for forming the ends of said beam structures.

6. A mold assembly for use in fabricating elongated concrete beam structures comprising a rigid elongated foundation structure; laterally spaced support structures rigid with said foundation and extending vertically up-

ward from said foundation along the length thereof; flexible sheet-like side mold assemblies; spaced upper and lower sets of support means supporting said side mold assemblies from said vertical support structures for shifting movement toward and away from the longitudinal axis of said foundation and for bending and twisting movements; a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies; means mounting said bottom mold assembly for movement longitudinally of said support structures; end mold sections adapted to form the ends of said beams; and means for supporting said end mold sections to form beams of predetermined length.

7. A mold assembly for use in fabricating elongated concrete beam structures comprising a rigid elongated foundation structure; laterally spaced support structures rigid with said foundation and extending vertically upward from said foundation along the length thereof; flexible sheet-like side mold assemblies; upper and lower sets of support means supporting said side mold assemblies from said vertical support structures for shifting movement toward and away from the longitudinal axis of said foundation and for bending and twisting movements: mold sections adapted to form the ends of said beams; a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies; and means for removing said bottom mold carrying a formed concrete beam structure from the space between said vertical support structures.

8. A mold assembly for use in fabricating elongated hollow concrete beam structures comprising: a rigid elongated foundation structure; a plurality of support members rigid with said foundation and extending vertically upward from lateral edges of said foundation at spaced points along the length thereof, flexible sheet-like side mold assemblies; a plurality of vertically and longitudinally spaced means supporting said side mold assemblies from said vertical support members for shifting movement toward and away from the longitudinal axis of said foundation and for bending and twisting, a bottom mold assembly adapted to extend across the space between the bottom edges of said side mold assemblies; adjustably mounted mold sections adapted to form the ends of said beams; a removable core mold assembly adapted to be supported between said side and end mold assemblies; and means for removing said bottom mold assembly carrying a formed beam from between said support members.

9. The combination as set forth in claim 8 together with means for vibrating the mold assemblies during the pouring of concrete to form the beam structure.

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