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3,609,830

METHOD AND APPARATUS FOR CASTING MONOLITHIC CONCRETE STRUCTURES

Filed May 12, 1969

3 Sheets-Sheet 1

Fig. 1

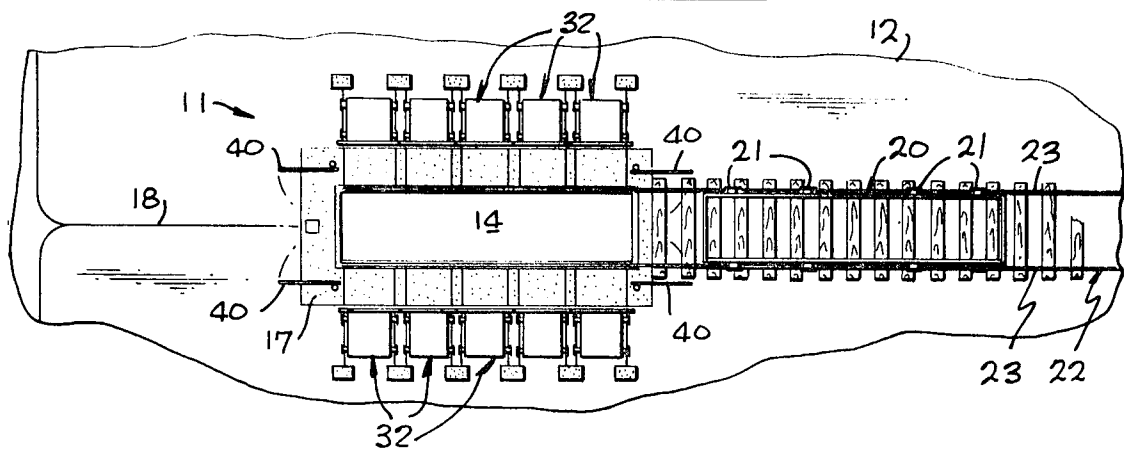
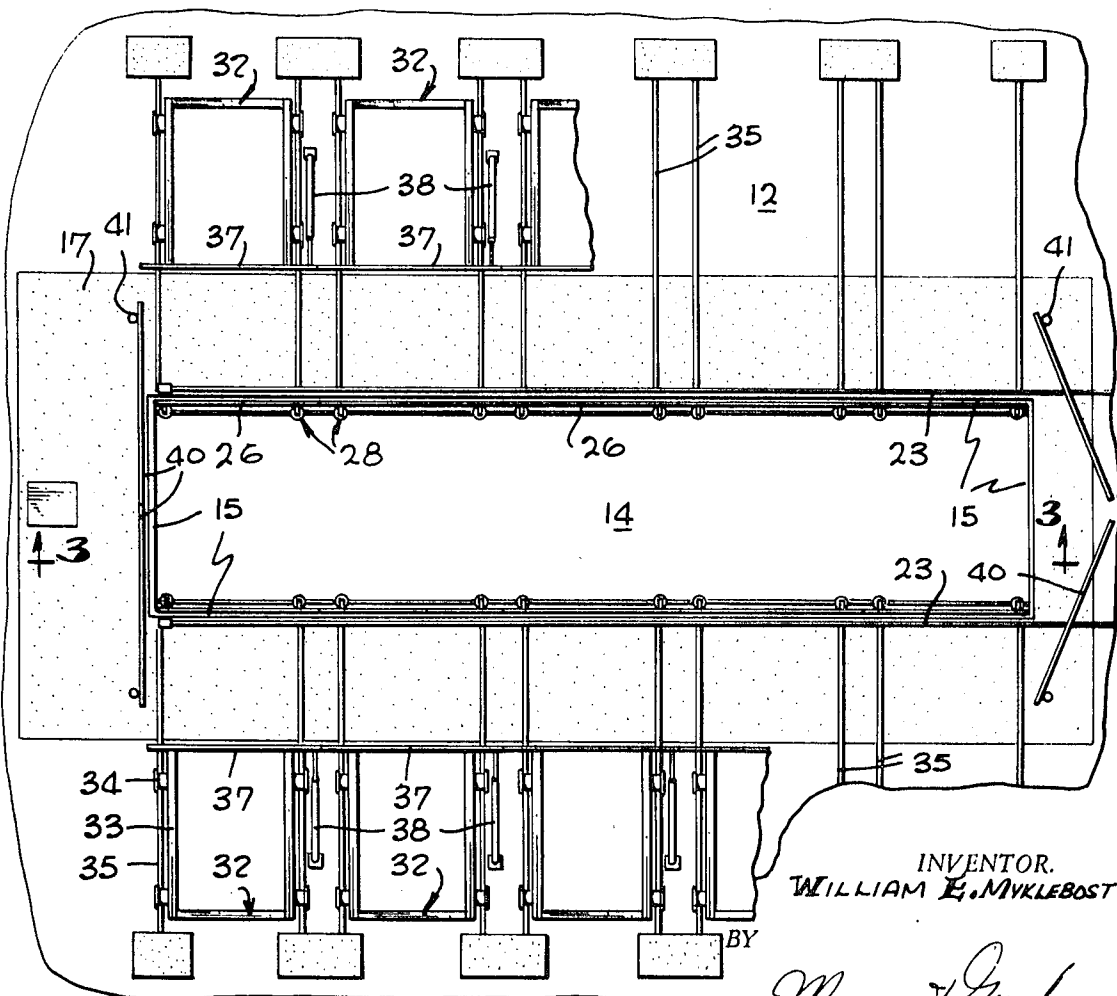


Fig. 2



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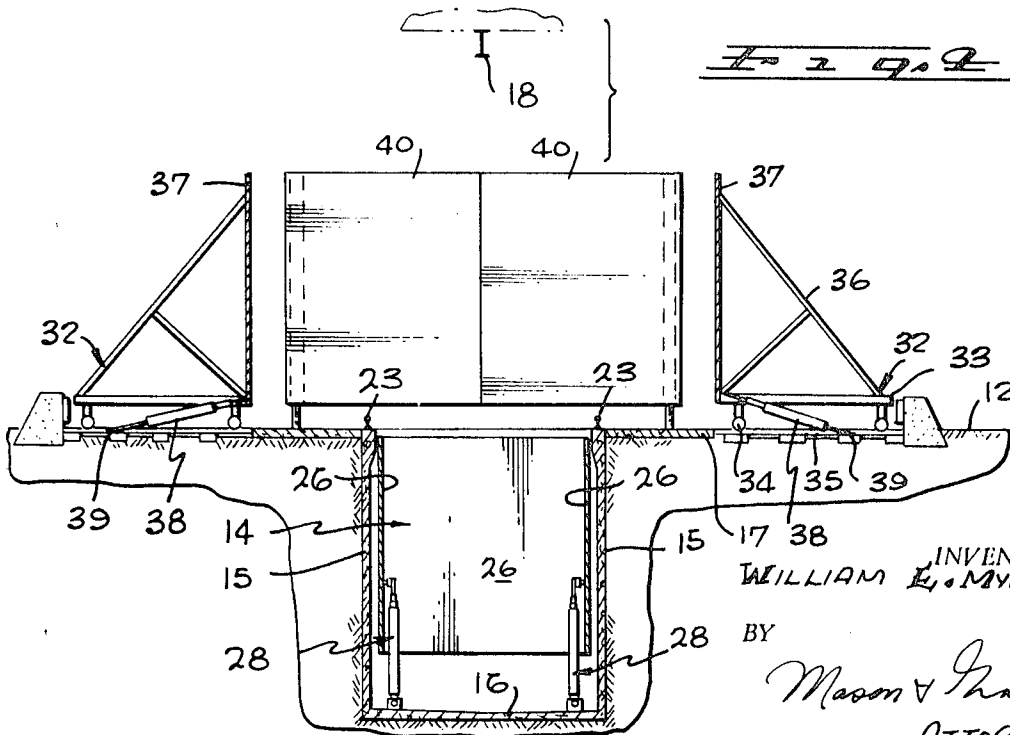
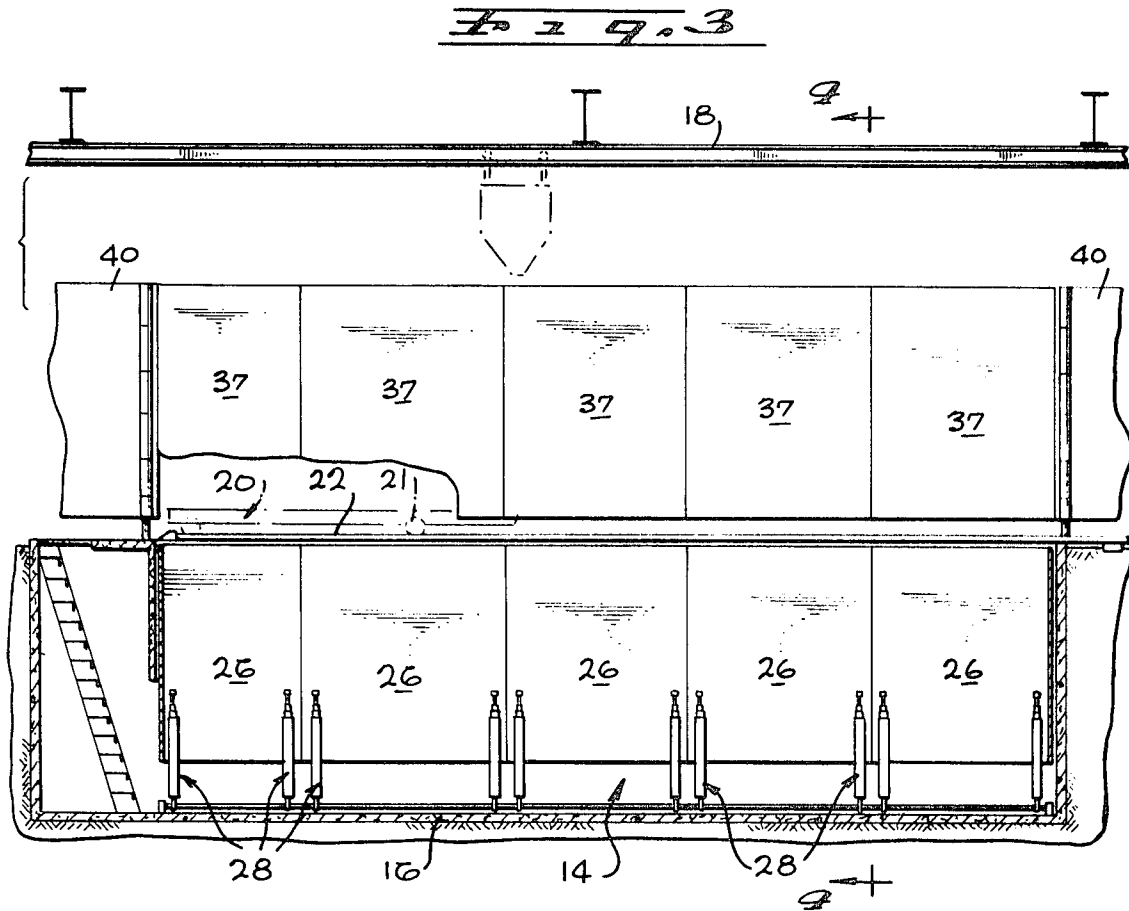
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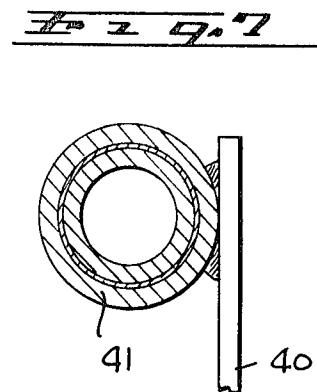
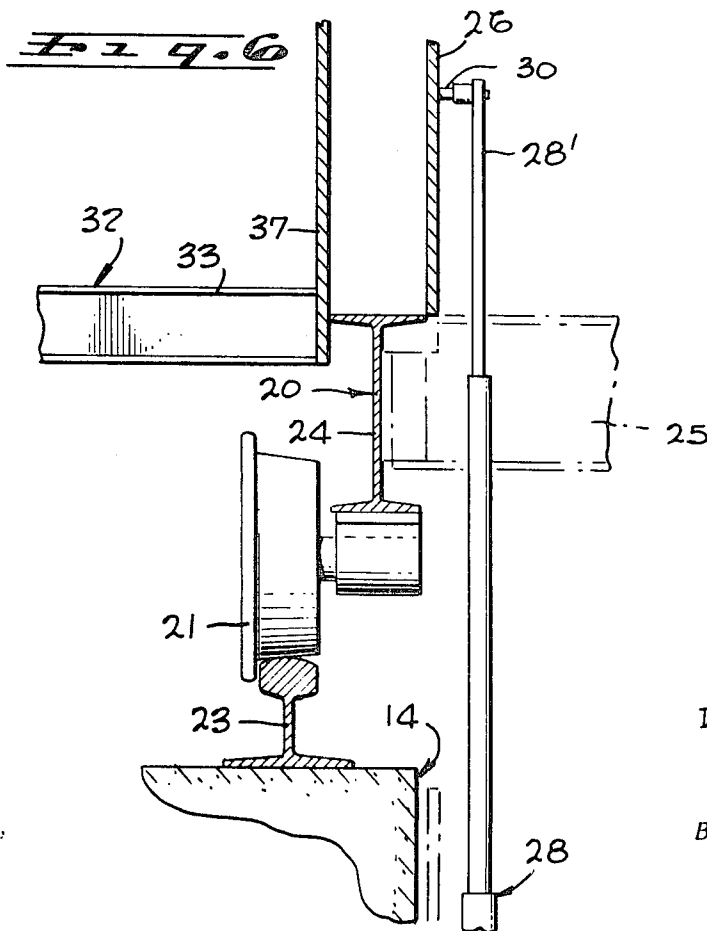
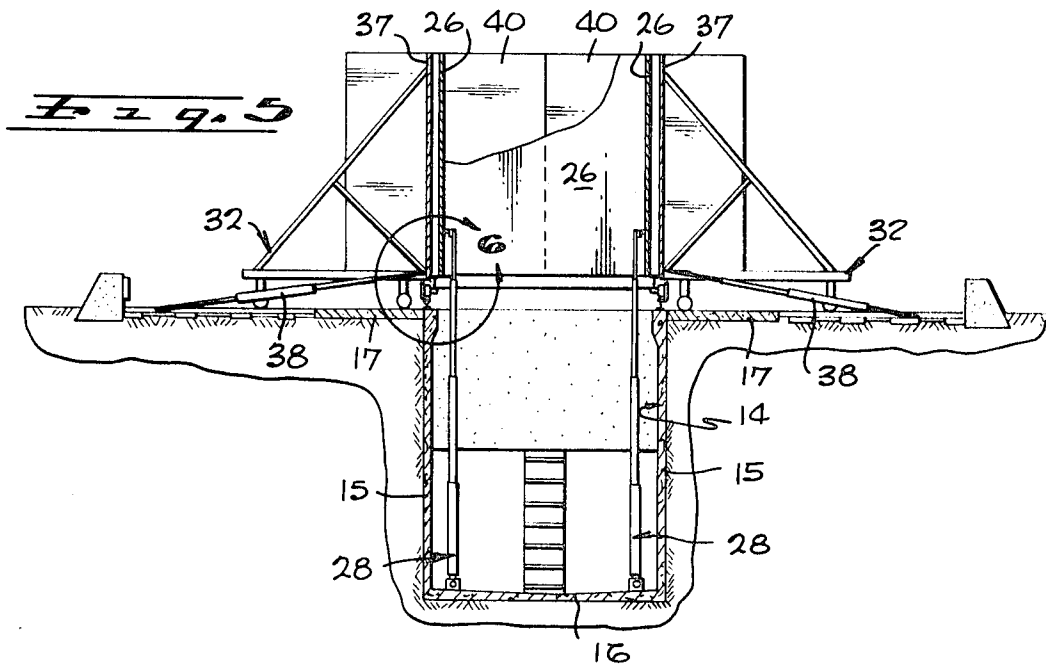
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METHOD AND APPARATUS FOR CASTING MONOLITHIC CONCRETE STRUCTURES

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U.S. Cl. 25—41 D

11 Claims

ABSTRACT OF THE DISCLOSURE

A method of casting hollow monolithic structures of concrete and apparatus therefor including a casting plant with a pit and track means to support a casting carriage over the pit. Mobile means is provided around the pit for handling the outer form walls of the casting mold and means is provided in the pit for supporting and for raising and lowering inner form walls for the casting mold.

The invention relates generally to the art of molding or casting concrete structures, particularly large hollow monolithic structures.

An object of the invention is to provide a novel method and novel apparatus particularly designed for casting large concrete modular units such as can be used in the construction of residences and high-rise buildings but also suitable for casting a wide variety of other relatively large structures such as culverts, bridges, silos, swimming pools or sections of such structures.

It is a particular object to provide a method and apparatus designed to facilitate the casting of concrete structures utilizing concrete made from a recently developed form of cement, as well as conventional cements, having the property of expanding in a predictable and controllable manner as it cures in such a way as to stress steel reinforcing material around which the concrete is poured. The concrete is known by the name "Chemstress" and is manufactured by The Chemically Prestressed Corporation. The use of this cement greatly facilitates three-dimensional casting of exterior and interior walls and ceiling planes of buildings in a single monolithic unit with no joints between walls and ceilings, and enables a very substantial weight reduction to be achieved as compared with the use of conventional cement.

Another object is to provide a novel method of and novel apparatus for casting large structures of concrete which greatly facilitate the handling of the forms and the resulting casting.

A further object is to provide novel apparatus particularly designed for casting large concrete structures involving novel means for assembling the outer form walls of the mold for the proposed casting as well as novel means for storing, moving into place and subsequently removing the inner form walls of the mold.

Briefly, by way of summary, the invention is concerned with a method and apparatus whereby a casting support is placed over a pit and the inner form walls of the mold are raised into place from the pit through the support and wherein outer form walls are assembled about the casting support which bears the weight of the casting, and with the subsequent stripping of the mold by returning the inner and outer form walls to their initial places.

The above and other objects will be apparent from the drawings and the following description. Referring to the drawings:

FIG. 1 is a diagrammatic plan view of a casting station showing apparatus for carrying out the invention;

FIG. 2 is a fragmentary plan view of the casting station and apparatus of FIG. 1, but on a larger scale;

FIG. 3 is a longitudinal sectional view on line 3—3 of FIG. 2;

FIG. 4 is a cross sectional view on line 4—4 of FIG. 3 showing the inner and the outer side form wall means retracted;

FIG. 5 is a view similar to FIG. 4 but showing the inner and the outer form wall means in place to form a mold;

FIG. 6 is a fragmentary sectional detail view in the same plane as FIG. 5, showing the area designated by the line 6 on FIG. 5; and

FIG. 7 is an enlarged cross sectional view through one of the upright posts and a portion of the end form member thereon.

In general, the invention comprises the method of casting large hollow monolithic structures of concrete by utilizing a mobile casting support or carriage at a working surface or level in conjunction with a pit below that surface, wherein wall means designed to define the inner form walls of the casting mold are raised from within the pit through the casting support, in position over the pit to extend above the working surface level and wherein wall means designed to define the outer form walls of the mold are assembled or moved into place around the casting support to complete the mold. The latter is filled with concrete, and, after the concrete has partially cured, the mold is stripped by lowering the wall means defining the inner form walls back into the pit and by moving the wall means defining the outer form walls of the mold laterally away from the casting support. The cast structure is then transported to a curing area on the mobile casting support on which it has been cast.

The invention also comprises apparatus for carrying out the method, a preferred form of which is herein-after described with reference to the drawings. In FIG. 1, numeral 11 designates a casting station or area of which there may be several in a given plant. This is characterized by a working surface 12, shown as being ground level, with a pit 14 interrupting the surface and extending a substantial distance below it. The pit is preferably lined with concrete walls 15 and a concrete floor 16, and the working surface is preferably provided with a concrete apron 17 around the pit. An overhead monorail 18 may be provided to facilitate handling of concrete and materials.

The pit 14 is of sufficient size to accommodate the inner form wall means designed to define the inner walls of the mold to be used in casting the concrete structure, that is, the pit should be of sufficient size to fully accommodate such inner form wall means at its largest dimensions fully assembled so that when the inner form wall means is not being used as a part of the mold, it can be contained within the pit. The latter is shown as rectangular, although for some castings other shapes might be more appropriate.

It is a feature of the invention that a mobile casting support is used in conjunction with the pit of such nature that the support can be placed over the pit and in this connection it is preferred to use what will be termed a casting carriage, designated 20, having flanged wheels 21 adapted to run on a track 22 which may extend from any suitable remote point to the pit, which it straddles, one rail 23 thereof extending along one upper side edge of the pit and the other rail 23 along the other upper side edge. The casting carriage is constructed with a rectangular frame 24 of suitable steel girders and its size is such that its internal dimensions are slightly greater than the internal dimensions of the pit. Demountable reinforcing members 25 may be provided extending from side to side as indicated in FIG. 6, and these should be capable of being installed at substantially any position along the

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length of the frame since their principal use is to support internal walls within the structure to be cast.

Means is provided within the pit for supporting and for raising and lowering what will be termed inner form wall means 26 designed to define the inner walls of the mold for the structure to be cast. The means comprises a series of fluid rams or jacks 28 which are shown disposed on the floor of the pit in two rows adjacent the sides and these may be of the type in which several telescoping sections are utilized in order to obtain the necessary extension. Preferably these rams are connected into or as part of a conventional hydraulic system for the controlled supply of pressure fluid to each of the rams. The inner form walls 26 are supported on the uppermost extension or section 28' of each ram as by means of a suitable fitting 30 welded or otherwise secured to the form wall and detachably secured to the end of the section by any conventional means. In use, the entire inner form wall structure is raised into place from the position it occupies in FIG. 4 to that which it occupies in FIG. 5, the form passing through the casting carriage which has previously been placed over the pit. Any reinforcing members 25 that may be used are secured in place after the inner form structure has been raised.

Means are provided around the pit at the working surface or ground level to facilitate the completion of the mold, and this comprises means for moving outer form wall means laterally toward the casting carriage from opposite sides in order to form the two side form walls of the mold. A preferred way of accomplishing this is by the utilization of a plurality of wheeled frames 32, each of which has a main frame 33 provided with flanged wheels 34 adapted to run on the rails of a track 35 disposed normal to the side edge of the pit and a reinforcing framework 36 of any suitable construction thereon which supports a wall section 37 that forms a part of the overall side wall of the mold. Each of the wheeled frames is forced and held in place with the wall 37 against the casting carriage by means of a fluid ram 38, one end of which is connected to the wheeled frame and the other of which is connected to a stationary support 39.

Wheeled frames similar to those just described also may be used at the ends of the pit, however, in place of this, there is shown an end form means comprising a pair of pivotally mounted form wall end members 40, each of which is supported on and swingable on an upright post 41 mounted adjacent the corner of the pit. The members 40 may be secured in closed position to form the outer end walls of the mold by lock bars (not shown) or other conventional means.

It will be understood that, after the inner form walls are raised into place, such reinforcing steel as is to be used in the casting is placed around the inner form walls, and any desired conduits and plumbing placed in the proper locations. Also, suitable cores may be provided on any of the forms to provide voids in the completed casting, such as might be required for doors and windows in a building module.

Once the inner and outer form walls are in place, the concrete is poured into the form in the usual manner, the casting carriage acting as the bottom of the mold and thus serving to carry the weight of the casting. After the concrete has set and has partially cured sufficiently to enable the casting to be moved safely, the mold is stripped by retracting the wheeled frames 32 with their side form wall sections 37, by swinging outwardly the form wall end members 40, and by lowering the inner form wall means 26 back into the pit. The casting carriage with the casting thereon is then hauled away to an area where the casting can be cured sufficiently to remove from the carriage.

Throughout the description of the invention reference has been made to a "pit" in the sense that this means a hole or substantial depression below the surface of the ground or a working surface. However, for the purposes

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of this application, the term should not be so limited since "pit" or an equivalent thereof, might in fact be at ground level, or factory floor level, and suitable tracks built at a height above such ground or floor level for the casting carriage and outer form support means.

I claim:

1. In apparatus for casting a hollow structure of concrete, means providing a working surface and a pit extending below the level of such surface, movable means on said surface surrounding said pit for supporting outer form walls of a mold, a casting carriage on said surface movable to a position over the pit, said carriage having an open interior, inner form walls within said pit, and means in the pit for raising said inner form walls through said carriage into place to the level of the outer form walls and holding such inner form walls in place.

2. The apparatus set forth in claim 1 in which said casting carriage is movable on a track which straddles the pit and which extends to a point remote from the pit.

3. The apparatus set forth in claim 1 in which the means for supporting the outer form walls comprises a plurality of track-mounted wheeled frames movable toward and away from the pit and fluid ram means connected between each wheeled frame and a stationary support.

4. The apparatus set forth in claim 1 in which a part of the means for supporting the outer form walls of the mold comprise upright posts adjacent the ends of said pit in said working surface and rising to a substantial height thereabove, and outer form wall end members pivotally mounted on said posts.

5. The apparatus set forth in claim 1 in which the means in the pit for raising the inner form wall means comprises a series of fluid rams mounted in the pit.

6. In apparatus for casting large hollow concrete structures, means for use in assembling and forming the outer walls of the mold, comprising a working surface on opposite sides of a mold site, sets of parallel tracks on the working surface at opposite sides of the mold site, said tracks extending toward and away from the mold site, wheeled frames on said tracks, mold wall members carried by said wheeled frames, means for moving said wheeled frames toward the mold site and holding them with the mold members thereof in position as parts of the mold, posts adjacent the ends of the mold site and end form members swingably supported on said posts.

7. In apparatus for casting a hollow structure of concrete, means providing a substantially level working surface with a pit therein extending below the level of such surface, a main track on said surface adapted to extend to a remote point and straddling said pit, a casting carriage on said track having an open frame and adapted to be positioned over the pit, means in the pit for supporting and for raising and lowering inner form walls of a mold, and means on the surface movable toward and away from the pit for moving and supporting outer form walls of a mold.

8. The apparatus set forth in claim 7 in which a plurality of auxiliary tracks are provided on said working surface at each side of said pit extending toward and away from the pit and in which the means for supporting outer form walls of a mold comprise wheeled frames on said auxiliary tracks.

9. The apparatus set forth in claim 7 in which the means in the pit for supporting and for raising and lowering inner form walls of a mold comprises a series of fluid rams.

10. The apparatus set forth in claim 8 in which the means in the pit for supporting and for raising and lowering inner form walls of a mold comprises a series of fluid rams, and in which a part of the means for supporting the outer form walls of the mold comprise upright posts adjacent the ends of said pit in said working surface and rising to a substantial height thereabove, and outer form wall end members pivotally mounted on said posts.

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11. In apparatus for casting a hollow structure of concrete, means providing a working level and a lower level therebelow with a vertically open area between, movable means at said working level for supporting outer form walls of a mold, a casting carriage at said working level movable to a position over the open area, said carriage having an open interior, inner form walls at said lower level, and means at said lower level for raising said inner form walls through said carriage into place to the level of the outer form walls and holding such inner form walls in place.

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GIL WEIDENFELD, Primary Examiner

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