

United States Patent

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[54] SYSTEM FOR PRODUCING MODULAR BUILDING BLOCKS

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[51] Int. Cl.E04b 1/16

[58] Field of Search.....264/33, 35; 25/131 R

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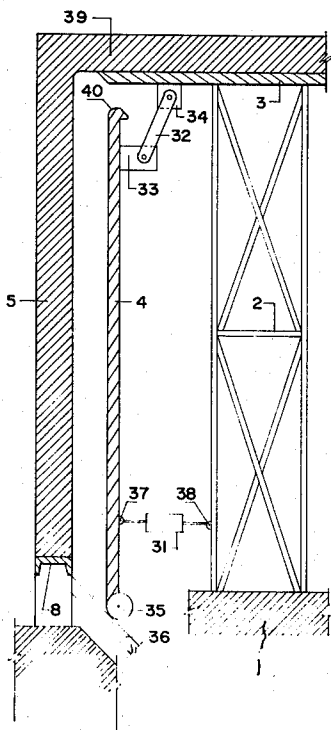
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[57] ABSTRACT

The disclosure sets forth a system for prefabricating modular boxlike units of concrete, in which the upper slab or top slab is poured together with the walls and then subsequently is lifted and placed upon a lower slab form, whereby the lower slab is poured to create monolithic structure with the top, side and partition walls. The outside walls and partition walls may also be precast and then placed in position with the pouring of the upper or top slab and then stripped monolithically with the upper slab.

8 Claims, 7 Drawing Figures



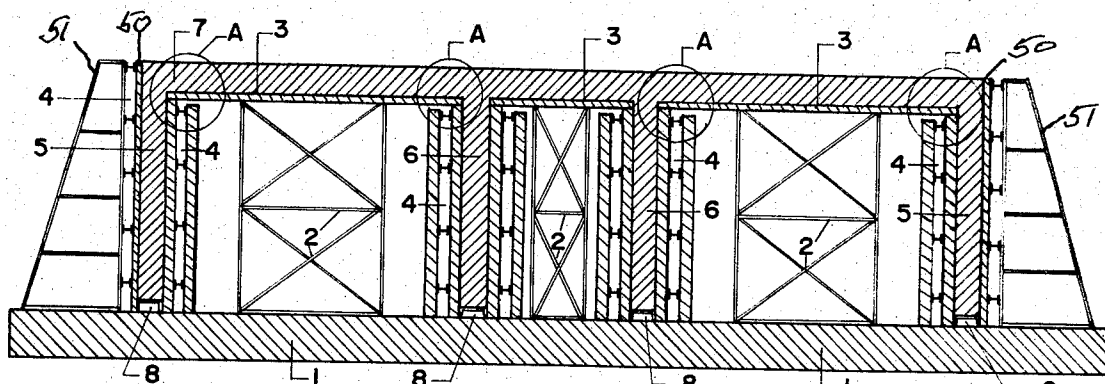


FIG. 1

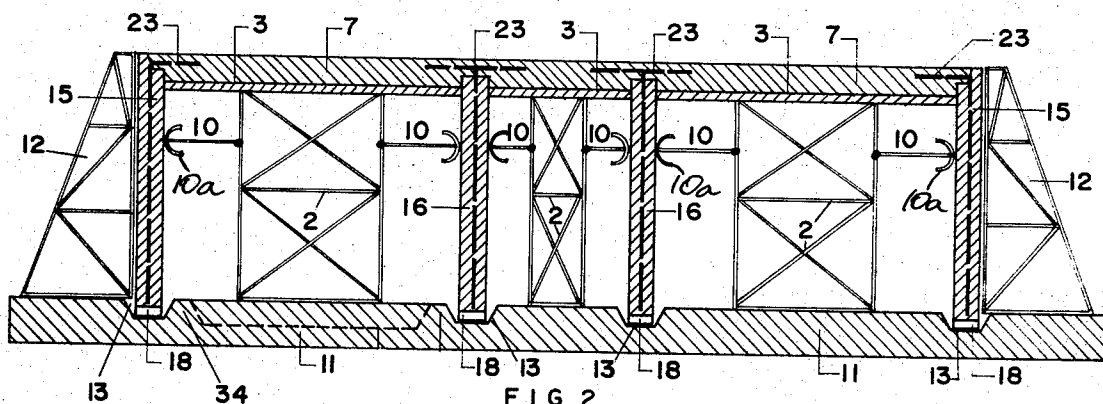


FIG. 2

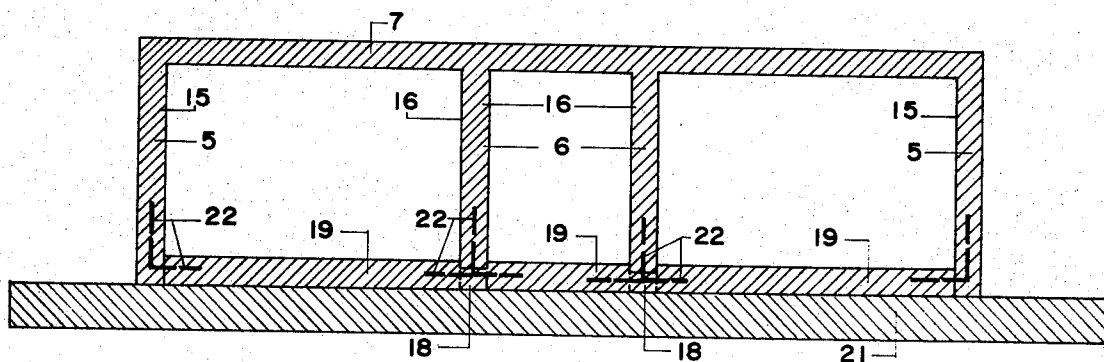


FIG. 3

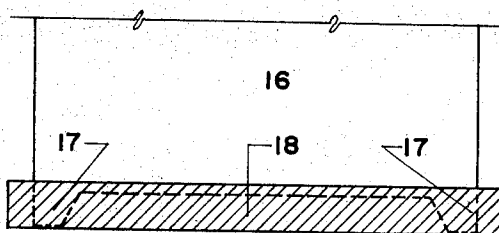


FIG. 4

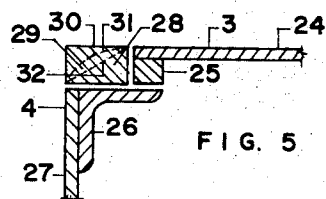


FIG. 5

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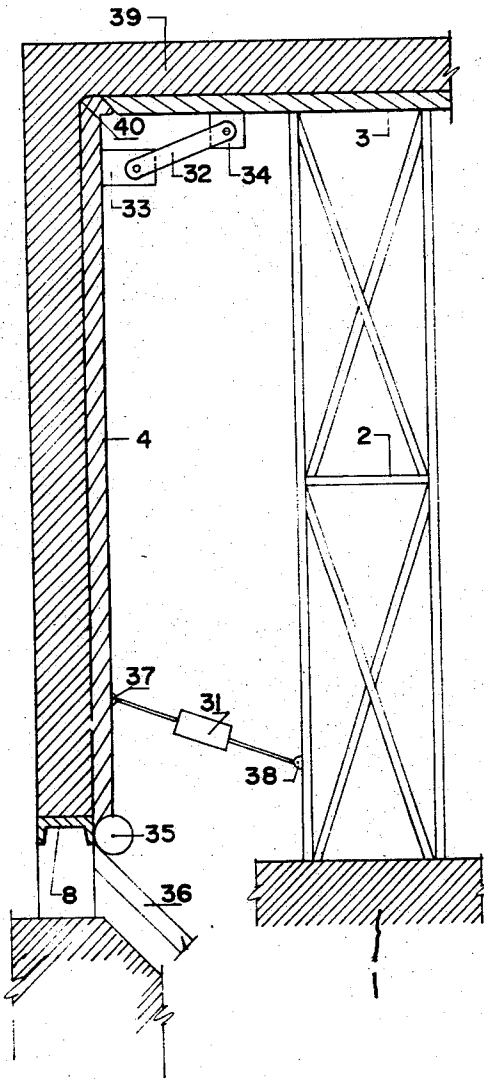


FIG. 6

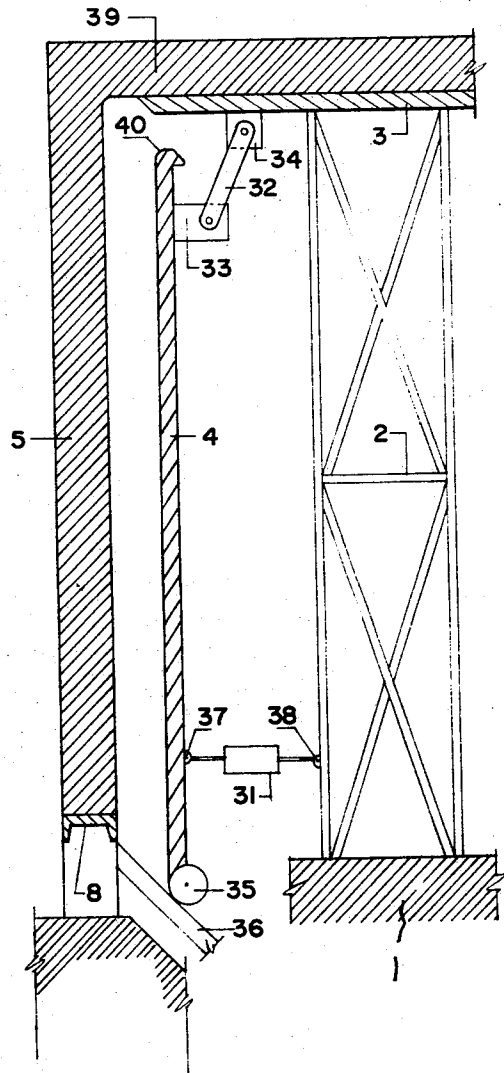


FIG. 7

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SYSTEM FOR PRODUCING MODULAR BUILDING BLOCKS

The present invention relates to a system of producing boxlike prefabricated modular units in two steps.

It is among the objects of the present invention to provide an improved system for the manufacture of boxlike prefabricated modular units for the purpose of forming various types of building structures.

Another object is to provide a simple system of manufacturing and casting modular structures of boxlike form, together with the internal or partition walls to achieve a monolithic structure and avoid distortion of the module.

Another object is to provide a prefabrication system in which both exterior and partition walls are cast in place and in which various connection parts or connecting columns are cast in place with them.

Still further objects and advantages will appear in the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

In accomplishing the above objects, modular boxlike prefabricated concrete units are formed by pouring the upper roof or top slab together with the walls and partitions, which walls and partition walls if desirable may have been previously prefabricated and set in proper position. This is done by applying the concrete against stationary slab forms and movable wall forms, following which the boxlike structure is then placed upon a lower slab form.

The lower slab then is poured to engage and form a monolithic structure in respect to the outside and interior partition walls and then form a monolithic structure which may take the form of a tunnel, square rectangular or boxlike unit with both ends open or closed, as may be desirable.

In carrying out the above procedure, the various exterior walls and interior partitions may have been precast and then placed in position between the upper slab forms, prior to pouring of the upper slab. Then the upper slab, together with the walls monolithically joined therewith may be stripped.

In either case some of the partitions or outside walls may be precast and others may be cast in place to give the desired modular structure. The joints between the wall and roof forms may be provided with fillers.

In connection with the combination of walls and partitions disclosed, part of them may be cast in place and part of them may be precast, and this may be varied quite widely, depending upon the desirability of the various constructions.

BRIEF DESCRIPTION OF DRAWINGS

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described, and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which fall within the scope of the claims hereunto appended.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:

FIG. 1 is a diagrammatic transverse vertical sectional view showing the system of providing the various slab and wall forms for forming the side walls, interior partition walls and the top or ceiling slab.

FIG. 2 is a diagrammatic transverse vertical sectional view similar to FIG. 1, showing the system of providing the various slab forms when the walls are precast and interior partitions are precast and inserted through openings of the fixed upper floor slab.

FIG. 3 is a diagrammatic transverse vertical sectional view, showing the completed upper structures of modular box including walls, partitions, and an upper slab placed upon

another additional lower slab form for the pouring of the lower slab.

FIG. 4 is a diagrammatic vertical sectional view showing the engagement between the vertical partition wall and horizontal floor slab.

FIG. 5 is a separated diagrammatic fragmentary transverse sectional view showing a corner junction.

FIG. 6 is a diagrammatic side elevational view in side vertical section, showing an alternative device for opening and closing the wall mold member, showing the wall mold structure in closed position.

FIG. 7 is a diagrammatic side elevational view similar to FIG. 6, which shows the mold in opening position for stripping and cleaning.

Referring to FIG. 1, there is shown a fixed base 1 on which are permanently mounted the fixed scaffolds 2 carrying a form 3 for pouring an upper slab. Three forms 3 are shown in the embodiment of FIG. 1. The form 3 for the upper slab may be permanently nailed, bolted or otherwise connected to the scaffold 2. The wall forms 4 consisting of inside and outside spaced and separated members are positioned directly under the slab form 3 for the top slab.

In the space between the wall forms 4 at the lower part thereof are positioned the upwardly projecting inverted channel shaped members 8, which may be steel channels and which may be permanently mounted on the base member 1. These inverted channels will produce the base form for the outside walls 5 or for the interior partition walls 6. The outside walls 5 are provided with the outside forms 50, held in position by the supporting structure 51.

When these forms are set in position, the upper slab 7, together with the partitioning walls 6 and outside walls 5, may be poured at the same time, or the walls 5 and 6 may first be poured, following which the top slab 7 is poured.

Alternately the outside walls 5 and interior walls 6 may be preformed and placed in position and then the top slab 7 poured thereover. As a result, the partition walls 6, the outside walls 5 and the top slab 7 will have a monolithic structure. In the areas indicated at A the connection between the side wall forms and top slab form may be provided as indicated in FIG. 5 or as indicated in FIGS. 6 and 7.

The top slab form 3 and the interior wall form 4 as shown in FIG. 5 may be formed of wood, steel, plywood or other suitable material. The section 25, which may be of wood or other material, may be permanently connected to the outer edge 24 of the form 3 for the top slab 7.

The right angle section 26 similarly may be permanently connected by nailing, welding or otherwise to the upper edge 27 of the side wall form 4.

These reinforcing edge elements 25 and 26 will form an open or recessed corner, which may be filled by the filler member 29 of wood, rubber or plastic or other suitable material. There may be, among other possibilities, a horizontal top face 30 to form a square corner or a rounded top face 31 to form a round corner or an oblique face 32 to form a triangular corner. These faces 30, 31 and 32 are alternately used. These faces 30, 31 and 32 may extend along the entire length of the filler form 29 or they may be along portions thereof, as indicated in FIG. 5.

In FIG. 2 the base or form slab 11 is provided with recesses 13 which will receive the lower edges of the prefabricated outside walls 15 and the prefabricated inside partitioning walls 16. These prefabricated walls may be held in position by means of the swinging arms 10 supporting the precast walls with contact ends 10a and outside scaffolds 12 if necessary.

The top slab 7 is then cast upon the top forms 3, supported by the scaffolds 2. It will be noted that the prefabricated partition 16 may slightly project above the forms 3 and that outside walls 15 may have a step in the outside part projecting up to the top of slab 7 to form the mold for slab 7. The top slab is then cast on top of the forms 3 and to impress the upper projecting ends of the outside and partitioning walls 15 and 16.

This will result in a prefabricated construction of a top slab and outside partitioning walls. The steel reinforcements 23 may be used, extending vertically through the partitioning and side walls 15 and 16 and then turned horizontally so that they will be engaged in the poured ceiling or upper slab 7. The recesses 18 may be left in the bottom edges of the walls 15 and 16 so as to enable junction with the slab which is cast to join the lower ends of the legs 15 and 16, as shown in FIG. 2.

This recess 18 is indicated in FIG. 4 between two downward projections 17 from the side wall 16 in side view at 90° to the showing of FIG. 2. The downward projection 17 could be in the end or the middle of the walls or any choice of location.

In FIG. 3 the unitary or integral module of FIG. 1 is taken away from the forms as shown in FIGS. 1 and 2 and then is set down on a base slab form 21. It will be noted that the exterior walls 5 and 15 and the interior partitioning walls 6 and 16 will then be joined together by means of the concrete which is poured to flow through the openings 18 below and engaging the downward projections 17. The projections 17 and the recesses 18 are required for continuation of the floor slab under the partitions 16. This lower slab 19 will unitarily join together the partitioning and outside walls. Steel reinforcements may be used at 22 if desired to join together the base slab and the outside and partitioning walls.

These steel reinforcements 22 may form part of the outside and partitioning walls 15 and 16. The ends of the reinforcements 22 are bent at right angles to engage in the base slab 19 to be poured.

In the forms, normally form 3 as shown in FIG. 1 is fixed and immovable, whereas form 4 may be moved toward or away from the wall as desired.

When the slabs 7 are lifted, together with the inside walls 6 and 16 and the outside walls 5 and 15, from the arrangement shown, the filler strips, as shown in FIG. 5, will either be lifted together with the form and afterward removed or stripped from the concrete or they will fall out of position.

Alternatively to FIG. 5, the wall form 4 and the slab form 3 may meet and have a smooth surface at the contracting edge without the necessity of using the filler 29. In this case the wall form 4 is desirably lowered before it is moved away from the interior face of the wall or may be arranged to swing away from the wall as it is lowered, as shown in FIGS. 6 and 7.

Regardless of whether the walls 5, 6 and 15 and 16 are cast in place or are precast, the floor casting operation as indicated in FIGS. 3 and 4 will take place.

Referring to FIGS. 6 and 7, the top slab form 3 supported by the scaffold 2 will be the base upon which the top slab or ceiling is cast. The side wall form 4 is supported at its lower end by a roller 35 which may run on a sloping guide plate or rail 36 and a number of these may be placed side by side along the width of the wall form 4. The hinge link 32 mounted at one end 33 on the wall form 4 and at the other end 34 on the top slab form 3 may aid in holding and directing the wall form 4 into and out of position.

Roller 35 and rail 36 may be eliminated by adding one or more brackets like 32 at the middle or lower part of the form in a position which will work parallel to bracket 32 and will be fastened to scaffold 2 or to fixed base 1. A plurality of such brackets 32 will allow the form to swing down and open or up and closed with or without the use of roller 35 and rail 36. The plate or rail 36 might be straight or curved to adjust the movement of the form guided by a single or a plurality of brackets 32.

The hydraulic, pneumatic or mechanical device 31, a number of which may be arranged along the form 4, may be provided with the attachments 37 to the form 4 and 38 to the scaffold 2. The upper end of the movable form 4 is shaped so as to fit into and with the oblique end of the top form 3, as shown in closed position at the top of FIG. 6.

The device 31 may be suitably operated by hand or automatically, and it will cooperate with the linkage 32 in moving the form 4 toward and away from the wall 5 which is to be cast. The relationship between the slope of the end of the form

3 and the slope of the rail 36, together with the length and inclination of the linkage 32, are calculated to secure easy stripping.

The device as shown may be utilized either with mechanical, pneumatic or hydraulic devices, operated by hand or automatically, so that a wall form may be readily stripped and set back into position. A hinged swivel hanging bracket may be used on one side of the form to permit it to slide and drop at the same time and the arrangement for pressing the form into position and at the same time lifting the form may use additional means, such as a wheel, bearing, movement against the roll, or a guide.

The bracket may serve to hold and hang the form when stripped and it may withstand the pressure of the concrete when it is poured. The applicant's device also permits fastening the form at one end automatically, with automatic fastening at the other end without additional pressure or implementation.

It is thus apparent that the applicant has provided a universal system for prefabricated modular boxlike units where the top or roof slab is poured together with the outside walls and inside partitioning walls against stationary slab forms and movable wall forms, following which it is lifted and placed upon a lower slab form where the lower slab is poured to create a monolithic structure. Upon the setting of the concrete the complete unit is lifted off the base slab form and transported to the building site.

As many changes could be made in the above system for producing modular building blocks, and many widely different embodiments of this invention could be made without departure from the scope of the claims it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A system for prefabricating modular boxlike preformed units for assembly into building structures for homes, apartments, factories, garages and the like, comprising providing inner and outer forms for the outside walls and a ceiling form for the ceiling top slab, maintaining the ceiling slab form in a permanent, stationary position during the prefabrication of successive units, casting the ceiling slab in engagement with the outside walls to form a monolithic structure including the ceiling slab and the outside walls, moving the inner forms in their entirety, downwardly and angularly away from the outside walls and the ceiling form, maintaining the inner wall forms in a substantially vertical plane during their angular movement, removing the monolithic structure to a base slab form, then casting the lower floor slab in junction with the lower edges of the outside walls to form the integral modular boxlike unit, and thereafter removing the unit from the base slab form.

2. The system of claim 1, said outside walls being precast and placed in position beneath the ceiling slab form.

3. The system of claim 1, in which said boxlike units are used for single housing.

4. The system of claim 1, in which the boxlike units are used as part of a modular prefabricated multi-floor construction.

5. The system of claim 1, in which partition walls are provided with recesses in their lower edges to enhance the pouring and passage of the concrete forming the floor slab.

6. A system of prefabricating modular boxlike preformed units for assembly into building structure for homes, apartments, factories, garages and the like, comprising providing inner and outer forms for the outside walls and a ceiling form for the ceiling top slab, maintaining the ceiling form in a permanent, stationary position during the prefabrication of successive units, casting the ceiling slab in engagement with the outside walls, moving the inner forms, in their entirety downwardly and angularly away from the outside walls and the ceiling form, maintaining the inner wall forms in a substantially vertical plane during their angular movement away from the outside walls and the ceiling form, forming a filler joint at the junction of the ceiling slab and each outside wall, to

produce a monolithic structure including the ceiling slab, the outside walls and the filler joints, removing the monolithic structure to a base slab form, then casting the lower floor slab in junction with the outside walls to form the integral modular boxlike unit, and thereafter removing the unit from the base slab form.

7. A system of prefabricating modular boxlike preformed units for assembly into building structures for homes, apartments, factories, garages and the like, comprising providing inner and outer forms for the outside walls and a ceiling form for the ceiling top slab, maintaining the ceiling slab form in a permanent, stationary position during the prefabrication of successive units, moving the inner wall forms from an open position to a closed position preparatory to the prefabrication of each unit, casting the ceiling slab in engagement with the outside walls to form a monolithic structure including the ceiling slab and the outside walls, moving the inner wall forms, in their entirety, downwardly and angularly away from the outside walls and the ceiling form to return said inner forms to their open position, maintaining the inner wall forms in a substantially vertical plane during their angular movement from the closed position to the open position, removing the monolithic structure to a base slab form, then casting the lower floor slab in junction with the outside walls to form the

integral modular boxlike unit, and thereafter removing the unit from the base slab form.

8. A system of prefabricating modular boxlike preformed units for assembly into building structures for homes, apartments, factories, garages and the like, comprising providing inner and outer forms for the outside walls and a ceiling form for the ceiling top slab, maintaining the ceiling top slab form in a permanent, stationary position during the prefabrication of successive units, supporting the inner wall form for each wall by a hinged swivel bracket, moving said inner wall forms from an open position to a closed position preparatory to the prefabrication of each unit by directing each of said inner wall forms, in its entirety, in an angularly upward direction while maintaining the same in a substantially vertical plane, casting the ceiling slab in engagement with the outside walls to form a monolithic structure including the ceiling slab and the outside walls, moving the inner wall forms away from the outside walls and the ceiling form to return said inner forms to their open position, removing the monolithic structure to a base slab form then casting the lower floor slab in junction with the outside walls to form the integral modular boxlike unit, and thereafter removing the unit from the base slab form.

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