

July 7, 1970

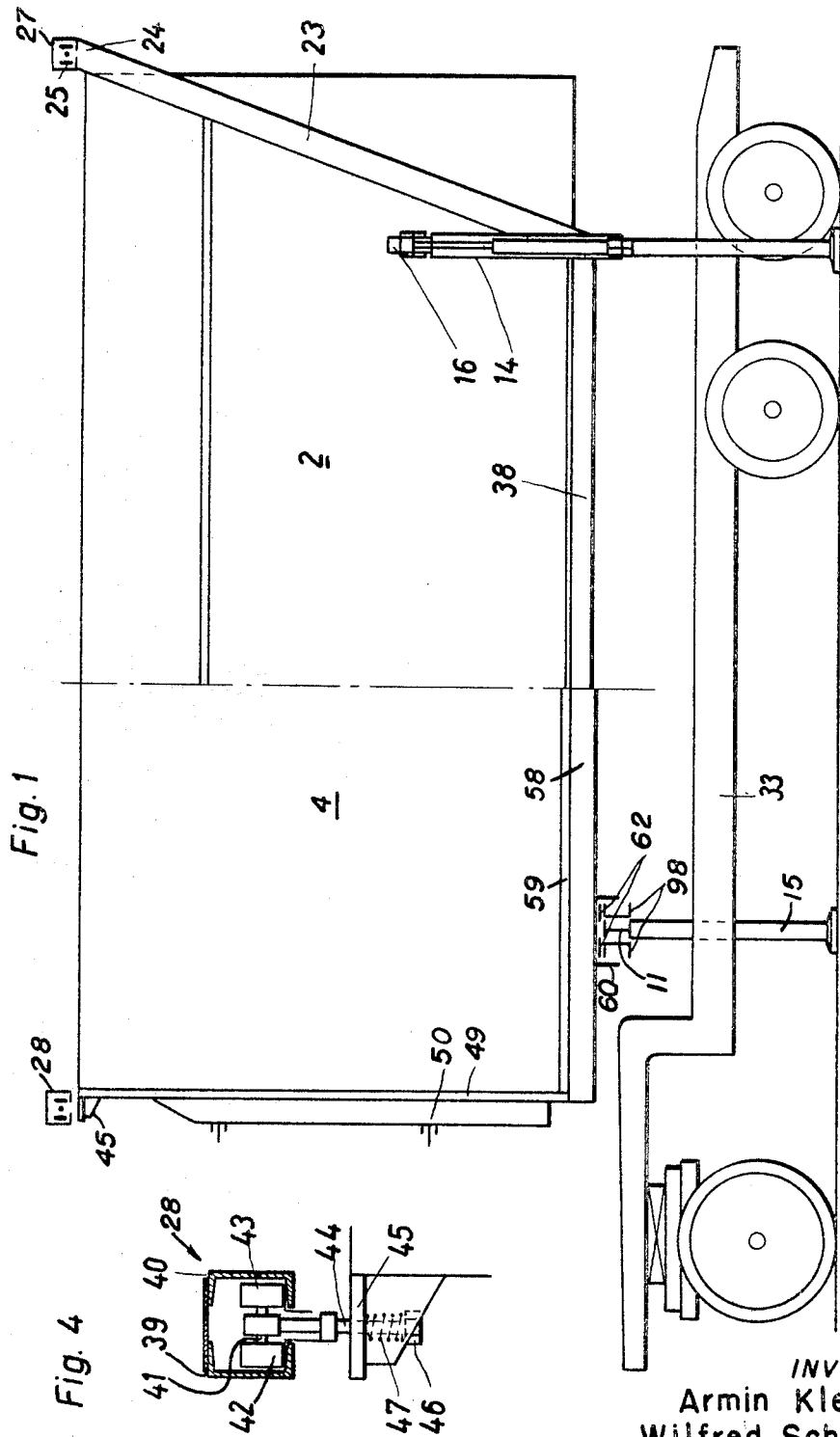
A. KLEIBER ET AL

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PORTABLE SLAB MOLD

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Fig. 2

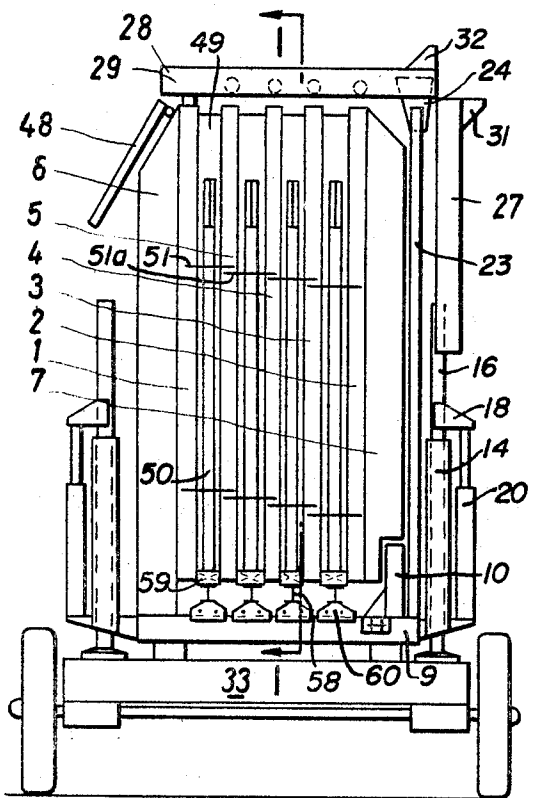


Fig. 5

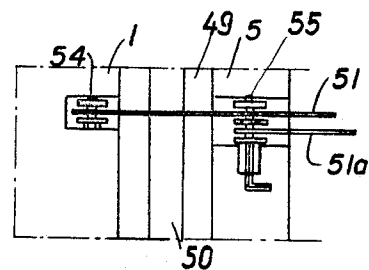


Fig. 6

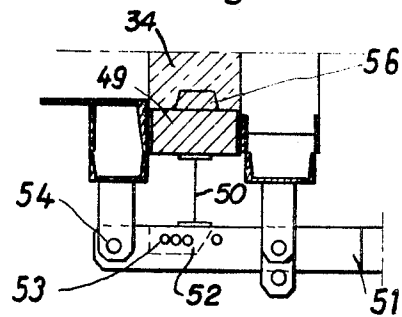
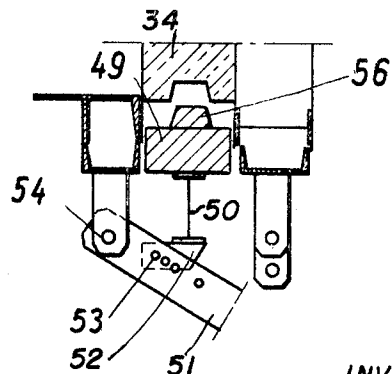


Fig. 7



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Fig. 3

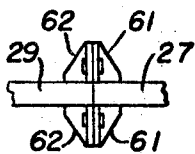
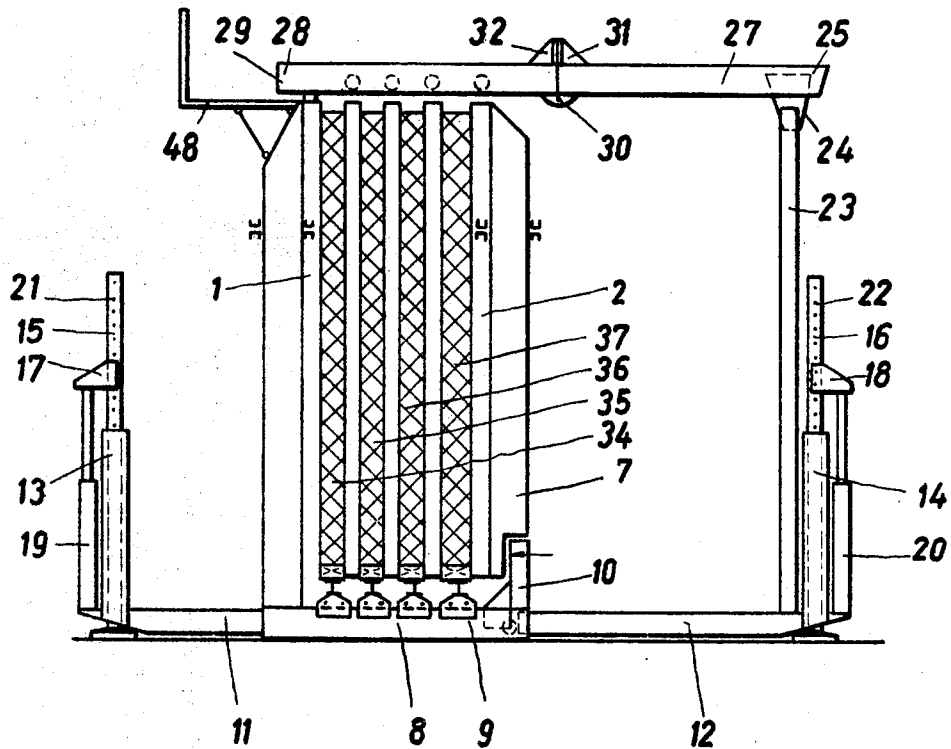


Fig. 3a

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3,519,243

PORTABLE SLAB MOLD

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K 60,030

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19 Claims

ABSTRACT OF THE DISCLOSURE

A slab mold for simultaneously producing a plurality of slabs and capable of being rapidly converted into a portable configuration, in which it can be carried on a conventional truck trailer, and of being rapidly erected for use at any desired location, the mold having extensible bottom girders and overhead girders and intermediate panels suspended from the overhead girders so as to be rollable therealong.

BACKGROUND OF THE INVENTION

The present invention relates to slab molds and particularly to molds for making a plurality of concrete slabs.

The invention is concerned with multiple casting molds for the simultaneous production of a plurality of large-size precast slabs, preferably of concrete, which molds essentially include end plates and a plurality of interposed intermediate panels suspended from longitudinal overhead girder means, with bottom support being provided by bottom girder means.

Both horizontal and vertical molds are known in the art for the production of large-size concrete slabs either in the plants of concrete component makers or at building sites. Vertical molds permit the labor costs to be substantially reduced because they permit a plurality of concrete slabs to be cast in a conventional manner between spaced shuttering panels.

Various forms of construction of such multiple molds for the simultaneous casting of up to twelve concrete slabs are available. The shuttering panels may be of timber, timber-faced steel, or full steel construction. The mold includes, between the suitably backed end plates which are flexurally stressed by the pressure of the concrete against one side thereof, a plurality of intermediate panels forming partitions which are stressed by the pressure of the concrete and are subject to some flexural stress due to differences in the concrete levels in different compartments.

A multiple mold of such type constitutes a conventional frame structure with the end plates and the adjoining side walls of the frame preferably having a U-shaped configuration. In conventional arrangements, the structure is composed of supports anchored in the ground and carrying a track frame having a rail from which the intermediate panels and the movable end plate are to be suspended. This known form of construction of a multiple mold is useful when the requirement for a large number of concrete slabs justifies the erection of a stationary production plant anchored into the ground at the production site. However, this limits the applicability of such a multiple mold to production plants or very large construction sites.

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SUMMARY OF THE INVENTION

It is a primary object of the present invention to avoid these drawbacks and difficulties.

Another object of the present invention is to permit large slabs of a settable material to be molded at any desired location.

A further object of the present invention is to facilitate the transportation and erection of such mold.

These and other objects according to the present invention are achieved, in a multiple casting mold for the simultaneous production of a plurality of large precast slabs, which mold is composed of end plates and intermediate panels defining the sides of the mold chambers, and frame means including overhead girder means from which the panels are suspended and bottom girder means supporting the panels, of the improvement wherein at least one of the girder means is extensible for facilitating the lifting of the mold, and the frame is of rigid construction and arranged to be lifted by lifting devices.

For erecting the multiple mold in working position the bottom girder means and the overhead girder means must have a minimum extended length to permit an economical number of slabs to be simultaneously cast. The extension for the girder means may be slidable or hinged with respect to the stationary member of the girder means so that in the retracted or lowered position of the extensions, the frame means have an overall width for transportation appropriate for loading the mold on a flatbed trailer. An alternative possible form of construction would consist in providing threadably attachable extensions or extensions adapted to be removed in some other way, so that they need not be fitted to the frame structure of the multiple mold until the latter is in position at the site where it is to be used. The bottom girders may be extensible at one or both ends.

Overhead girders which are extensible at one or both ends would likewise commend themselves as a useful arrangement because this facilitates separating the suspended partition panels to create a sufficiently wide working gap between them. Elements for cooperation with lifting means are provided to permit the multiple mold to be first lifted sufficiently to permit a flatbed trailer to be backed under the mold and the mold to be lowered on the platform of the trailer or, alternatively, to permit the mold to be lifted off the trailer and deposited on its foundations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partially in cross section along the line 1—1 of FIG. 2, of a mold according to the present invention about to be loaded on a trailer for transportation.

FIG. 2 is an end view of the mold of FIG. 1 mounted upon the trailer.

FIG. 3 is a cross-sectional end view of the mold in its working position on the ground.

FIG. 3a is a detail view of a modified form of construction of a portion of the arrangement of FIG. 3.

FIG. 4 is an enlarged detail view of a portion of the device of FIG. 1 showing the overhead girder and roller suspension.

FIG. 5 is a side view of the operating mechanism for the side panels of the device of FIG. 1.

FIG. 6 is a plan view of the side panel of the mechanism of FIG. 5 in the casting position.

FIG. 7 is a view similar to that of FIG. 6 of the mechanism in the release position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS 1, 2 and 3, where the left half of the mold structure shown in FIG. 1 is in cross section and the right half is in elevation, there is shown a multiple casting mold composed of end plates or panels, 1 and 2, defining the end surfaces of the mold. Only end plate 2 is visible in FIG. 1. A plurality of intermediate panels 3, 4 and 5 are provided between these end plates. The end plate 1 has secured thereto a pair of upright members 6, each of which is disposed near a respective vertical edge of the end plate and is secured respectively at its lower end to a respective one of two transversely extending lower girders 9. At its upper end, the end plate 1 is secured to a pair of overhead girders 28 located beyond the sides of the mold as shown in FIG. 1 and as will be described in detail later.

The other end plate 2 is provided with a pair of similar uprights 7. These uprights 7 are cut away at their lower end so that they may receive abutments 10 carried on the bottom girders 9 and provided for locating the end plate 2 in dependence upon the number of concrete slabs to be produced in the mold. Each girder 9 is provided with two extensions 11 and 12 each extending from a different respective end thereof. These extensions 11 and 12 are movable from the position shown in FIG. 2, in which they are substantially wholly telescoped within the girders 9, to the extended position shown in FIG. 3, in which they substantially increase the effective length of the girder 9. The extension members 11 and 12 are of substantial strength so that when extended they may support the mold, as will be described in detail hereinafter.

At their free ends, each of extension members 11 and 12 is provided with a respective one of a pair of vertical sleeve members 13 and 14 in each of which is slidably received a respective one of the lifting columns 15 and 16. These lifting columns 15 and 16 are provided with ground-engaging feet or pads. Also secured to the ends of the extension members 11 and 12 are lifting jacks 19 and 20, respectively. The piston rods of these jacks 19 and 20 are provided with brackets 17 and 18, respectively. The columns 15 and 16 are provided with a number of vertically spaced apertures 21 and 22, respectively, and the lifting brackets have corresponding apertures. By means of pegs the brackets 17 and 18 may be secured to the columns 15 and 16 at any desired location.

At the outer end of each extension 12 is provided a rearwardly sloping strut 23, only one of which is shown in FIG. 1. Each strut 23 has a bracket 24 at its upper end, which bracket 24 carries rollers 25 that rest upon the surface of an extension member 27 for each overhead girder 28. These extension members 27 are hinged to the fixed members 29 of the girders 28 by means of hinges 30. At the adjacent ends of the two members 27 and 29, there are stop plates 31 and 32, which, when the members 27 and 29 are aligned, butt against each other and may be secured together.

FIG. 3a shows a modified form of construction according to the present invention wherein the extension members 27 are detachably connected to fixed members 9 by having their flanges 61 and 62 bolted together.

While the right-hand portion of FIG. 1 is an elevation view of the mold device with the upright 7 removed, the left-hand portion of the mold of FIG. 1 is in cross section along the line 1—1 of FIG. 2, which line is disposed between two intermediate panels 3 and 4 in a space to be filled with a mass 36 of concrete (see FIG. 3) to be molded into a slab. The other mold spaces are to be filled with similar masses 34, 35 and 37 of concrete. The portion of FIG. 1 in cross section shows one of the bottom support girders 58 and a wooden joist 59 carried

on girder 58 and defining the bottom of the mold space. Each girder 58 is supported by the lower girders 9 through the intermediary of guides 60 and a plurality of rollers 62 disposed between each guide 60 and a girder 9 for permitting joists 59 to be moved by a certain amount along girders 9. The two horizontal lines in the right-hand portion of FIGS. 1 (which lay above No. 2) indicate a tension connection between the sloping struts 23.

As is shown in FIG. 4, each girder member includes a pair of facing, C-shaped channel members 39 and 40 connected together by an overhead plate. A pair of rollers 42 and 43 are rotatably carried on an axle 41 and are arranged to roll on the inner surfaces of the lower flanges of the two channel-shaped members 39 and 40, respectively. A hanger 44 is suspended from the axle 41 between the two rollers 42 and 43 and extends through the slot defined by the inside edges of the lower flanges of the channel members 39 and 40. The hanger 44 passes through an aperture in a bracket 45 provided at the upper edge of each intermediate panel 3, 4 and 5. At its lower end, each hanger 44 has an adjustable nut or spring retainer 46 and a compression spring 47 extends between this nut 46 and the flange 45 so that the intermediate panel is resiliently supported thereby from the girders 28.

The edge surfaces of each mold cavity are defined by side panels 49 (see FIGS. 5, 6 and 7). These side panels 49, which are preferably each provided with a projection 56 on their front face to form a recess in the castable material 34 which when set forms a slab. Each side panel 49 is mounted on an I-section beam 50 secured to a bracket 52 that is pivotably connected to a respective one of the lever members 51, 51a, etc. Each lever member is pivotable about a pivot pin 54 carried between lugs secured to one end plate or intermediate panel (e.g., lever 51 is pivotable about a pin secured to end plate 1 and lever 51a is pivotable about a pin secured to intermediate panel 5) and is normally held in its closed position between a pair of lugs on an adjacent end plate or intermediate panel, being there held in the closed position by a knock-out pin 55 which passes through registering holes in the lever 51, 51a, etc., and the lugs. The lever is provided with a plurality of apertures 53 so that the position at which the bracket 52 may be connected to the lever is adjustable. Because of the way in which the side panels 49 are mounted, when these panels are withdrawn from contact with the side edges of the cast panels, after pin 55 has been removed, they will move in a direction substantially perpendicular to the edge surface of the cast material.

In order that the extensions 11 and 12 may form a rigid structure, a pair of horizontal beams 38 are provided (see FIG. 1) for connecting together the extensions 11 and 12, respectively, and also for completing the supporting structure in conjunction with the struts 23, each beam 38 forming a U-shaped supporting structure with the two extensions to which it is connected.

A platform 48 which may be pivoted from an inoperative position (as shown in FIG. 2) to an operative position (as shown in FIG. 3) is provided to serve as a high level stand for a workman.

It will be appreciated that other components which are not specially mentioned in the above description or shown in the drawings correspond to conventional constructional practice in multiple casting levels.

For use the apparatus is set up as shown in FIG. 3 with the extensions 11 and 12 extended and with the overhead extension member 27 forming a continuation of the fixed member 29. The intermediate panels 3, 4 and 5 are now moved into position butting against the wooden joists 59 and the end panel 2 is also placed in the appropriate position. The abutments 10 are then moved into position to hold the end plate 2 in its fixed position. The side panels 49 are placed into position and locked there by the insertion of knockout pins 55. The concrete or, if desired, other alternative castable and subsequently

setting material is then poured from above into the multiple mold and is allowed to set. Thereafter by moving the side panels 49 as described above and subsequently moving first the end panel 2 and subsequently the intermediate panels 3, 4 and 5, the cast slabs 37, 36, 35 and 34 may be removed for use. When it is desired to increase the number of intermediate panels for fabricating a larger number of slabs, the abutments 10 are attached somewhere along extensions 12, end plate 2 is moved to the right, and additional bottom wall assemblies 58, 59, 60 and intermediate panels are introduced. In addition, for molding slabs of different thicknesses, joists 59 and side panels 49 are replaced by members having the necessary width.

When it is desired to transport the mold, the latter is lifted by the jacks 19 and 20. If the stroke of the jacks is such that the mold can not be lifted to the desired height in one operation, lifting can take place in a number of steps. On completion of each step, the multiple mold can be supported from below and, by removing the pegs joining the brackets 17 and 18 to the columns 15 and 16, respectively, and by then moving the brackets up a number of steps and re-pegging, the multiple mold can be lifted to the desired height in a number of steps.

A flat-bed trailer 33 may then be backed under the cross members 9 as shown in FIG. 1. The jacks 19 and 20 thereafter lower the multiple unit onto the platform of the trailer 33 so that it is supported thereon, preferably through the intermediary of wooden blocks. The columns 15 and 16 are then moved upwards in their sleeves 13 and 14 and the extensions 11 and 12 are retracted into position alongside the girders 9 under the multiple mold.

As this occurs the rollers 25 on the bracket 24 carried by strut 23 move along the member 27 and into the fixed member 29 of the overhead girders 28. By uncoupling the lugs 31 and 32, the two upper girder members 27 may now pivot about their hinges 30 into a vertical position so that a compact structure is provided which is wholly contained within the space, directly above the platform of the semi-trailer 33.

When the trailer reaches the work-site, by following the reverse procedure, the multiple mold can be moved onto the ground.

The various parts of the apparatus may be made of any materials as appropriate to the art. The end panels 1 and 2 are usually made of steel. The intermediate panels 3, 4 and 5 may be made of timber, timber-faced steel or completely of steel.

If desired, instead of having lower extensions 11, the extension may be provided solely upon the upper or overhead girders 28 in which case the upper girder portions would be hinged together and fixed as described above. There would, of course, be extensions at both ends of the girder. Similarly, only the lower girders 9 may be provided with extensions 11 and 12.

We have found that the multiple mold described above provides a portable precasting mold which can be changed over from the working position to a suitable condition for transportation, and conversely, with the minimum operation.

It will be understood, of course, that the mold should be so flexurally rigid that it may be lifted by the lifting devices. If desired, the extensions 11 and 12 and/or the extension members 27 may be detachable from the lower girders 9 and/or upper girders 28, respectively.

A mold having the form of construction described herein provides considerable advantages with regard to the applicability of multiple molds because a very small amount of work is involved in changing over the mold from its transportable state to its working state and because a multiple mold prepared for concrete casting can thus be readily conveyed to a site on a suitable vehicle without any structural modification being required. Erection on the site merely involves extending or hingeably raising the extension members and lifting and lowering

the unit, an operation readily performed with conventional lifting devices, such as screw jacks, hydraulic rams and like equipment. Instead of providing lifting devices which are applied to the bottom girders from the outside, flat-bed trailers with specially contrived loading axles comprising elevationally adjustable lifting devices could be employed. Furthermore, the frame structure of the multiple mold could be lifted by placing loose supporting members equipped with lifting means underneath the multiple mold frame structure.

The bottom girders are preferably rigidly connected to uprights which provide backing for the fixed end plate.

According to another useful feature of the invention, the fixed member of the overhead girder means may be connected to its extension member by a hinge located below the underside of the girder section, and abutment plates may be rigidly affixed to the top of the section of the fixed member and of its extension in such manner that said plates swing into abutting contact in the parting plane above the hinge when the extension member is raised. Since the overhead girder means are merely called upon to carry loads acting in the direction of gravity, this form of construction appears to be best because it is capable of supporting the loads satisfactorily while permitting the overhead girder means to have their desired variable length.

Furthermore, according to yet another useful feature of the invention, the extensions of the bottom girder means carry upright sleeves within each of which is received for sliding movement a column having a ground-engaging foot, the arrangement being such that when the mold is raised, it can be supported by the columns. Preferably, lifting jacks are interposed between the bottom girders and the columns to cause relative movement therebetween to lift and lower the mold, which jacks are preferably connected to the columns by brackets whose position on the columns may be varied. However, instead of this type of lifting means, which permits the multiple mold to be raised or lowered in steps in relation to the ground or the platform of a flat-bed trailer, other conventional kinds of hydraulic or mechanical lifting devices, such as screw jacks, might be provided.

In a useful form of construction, the longitudinal overhead girder means are located above, but offset from, the concrete slabs that are to be cast, and carry the intermediate panels on spring suspension means. This form of construction permits the concrete slabs to be withdrawn from the mold horizontally or, in particular applications, they may be lifted vertically out of the mold by suitable hoisting tackle.

The longitudinal overhead girder means may advantageously be composed of two facing C-sections disposed with a slot-shaped gap therebetween and so contrived that twin running rollers carrying a hanger can run on the bottom flanges of the sections, the hanger passing through the gap and through a hole in a bracket attached to the intermediate panel and carrying a spring upon which the bracket rests. The spring retainer may be elevationally adjustable for setting the upper edges of the intermediate panels to a selectable level.

In a form of construction that is particularly well adapted to carry heavy loads, the struts may be connected to the extensions of the bottom girder means and the bottom girder means and/or their extensions interconnected to form a trough-shaped frame structure. In such an arrangement, the struts may extend from their supporting point on the extensions of the overhead girder means at a steep angle downwardly toward the ground to a corresponding point of support on the extensions of the bottom girder means. Since the struts are preferably rigidly connected to the extensions of the bottom girder means, the rollers riding in the overhead girders will eventually cross the dividing line between the fixed members and their hinged extensions as the slidable extensions of the bottom girders are being retracted. When

this occurs, the hingeable extensions of the overhead girder means can be tilted vertically downwards to reduce the length of the overhead girder means in a desirable manner for transportation.

The side panels 49 which are insertable between the end plates and the partition panels to form the edges of the concrete slabs, and which must be detachable for extracting the finished castings, constitute another important structural element. It has been found that conventional hingeably attached side panels, which are withdrawable from the edges of the castings by being hingeably swung outwards, often cause difficulties when the finished castings are to be removed. According to another optional feature of the invention it is therefore proposed to attach the side panels to the cross panels by a double hinge to permit the side panels to be withdrawn perpendicularly from the edges of the concrete slabs.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

What is claimed is:

1. In a multiple casting mold for the simultaneous production of a plurality of large precast slabs, which mold is composed of end plates and intermediate panels defining the sides of the mold chambers and frame means including overhead extensible girder means from which the panels are suspended, and bottom extensible girder means supporting the panels, the improvement wherein said overhead girder means comprises at least one stationary girder element and at least one extension element and means mounting said extension unit on the stationary unit for varying the length of said overhead girder means, and wherein said bottom girder means includes at least one stationary member and at least one extension, said arrangement further comprising at least one strut carried by one said extension of said bottom girder means and supporting an extension element of said overhead girder means when said overhead extension element is fully extended.

2. An arrangement as defined in claim 1 further comprising connecting elements connected to said bottom girder means for attachment to such lifting devices.

3. An arrangement as defined in claim 1 further comprising uprights rigidly connected to one of said end plates and to said bottom girder means for fixing said one end plate with respect to said bottom girder means.

4. An arrangement as defined in claim 1 wherein at least one of said extensible girder means comprises at least one stationary girder element and at least one extension which is slidably mounted in said element for varying the length of said girder means.

5. An arrangement as defined in claim 1 wherein at least one of said extensible girder means comprise at least one stationary girder member and at least one extension detachably connected to said member for varying the length of said girder means.

6. An arrangement as defined in claim 1 wherein at least one of said extensible girder means comprises at least one stationary girder member and at least one extension pivotably connected to said girder member for varying the length of said girder means.

7. An arrangement as defined in claim 6 wherein said overhead girder means constitute said extensible girder means and are composed of two girder units each including one said stationary girder member and one said extension, and wherein said extension is pivotable about a horizontal axis between a raised position in which it is in line with its associated stationary girder member and a lowered position in which it extends downwardly.

8. An arrangement as defined in claim 7 further comprising stop plates rigidly connected to said stationary member and to said extension of said overhead girder

means for abutting against each other when said extension is in its raised position.

9. In a multiple casting mold for the simultaneous production of a plurality of large precast slabs, which mold is composed of end plates and intermediate panels defining the sides of the mold chambers, and frame means including overhead girder means from which the panels are suspended, and bottom girder means supporting the panels, the improvement wherein: said overhead girder means is extensible and is composed of two girder units each including one stationary girder member and one extension and wherein said extension is pivotal about a horizontal axis between a raised position in which it is in line with its associated stationary girder member and a lowered position in which it extends downwardly for varying the length of said overhead girder means and wherein said bottom girder means also constitute extensible girder means and are composed of at least one stationary member and at least one extension, said arrangement further comprising at least one strut carried by one said extension of said bottom girder means and supporting a respective extension of said overhead girder means when said respective extension is fully extended.

10. An arrangement as defined in claim 9 wherein each said strut is rigidly connected to its associated bottom girder means extension and is movable with respect to its associated overhead girder means extension along the length of the latter.

11. An arrangement as defined in claim 9 wherein said bottom girder means comprise at least two stationary girder members and at least two extensions, one for each said girder member, said arrangement further comprising at least one connecting beam connected between said extensions of said two girder members to form a U-shaped structure with said bottom girder means.

12. An arrangement as defined in claim 10 wherein said bottom girder means constitute said extensible girder means and include at least one fixed member and at least one extension movable with respect to said fixed member for varying the length of said girder means, said arrangement further comprising at least one upright sleeve connected to said extension, and at least one lifting column slidably received in said sleeve, said column being arranged for supporting said mold when the latter is raised.

13. An arrangement as defined in claim 12 further comprising at least one lifting jack connected between said bottom girder means and each said column for producing relative movement therebetween so as to raise and lower said mold.

14. An arrangement as defined in claim 13 further comprising at least one bracket connected between said jack and said column and being arranged so that its position along said column can be varied.

15. An arrangement as defined in claim 12 wherein said overhead girder means are disposed above, and longitudinally offset from, the mold chambers defined by said end plate and said intermediate panels.

16. An arrangement as defined in claim 1 further comprising spring suspension means connected between said overhead girder means and said intermediate panels for supporting said panels from said overhead girder means.

17. An arrangement as defined in claim 16 wherein said spring suspension means are adjustable for varying the height of said intermediate panels with respect to said overhead girder means.

18. An arrangement as defined in claim 1 wherein said overhead girder means are comprised of at least two girder units, each said unit comprising two C-shaped spaced from, and having their open sides extending toward, one another, at least one pair of rollers connected together by a shaft and each arranged to roll along the bottom flange of a respective one of said C-shaped members, and at least one hanger mounted on said shaft, extending between the bottom flanges of said two C-shaped

members, and supporting one of said intermediate panels.
19. An arrangement as defined in claim 1 further comprising a plurality of side panels each defining one vertical edge of one of said mold chambers, and pivotable supporting means supporting said side panel and arranged for moving said side panel in a direction perpendicular to its associated mold chamber between a closed position in which it closes its associated mold chamber edge and an open position in which it is spaced from such mold chamber edge.

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