Jan. 8, 1963 L. F. TUMEY 3,071,833

MOLDING APPARATUS

Filed March 21, 1960 5 Sheets-Sheet 1

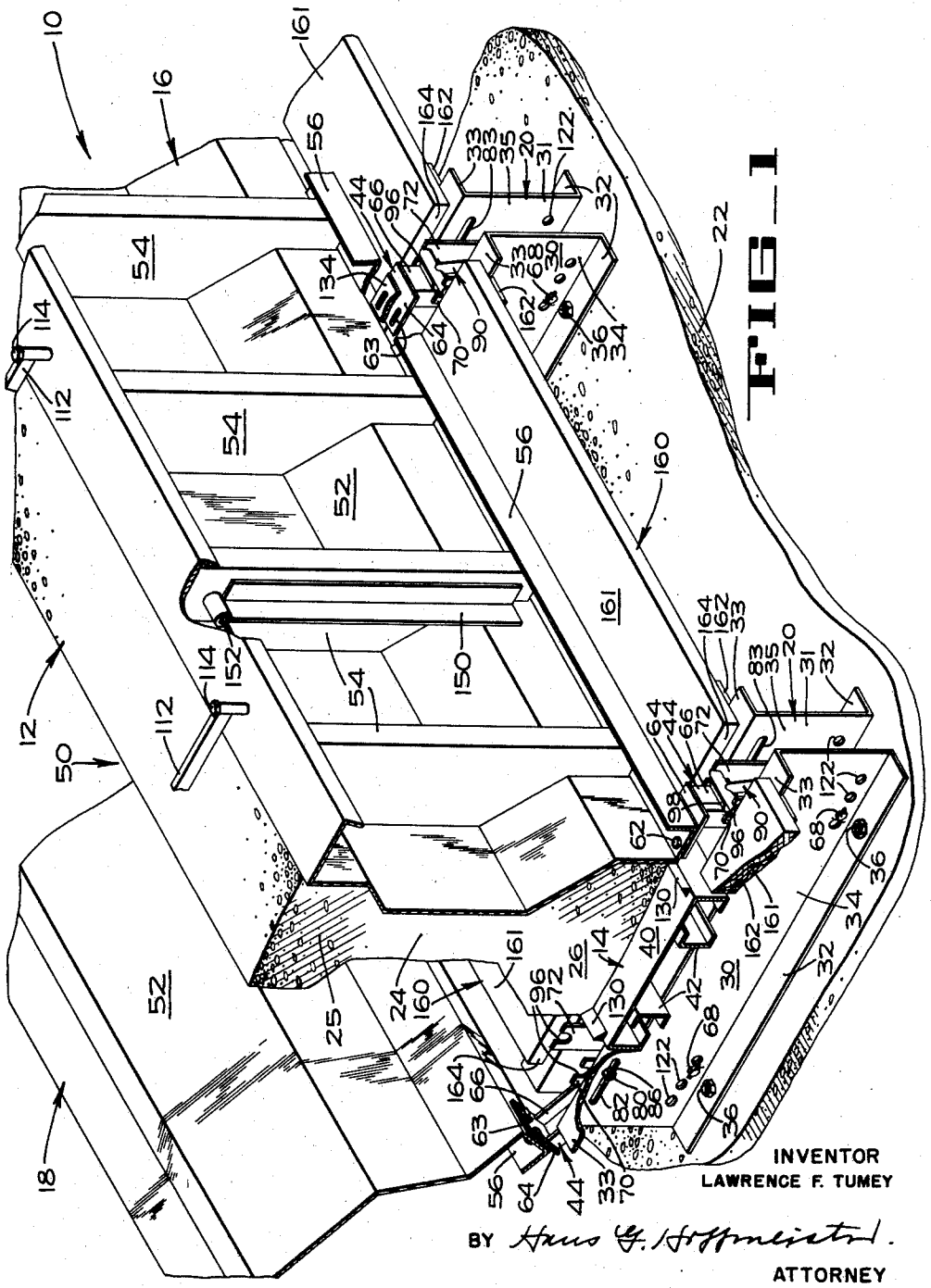


FIG. 1

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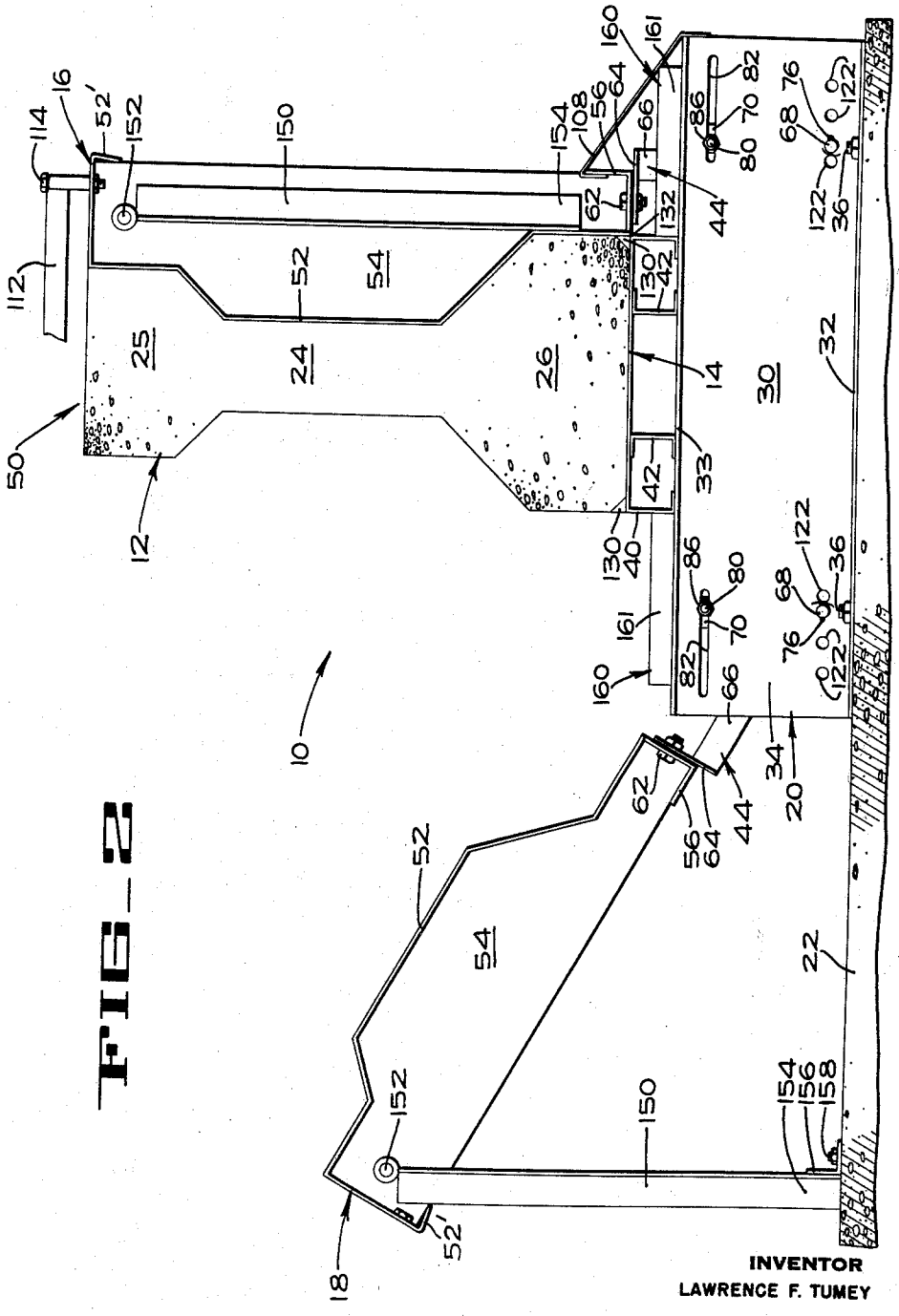


FIG. 2

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MOLDING APPARATUS

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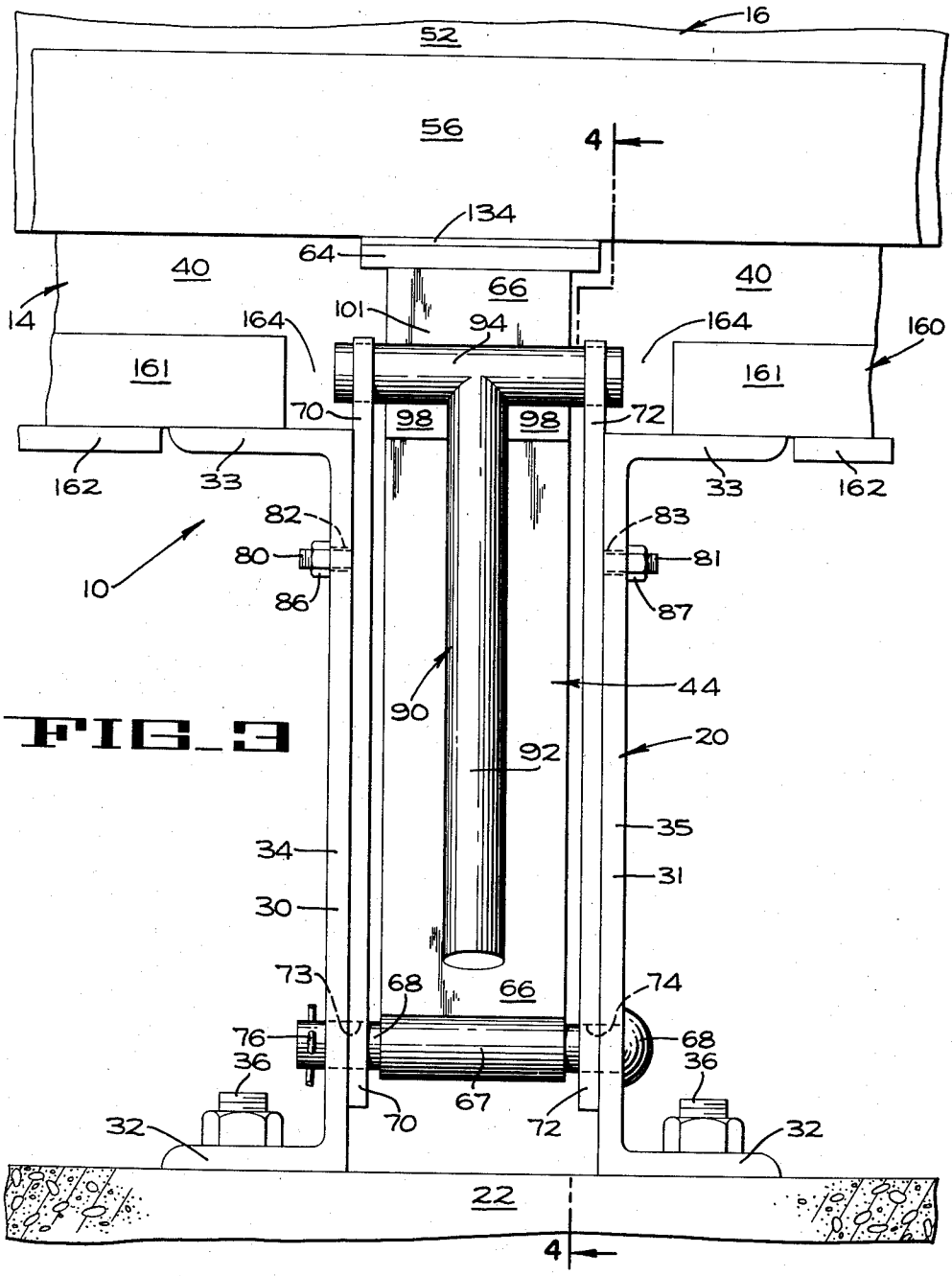



FIG. 3

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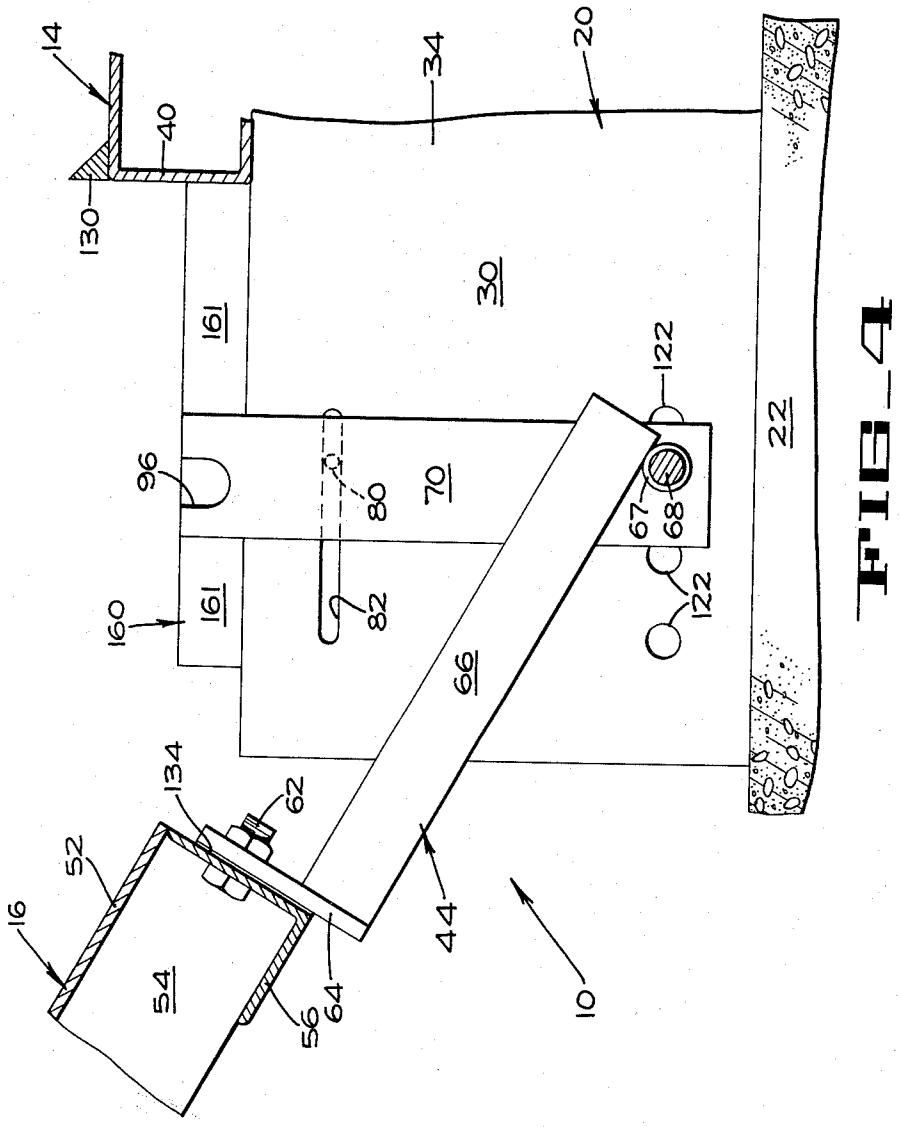



FIG. 4

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MOLDING APPARATUS

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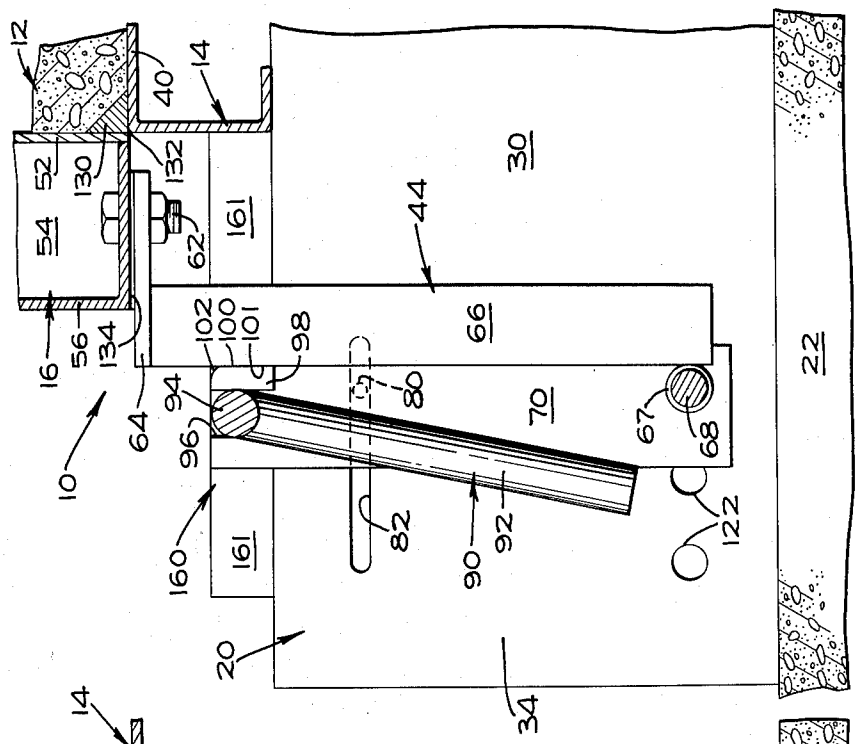



FIG. 6

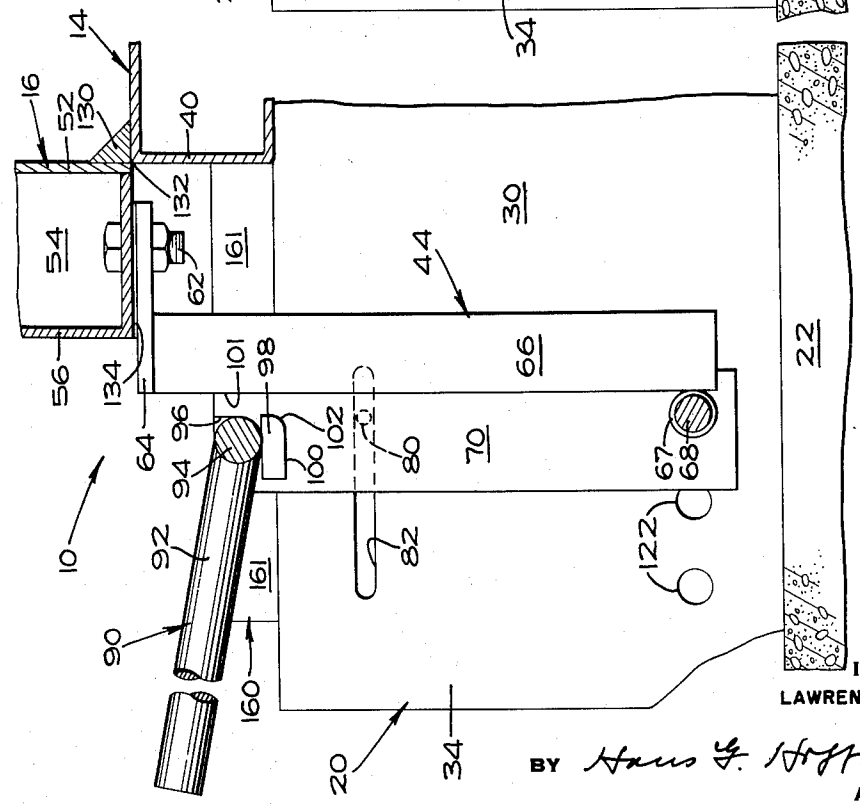



FIG. 5

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United States Patent Office

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# 3,071,833
# MOLDING APPARATUS

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4 Claims. (Cl. 25—121)

This invention pertains to a molding apparatus for forming structural members of concrete or like material and more particularly relates to forms in which concrete girders and I-beams can be cast.

Presently used forms for concrete girders and I-beams have several shortcomings; for example, they require cumbersome fasteners such as bolts and wedges, the sides of some of these forms do not pivot apart, and in the designs which do pivot apart, the opening between the sides of the form is too narrow to permit workmen access to the interior of the form. The pivoted apart sides of presently used forms are supported in their open position by large cradles which are bolted to the casting bed adjacent the sides of the form and these cradles are frequently in the way of working crews and mobile equipment. Presently used forms are not readily or completely adjustable to produce girders of different sizes and because of these shortcomings, these forms are expensive of both time and labor.

An object of the present invention is to provide an improved form for molding structural members of concrete or like material.

Another object of the invention is to provide a form whose sides pivot apart to permit free access to the interior of the form.

Another object is to provide a form which offers complete adjustability of the length and thickness dimensions of the molding cavity, thus making it possible to produce girders in a wide range of sizes.

Another object is to provide a girder forming structure which has a coarse and a fine adjustment for girder thickness.

Another object is to provide improved supports for the pivotally mounted sides of a girder form which supports operate automatically when the sides are moved to their stripping positions.

Another object of the invention is to provide an improved locking assembly for the movable sides of a girder form.

These and other objects and advantages of the invention will be apparent from the following description taken in conjunction with the acompanying drawings, in which:

FIGURE 1 is a fragmentary perspective showing a center portion of the girder forming apparatus of the invention and of a finished girder therein.

FIGURE 2 is an end elevation of the girder mold and the girder of FIGURE 1.

FIGURE 3 is a side elevation on an enlarged scale of a locking assembly for one side member of the mold.

FIGURE 4 is a section along line 4—4 of FIGURE 3 illustrating a portion of the side member of that figure in the position which it occupies when the mold is open.

FIGURES 5 and 6 are sectional views similar to FIGURE 4, showing the mold side member thereof in the position which it occupies when the mold is closed, and illustrating successive steps in the operation of a locking device used in conjunction therewith.



The forming apparatus **10** (FIGS. 1 and 2) for concrete girders such as that indicated at **12** comprises an elongate pallet or base forming member **14** and a pair of opposed side walls or side forming members **16** and **18**. Several piers **20** support the pallet and the side walls above a concrete casting bed **22**. A girder **12** cast in the forming apparatus **10** comprises a vertical web section **24**, an upper flange portion **25**, and a larger lower flange portion **26**. Girders of any desired length, width and depth dimensions, can be made, within reasonable limits, and they may or may not be prestressed by means of tensioned cables not shown.

The several piers **20** are placed at intervals along the casting bed **22** and support the molding apparatus **10** and the girder formed therein. Each pier **20** (FIGS. 1, 2 and 3) is constructed of two spaced apart channel members **30** and **31** standing on edge and the lower flange **32** of each channel member is bolted to the casting bed **22** by bolts **36**. The upper flange **33** of each channel member provides a surface for supporting the elongate pallet **14**. The upper and lower flanges of the channels **30** and **31** are connected by upright webs **34** and **35**, respectively.

The pallet **14** provides a continuous support for the cast girder **12** and comprises an inverted U-shaped member **40** (FIGS. 2 and 3) which rests on the upper flanges **33** of the several piers **20**. Longitudinally extending channel members **42** are welded to the undersurface of the U-shaped member **40** and are coextensive therewith to impart additional stiffness to the pallet **14**.

The two elongate side walls or side forming members **16** and **18** (FIGS. 1 and 2) of the apparatus are each pivotally connected to all of the piers **20** on hinge assemblies **44**. The side forming members **16** and **18** are independently movable to mold forming, erect positions wherein the pallet **14** and the side forming members **16** and **18** define a molding cavity **50** (FIG. 2) for receiving the wet concrete, or, alternatively, to stripping or open-mold positions wherein they are spread apart and thus permit the free removal of a cast girder therefrom. The stripping position of side wall **18** and the erect position of the side wall **16** are illustrated in FIGURES 1 and 2.

Since the side forming members **16** and **18** are identical in construction, corresponding parts of both will receive the same reference numerals, although only the side member **16** will be described in detail. The side forming member **16** (FIGURES 1 and 2) includes a forming wall **52** made from a sheet of steel and bent longitudinally to conform to the desired cross-sectional shape of the side of the girder **12** to be cast. Stiffening plates **54** (FIGS. 1 and 2) are welded to the outside of the wall **52**. The bottom edge of the wall **52** and the lower ends of the several plates **54** are welded to an elongate angle member **56**. The angle member **56** is connected to several individual hinge assemblies **44** (FIGS. 1–6), two of which are connected to each of the piers **20**, one on each side of the mold **10**, i.e., one for each of the mold sides **16**, **18**. All of the hinge assemblies on one side of the mold **10** are connected to the mold side member **16** by bolts **62** extending through the angle member **56** and through holes **63** in plates **64**, one of which is associated with each hinge assembly **44**. As shown most clearly in FIG. 4, each plate **64** is welded to the upper end of a support arm **66**. A horizontal cylindrical bearing **67** (FIGS. 3–6) is secured to the lower end of each support arm **66** and is

adapted to receive a headed pintle pin 68. The pintle pin 68 is mounted between the upright webs 34 and 35 of the two channels 30 and 31, respectively, of a pier 20, as best shown in FIG. 3. A pair of locking plates 70 and 72 are placed adjacent each side of the support arm 66 (FIG. 3) and between the upright webs 34 and 35 of the channels 30 and 31. The locking plates 70 and 72 are each provided with a hole 73 and 74 (FIG. 3) for receiving the pintle pin 68, which is releasably maintained in place by a cotter pin 76 (FIG. 3).

The locking plates 70 and 72 have laterally projecting bolts 80 and 81, respectively (FIGS. 3–6), welded thereto adjacent their upper ends. Each bolt 80 and 81 projects through a respective slot 82 and 83 in the adjacent channel member 30 and 31, respectively. The pair of locking plates 70 and 72 are adapted to pivot a short distance on the pivot pin 68 and are secured to the associated channel member 30 and 31 in a selected position of adjustment by means of nuts 86 and 87 (FIG. 3) on the bolts 80 and 81, respectively.

When the side forming member 16 is swung from its stripping position into its erect position, the hinge assemblies 44 associated therewith swing upward and inward about their pivot pins 68. The hinge assemblies 44 and the connected side forming member 16 are retained in their erect position by a plurality of removable locking levers or force applying members 90 (FIGS. 3, 5 and 6), one of which is provided for each locking assembly 44. Each locking member 90 includes a handle 92 and a cross bar 94 fastened to one end of the handle. The ends of the cross bar 94 are adapted to fit into slots 96 (FIGS. 1 and 4–6) cut into the tops of any of the pairs of locking plates 70 and 72. Welded to the cross bar 94 is a cam block 98. After the side forming member 16 is swung into its erect position, a locking member should be applied to each of the several locking assemblies of that side member. The cross bar 94 of each locking member 90 is inserted into the receiving slots 96 of a pair of the locking plates, as shown in FIG. 5, and the handle 92 is then swung downward, to the position illustrated in FIG. 6. This rotates the bar 94 approximately 90 degrees, forcing the cam block 98 against the associated support arm 66.

It will be observed in FIGURE 5 that the cam block 98 includes a flat surface 100 which is adapted to abut flat against the front face 101 of the support arm 66 and a rounded corner 102 that merges into the surface 100. The distance which separates the rounded surface 102 and the central longitudinal axis of the cross bar 94 is greater than the separation between the flat surface 100 and said axis. The cam block 98 thus presents a high surface 102 which must be forced past the flat surface 101 when the handle 92 is lowered. The locking member 90 thus snaps over center just prior to arrival of the hinge assembly 44 in its final pressure applying position, thereby locking the parts in their operative position so securely as to preclude their accidental dislodgement therefrom, and yet permitting easy and almost instantaneous release thereof when opening of the mold 10 is desired.

The mechanical advantage inherent in the relatively long handle 92 and the short radial distance of the camming surface 102 of the block 98 from the axis of the bar 94, enables an operator to apply very heavy inward pressure to the several support arms 66 of the side member 16 by turning downward the handles 92 of all of the locking members 90 associated therewith. In this manner the lower edge of the side member 16 is pressed against the pallet 14 so forcefully as to preclude leakage therebetween when fluid concrete is placed within the mold 10. The handle 92 is attached to the bar 94 at an acute angle to the surface 100 of the cam block 98 (FIG. 6) so that the handle projects outward and can be more easily grasped when the hinge assembly 44 is to be opened.

Whereas the construction and manner of operation of only the mold side member 16 and its associated hinge supports and hinge members have been described, it will be understood that the opposite mold side member 18 and its associated hinge supports and hinge members are of the same construction and are similarly operated.

Some of the green concrete mix is apt to be spilled out of the form when a girder is being cast therein; therefore, to prevent this material from fouling the hinge assemblies 44, a shield member 108 (FIG. 2) is placed over each hinge assembly 44 by being hooked over the angle member 56 as shown in FIG. 2.

The girder forming apparatus 10 is made more rigid when it is being prepared to receive concrete mix by the attachment of several tie bars 112 (FIGS. 1 and 2) between the upper portions of the side forming members 16 and 18, to which the bars 112 are connected by suitable bolts 114.

The length dimension of the mold cavity is adjustable because the side forming members 16 and 18 and the pallet 14 are provided in sections of various lengths which are interchangeable and any desired assortment of which are adapted to be connected together to provide a girder form of the desired length.

The thickness dimension of a girder to be cast is determined by the separation of the two side forming members 16 and 18. To prepare the mold 10 for the casting of a girder of a certain thickness, a pallet 14 whose width corresponds to the desired girder width is placed on the piers 20 and the separation of the side forming members is changed to conform to the width of the new pallet. The separation of the side forming members is adjusted by moving the pivot pins 68 to appropriate holes 122 (FIGS. 1, 4 and 5) in the channel members 30 and 31 of the pier 20. It will be apparent that several pairs of holes 122 can be made in the channel members 30 and 31 to provide a wide range of thickness dimensions of the girders which it will be possible to cast therein. In their erect positions, the side forming members are adjusted to tightly engage a chamfering strip 130 (FIGS. 1 and 2) which is connected to the outer longitudinal edges of the pallet 14 in order to form a part of said pallet. The placement of the hinge assembly pivot pins 68 in the holes 122, and the width of the pallet, are chosen to ensure a tight, leak-proof joint 132 (FIG. 5) between each chamfering strip 130 on the pallet 14 and the wall member 52 of the associated side forming member. Toward this same end, a spacer strip 134 may be interposed between each side member 16, 18 and the plate 64 of the several associated locking assemblies 44, thus to attain the optimum relation of the form side member to the pallet when the mold is closed.

The placement of the locking assembly pivot pins 68 within a selected pair of holes 122 provides a coarse adjustment for the separation of the side forming members 16 and 18. However, two fine adjustments are available either or both of which can be used in the event that the coarse adjustment does not adequately seal the inner surfaces of the side forming members 16 and 18 against the pallet when the locking members 90 have been inserted. One fine adjustment is accomplished by loosening the nuts 86 and 87 on the bolts 80 and 81, respectively, and sliding the bolts 80 and 81 along the slots 82 and 83 so as to pivot the attached locking plates 70 and 72, respectively, toward the center of the girder forming apparatus. A fine adjustment of the seal effected against the chamfering strip 130 is thus provided by the locking plates 70 and 72 and this fine adjustment is available regardless of which of the coarse adjustment holes 122 are used.

A second fine adjustment of each side forming member 16 and 18 is provided by slotting the holes 63 (FIG. 1) in the plate 64 connected to the support member 66 of each hinge assembly 44. The position of a side forming member relative to the plate 64 may thus be adjusted by adjusting the side forming members on the bolts 62 in the slotted holes 63. Efficiency of the seal

effected against the chamfering strip **130** can thus be assured.

After placing a locking member **90** on each of the hinge assemblies **44** and actuating the several locking members as above described, the girder forming apparatus **10** is completely prepared to receive green concrete mix. The locking members **90** exert a constant force on the support members **66** of the hinge assemblies **44** which maintains the side forming members erect and ensures that susbtantially no leakage will occur at the joints **132** between the pallet and a side forming member.

Both of the side forming members **16** and **18** are provided with several struts **150** (FIGS. 1 and 2) each of which is connected by a pivot bolt **152** to the upper portion of one of the stiffening plates **54** of the associated side forming member. When a side forming member (FIG. 2) is swung to its stripping position, the struts **150** freely swing under the influence of gravity about their respective pivot bolts **152** and automatically assume the vertical supporting position shown in FIGURE 2. The lower ends **154** of the struts **150** contact the upper surface of the casting bed **22** at a point directly below the pivot bolts **152** and support the associated side forming member of the apparatus in its stripping position. An angle member **156** is connected by bolts **158** to the casting bed in position to prevent the struts from being inadvertently knocked out from under the respective side forming member. As illustrated in FIG. 2, in their supporting positions the struts contact a downturned flange **52'** on their corresponding side forming members.

Bridging each pair of adjacent piers **20** adjacent the ends thereof is a catwalk **160** (FIGS. 1 and 2). The catwalk **160** is made from one or more wooden boards **161** and each board has a cleat **162** (FIG. 3) nailed to its undersurface near each of its ends for preventing the board from shifting longitudinally with respect to the piers upon which it rests. These catwalks provide runways to facilitate movement of workmen and equipment on both sides of the pallet **14**. The catwalks **160** are at an elevation which is substantially the same as the elevation of the pallet, and therefore at a considerable height above the axes about which the side members **16** and **18** pivot as they move to and from mold closing relation. Therefore, the arms **66** which connect the side members to their bearing members **67** are quite long, with the result that when the side members are swung outward to their stripping positions, they are swung beyond the catwalks **160** from the pallet as clearly shown in FIGS. 2 and 4. Because of this arrangement, workmen can move comfortably and freely as they work with stressing cables and other equipment, not shown, in the interior of the apparatus **10** without having to reach over or around the side forming members **16** or **18**. It will be noted that the catwalks **160** can be permanently attached to the piers **20** because the boards **161** extend only part way across the upper flanges **33** of the channel members of the piers and not across the space between the two channel members **30** and **31** of the piers. Therefore a gap or opening **164** (FIGS. 1 and 3) remains between the ends of the adjacent boards **161** and these gaps permit the support member **66** of each of the locking assemblies to move into its respective gap as the side form is raised or lowered on the hinge assemblies **44**.

While a particular embodiment of the present invention has been shown and described it will be understood that the apparatus is capable of modification and variation without departing from the principles of the invention and that the scope of the invention should be limited only by the scope and proper interpretation of the claims appended hereto.

Having thus described the invention, that which is claimed as new and which is desired to be protected by Letters Patent is:

1. Apparatus for forming moldable substance which comprises a casting bed; a plurality of piers supported on said casting bed, each pier including two spaced apart channel members forming a gap; a pallet spanning the plurality of piers; a side forming member located at each side of said pallet; a plurality of hinge assemblies located in said gap and pivotally connecting each side forming member to said piers, said hinge assemblies each including a pivot pin connected between the channel members of one of the piers, said pivot pin being adaptable to fit in a plurality of positions between the channel members, a support arm pivotally connected to said pivot pin, and means for adjustably fastening said support arm to one of said side forming members; a lever receiving member located adjacent to each side of each of said support arms, a receiving slot in the upper end of each lever receiving member, each lever receiving member being pivotally mounted on the associated one of said pivot pins for movement toward and away from said pallet; means releasably fastening each receiving member to its adjacent channel member in selected spaced relation to said pallet; and a locking lever for each of said hinge assemblies mounted in said receiving slots for pivotal movement into abutment with the associated support arm for forcing the forming member fastened thereto into sealing engagement with the pallet to prevent leakage of moldable substance therebetween.

2. In a molding apparatus, a support, a base forming member mounted on said support and having a substantially horizontal upper surface and opposite side edges, a side forming member having inner and outer surfaces and upper and lower edges, means pivotally mounting said side forming member for movement between a mold forming position with its inner surface in mold-forming relation with said base member and a mold open position with said side forming member spaced outward from said base member, an elongated rigid strut having an upper end pivotally connected to said side forming member adjacent to its outer surface and in upwardly spaced relation to its lower edge for swinging movement between a retracted position along said outer surface when said side member is in said mold forming position and a supporting position hanging downward from said side member and resting on said support when said side member is in said mold open position, and an abutment on said support between said strut and said base member and in the path of the swinging movement of said strut when the latter is in its supporting position thereby to limit the movement of said strut toward said base member, said side forming member having an upper stop on the opposite side of said strut from said abutment to limit pivotal movement of said strut away from said abutment in said supporting position of said strut.

3. In a molding apparatus, a support, a base forming member mounted on said support and having an upper surface and a side edge, a locking plate having a lower end portion pivotally connected to said support and an upper end portion movable toward and away from said side edge upon pivotal movement of said plate, means adjustably interconnecting said plate and said support for holding said plate in selected spaced relation to said side edge, an arm having a lower end portion pivotally mounted in said support for pivotal movement about the same axis as said plate, said arm having an upper end portion, a side forming member mounted on the upper end portion of said arm for pivotal movement therewith between a molding position in mold forming engagement with said base member and a mold open position in spaced relation to said base member, a camming member rotatably supported in said plate for rotation about an axis substantially parallel to and spaced upward from the pivot axis of said plate for movement into and out of wedging engagement between said plate and said arm when said side forming member is in molding position thereby to urge said side forming member into mold tight engagement with said base forming member, and means connected to said camming member for moving said cam-

ming member into and out of said wedging engagement.

4. A molding apparatus as set forth in claim 3 including a catwalk positioned on said support adjacent said base forming member, said side forming member being positioned on said arm to pivot over said catwalk upon movement between said molding position in which said catwalk is outside of said side forming member and said open position in which said catwalk is between said base and said side forming member.

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