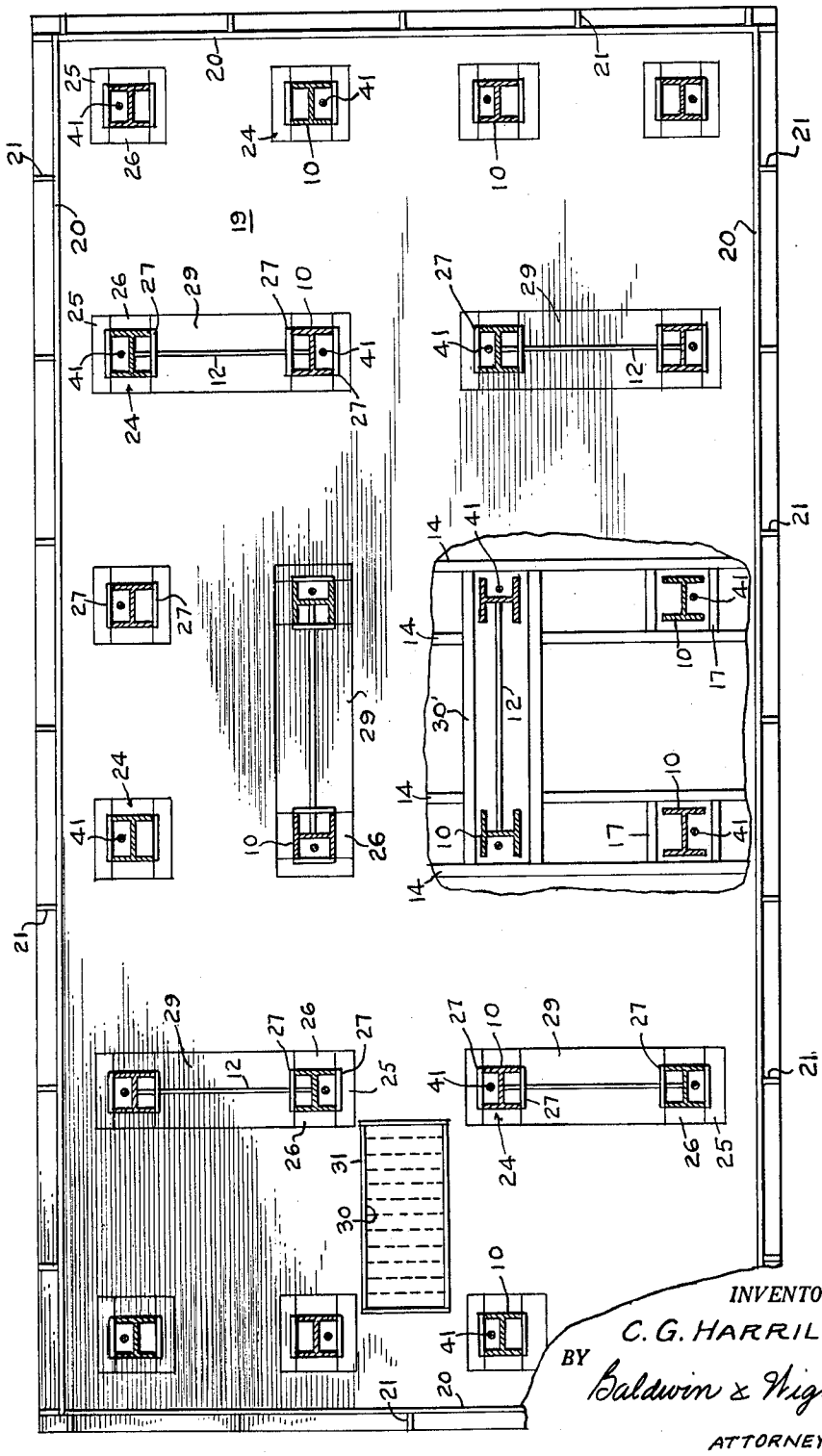
July 13, 1965 C. G. HARRILL 3,194,532

APPARATUS FOR POURING FLOORS OF A MULTI-STORY BUILDING

Filed Nov. 17, 1961 3 Sheets-Sheet 1

FIG. 1



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APPARATUS FOR POURING FLOORS OF A MULTI-STORY BUILDING

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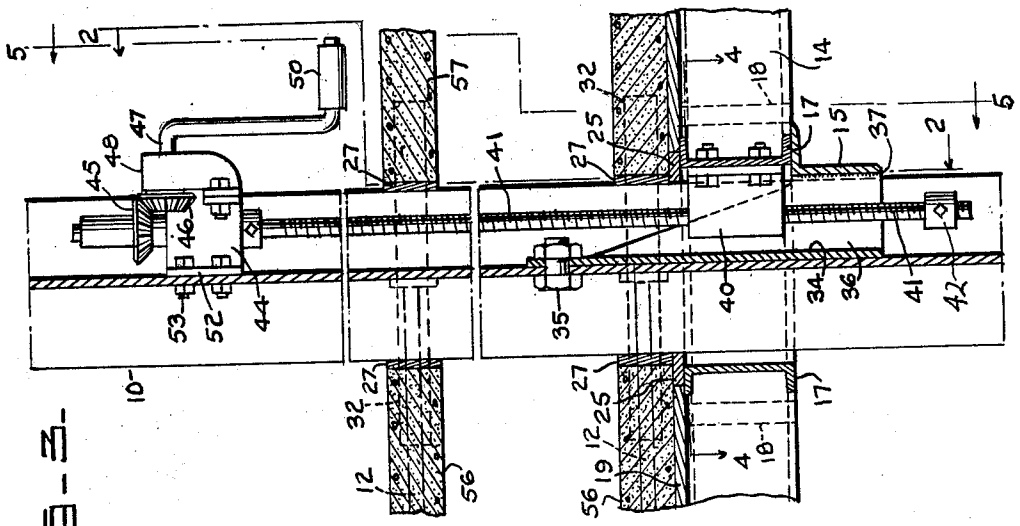


FIG - 3

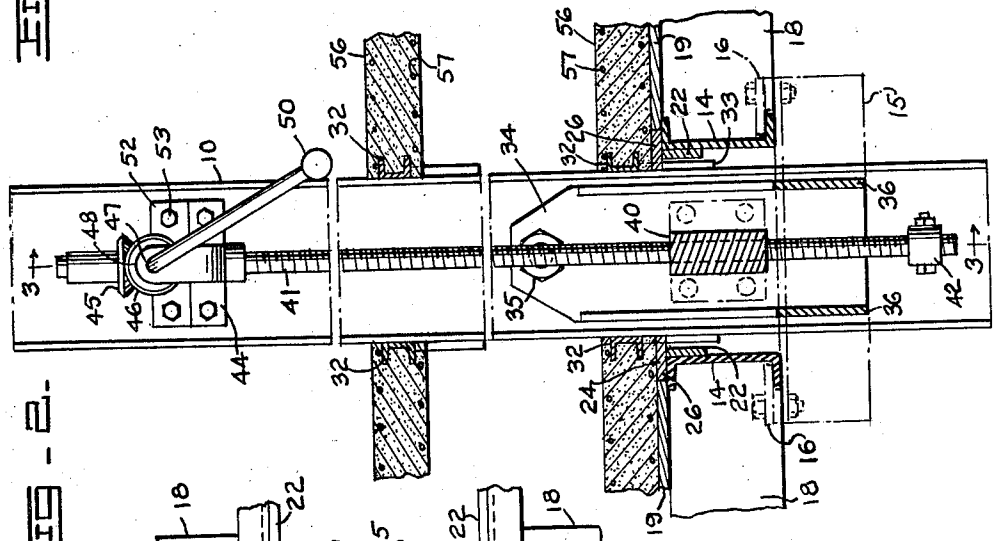


FIG - 2

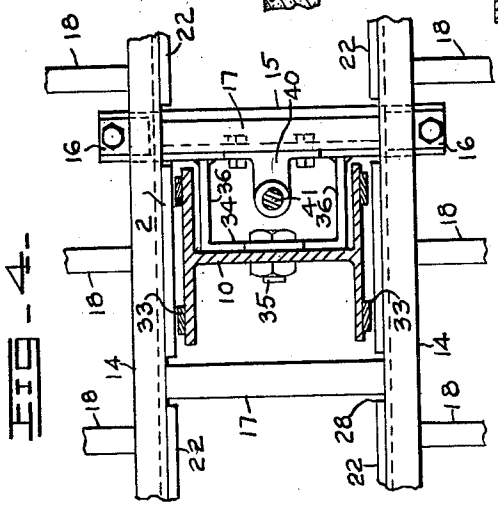


FIG - 4

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APPARATUS FOR POURING FLOORS OF A MULTI-STORY BUILDING

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FIG - 6 -

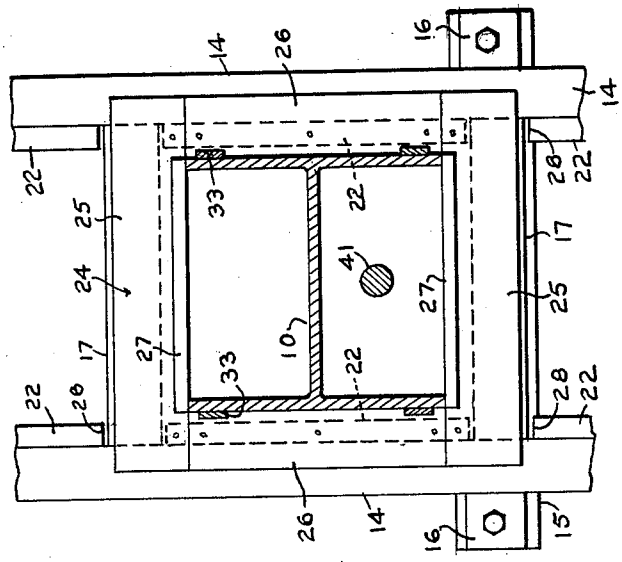


FIG - 7 -

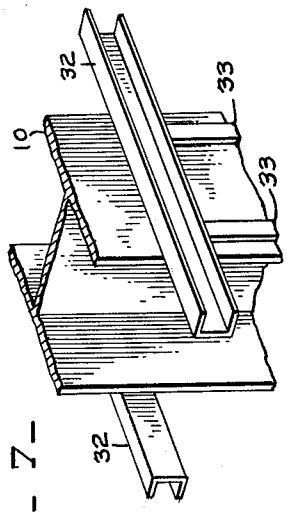
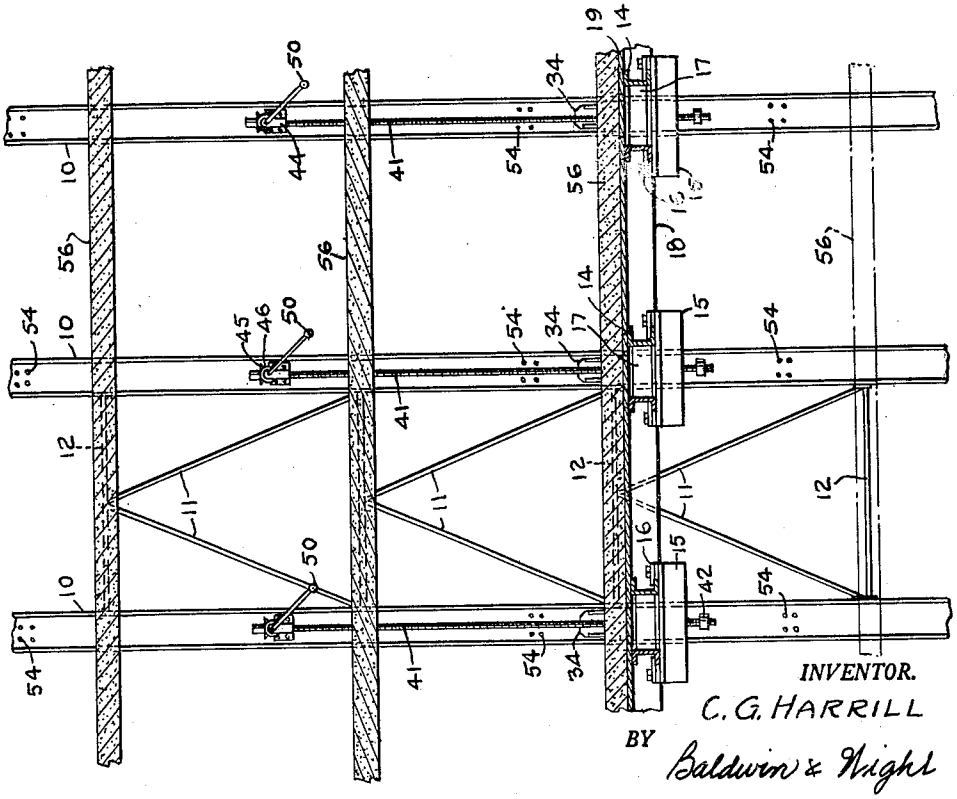


FIG - 5 -



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United States Patent Office 3,194,532 Patented July 13, 1965

3,194,532
APPARATUS FOR POURING FLOORS OF A MULTI-STORY BUILDING

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11 Claims. (Cl. 249—19)

This invention relates to a means for constructing buildings, more particularly the laying of the concrete floors of a building.

It is the conventional practice in constructing multi-story buildings to build from the ground up, and where concrete floors are laid, the first floor is laid, followed by the second and succeeding upper floors.

I have found that time may be saved and floor construction simplified by first erecting the vertical supporting structural elements of the building, for example H columns, and pouring the successive floors of the building from the top downwardly. The present invention therefore contemplates a method of so constructing the floors of a building, and the method comprises supporting, with respect to the vertical columns at the top of the building, forms in which the upper floor is poured in anchored relation to the columns, followed by the lowering of the forms away from the upper floor to the next lower floor, supporting the forms structure in such position, pouring such next to the top floor, and so forth downwardly through the height of the building. With such a method, the same form structure may be used without material alteration for successive floors from the top to the bottom of the building.

From a structural standpoint, an important object of the invention is to provide a novel floor form structure and to so support such structure with respect to the vertical columns of a building that after the uppermost floor has been poured, the forms supporting structure may be operated to lower the form structure into a position for the pouring of the next succeeding floor.

A further object of the invention is to provide such a form structure having detachable means at various supporting columns for fixing the form structure thereto, and to provide jack means also connectable between the form structure and the supporting columns so that after a floor has been poured and set, the detachable means referred to may be released for the supporting of the form structure solely by the jack means, whereby the form structure may be lowered into position for the pouring of the next lower floor, whereupon the detachable means referred to may be connected to the various columns and the jack structures released from the columns and lowered ready to support the form structure for the lowering thereof into position for pouring the next succeeding lower floor of a building.

A further object is to provide novel structural means forming a part of the form structure for supporting the forms themselves, and to provide novel means for anchoring the entire form structure at successively lower positions for the pouring of successively lower floors of a building so that the same form structure, with minor alterations, may be used throughout the height of a building for the pouring of all of the floors.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown one embodiment of the invention. In this showing:

FIGURE 1 is a plan view in the nature of a horizontal sectional diagram showing a convenient layout of elements of the present invention with respect to a typical building, parts being broken away;

FIGURE 2 is a vertical sectional view taken adjacent one of the H-section supporting columns, for example substantially on the line 2—2 of FIGURE 3;

FIGURE 3 is a similar view at right angles to FIGURE 2 taken substantially on the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary horizontal sectional view on line 4—4 of FIGURE 3;

FIGURE 5 is a fragmentary sectional view corresponding to line 5—5 of FIGURE 3 showing a portion of the supporting structure for a building with successive floors in the process of being poured;

FIGURE 6 is a fragmentary horizontal sectional view taken through a portion of one of the building columns, parts being omitted for the purpose of illustration; and

FIGURE 7 is a fragmentary perspective view of a portion of one of the columns with shear head floor-supporting means connected thereto.

Referring particularly to FIGURES 1 and 5, the numeral 10 designates a plurality of vertical building support columns shown in the present instance as being of the conventional H-section type. Some of the columns have been shown in FIGURE 1 as being turned 90° with respect to other columns. These columns are supported on suitable conventional foundations (not shown) and they are erected up to and preferably above the roof level of the building before the laying of the floors is begun. These columns, as erected, may be provided with suitable angular wind braces 11 and horizontal wind braces 12 for obvious reasons. As will become apparent, these wind braces may be left in position as the work of pouring successive floors progresses. It also will become apparent that the general arrangement of the wind braces shown is merely illustrative and forms no part of the present invention, and any desirable type of such braces may be employed. If the braces are to be left in position, the arrangement of the angular braces 11 in FIGURE 5 is preferred since it allows for the placing of doors in the walls which are built after all of the floors have been poured. On tall structures, temporary bracing will be required at intervals of three or four floors to brace the free standing columns, that is, those not connected to wind bracing. These temporary braces will be removed as the forms are lowered. The temporary braces form no part of the present invention and have not been illustrated.

After the columns 10 have been erected and suitably braced, the form structure to be described is assembled adjacent the top of the buliding, and any desired conventional means, forming no part of the present invention, may be employed for this purpose. For example, a standard erection crane, if suitable, may be employed for hoisting to the top of the building the component parts of the form structure, or a temporary elevator tower may be erected and temporary walk-ways, supported by the columns, may be placed in position for the assembling and connecting of the various elements of the form structure. If desired, for high buildings, a stiffleg guyed derrick may be used at the top of the building for elevating the parts of the form structure.

The form structure comprises a pair of structural elements such as channel beams 14 arranged at opposite sides of each of a plurality of aligned columns 10, as shown in FIGURE 2. For example, referring to FIGURE 1, a pair of beams 14 may be arranged at each side of each series of columns vertically or horizontally in FIGURE 1. Adjacent one side of each column, for example at the right side of the column 10 in FIGURES 3 and 4, a short angle member 15 may bridge the gap between two adjacent beams 14 and may be welded thereto or clipped in position as at 16 (FIGURES 2 and 4) to fix the mem-

bers 15 to the beams 14. Short channel beams 17 adjacent the other sides of each column 10 are welded at their ends to the beams of each adjacent pair 14. The angles 15 engage the bottoms of the beams 14 and 17 to support the latter. The beams 17, where practicable, are arranged on opposite sides of each column 10 to provide additional stiffening for the structure. Where wind bracing is employed as shown in FIGURE 1, the members 12 of such bracing will be attached to the columns as shown in broken lines in FIGURE 3. Where such braces occur, the beam 17 which crosses the vertical plane of the braces 12, will be omitted. For example, if the braces 12 were used as suggested in broken lines in FIGURE 3, the left-hand beam 17 would be omitted.

The members 14 are preferably of channel shape as indicated and each has its flanges facing away from the adjacent column 10 so that the channel of each beam 14 at one side of a series of columns faces the open channel of the beam 14 of the next series of columns spaced therefrom. These open channels receive the ends of joists 18 which form the basic support for the horizontal bed 19 of the floor form itself. The bed 19 of the floor form may be made of any suitable material such as boards, plywood, composition sheeting of suitable stiffness, etc. Referring to FIGURE 1, it will be noted that the form bed 19 is surrounded by edge forms 20 which will define the horizontal limits of the floor to be poured. These edge forms are braced outwardly thereof with respect to the bed 19 by corner blocks 21 or any other suitable means.

Referring to FIGURE 2, it will be noted that the beams 14 of each pair are spaced from the associated column, and inwardly of each beam 14 is arranged a nailing strip 22. The strips 22 are preferably bolted to the beams 14 and have their upper edges flush with the top flanges of the beams 14. The bed 19 is nailed to the strips 22 to be fixed in position relative to the beams 14.

Surrounding each column 10, the bed 19 is formed as a rectangular frame indicated as a whole by the numeral 24 and comprising horizontal strips 25 extending across the open side of each column, and horizontal strips 26 extending along the flanged sides of the column. Each strip 25 has nailed thereto a vertical edge form element 27, thus closing the open sides of the column to prevent concrete, when poured, from falling down through the columns. It will be noted in FIGURE 6 that the nailing strips 22 are broken, for example at the points 28, where the short beam sections 17 are connected between the pairs of beams 14. The strips 25 and 26 are lightly nailed to the strips 22 for a purpose to be described, and have their tops flush with the main portion of the form bed 19.

Between adjacent columns where wind braces are provided, "pop-out" horizontal form sections 29 (FIGURE 1) are employed, these sections at their ends carrying the adjacent form strips 27. The purpose of these "pop-out" plates will be described below and it will be apparent that they form continuations of the main bed 19 of the form. It also will be noted that anywhere within the area of the bed 19, openings 30 may be provided and surrounded by form strips 31, thus providing means for leaving floor openings for strairs, as indicated in dotted lines in FIGURE 1, openings for elevator shafts (not shown), and so forth.

In connection with the "pop-out" sections, it has been noted above that where a beam 17, extending between an adjacent pair of main beams 14, would intersect the vertical plane of wind braces, such beam 17 is omitted to prevent interference with the next lower wind braces when the form structure is lowered, as described below. Where columns 10 are turned at right angles to the position of the columns in FIGURES 2 and 3 relative to the beams 14 and 17, special cross braces 30' extend between the beams 14 at the remote sides of adjacent columns as shown just below the center of FIGURE 1. In such case, the adjacent beams 14 of adjacent columns are

cut off and welded to the special braces 30' thus leaving the space between adjacent columns free of the beams 14 so as not to interfere with movement of the next lower wind braces relative upward through such space as will become more apparent below.

Shear head means is connected to each column 10 to support the floor poured in the form. This may be in the form of channels 32 (FIGURES 2 and 7) welded to the flanged sides of the columns 10 and welded to depending steel straps 33 which, in turn, are welded to the beams 10.

A relatively heavy saddle plate 34 is provided at its upper end with a heavy bolt 35 for anchoring the saddle plate to the adjacent column, one of these plates being used for each column as will become apparent. Each plate 34 is provided at its sides with flanges 36 welded as at 37 (FIGURE 3) to the adjacent angle member 15. The supporting of this angle member with respect to the column therefore adequately supports the adjacent portion of the form structure also with respect to the column. Its connection at the point 35 is made prior to the pouring of each floor and remains in position until the floor has set after which the form structure is lowered to the next succeeding floor level, as described below.

One beam 17 of each pair has bolted thereto a screw bearing 40 through which is threaded a jack screw 41 having a limiting collar 42 fixed at its lower end. Where one of the beams 17 is omitted to prevent its interference with the wind braces, as stated above, the screw bearing 40 will be bolted to the remaining beam 17. For example if the left-hand beam 17 in FIGURE 3 had been omitted, the screw bearing 40 would be attached as shown in such figure. The upper end of each jack screw 41 is rotatable in a bearing 44 provided thereabove with a bevel gear 45. This gear meshes with a bevel gear 46 carried by a shaft 47 rotatable in a bearing 48 carried by the bearing 44. The shaft 47 is shown as having its portion outwardly of the bearing 44 formed as a crank to provide a handle 50 for rotating the gear 46 and hence the gear 45. The form of jack means illustrated is only suggestive of one type which may be employed, and it will be apparent that a ratch operated jack or hydraulic jack of any conventional type may be employed. Whatever type jack is employed is provided at the top 44 thereof with a plate 52 bolted as at 53 to the web of the associated column 10. The web of each column is provided above each floor level with a plurality of bolt openings 54, shown in FIGURE 5, to selectively receive the bolts 53.

In FIGURES 2 and 3, the form structure is shown as supporting in position a concrete floor 56 suitably reinforced as at 57, and an upper concrete floor 56 is shown in position supported by the shear heads 32 after the floor has set and the form structure has been lowered. In FIGURE 5, two upper floors 56 have been shown completed, another has been shown in recently poured position still supported by the form structure, and still another floor has been indicated as to its future position by the broken lines near the bottom of the figure.

Operation

The practice of the method and the operation of the means illustrated are as follows:

The columns 10 are erected in the manner suggested above and suitably wind-braced at selected points in the structure as indicated at 11 and 12. Where a tall building is being erected, temporary bracing will be provided as needed in connection with the free standing columns, that is, the columns which are not provided with the wind bracing illustrated. These temporary braces are removed as the pouring of the floors progresses as described below. The component parts of the form structure are raised to the top of the building and assembled in the manner suggested above to form the structure as illustrated. With the form structure assembled and with each saddle plate 34 bolted as at 35 to the associated

column, and with the base plate 52 of each jack bolted to the web of the column above the floor to be constructed, the pouring operation is ready to start. The strips 25 and 26 and the form pieces 27 will have been placed in position with the strips 25 and 26 nailed to the nailing strips 22, the nailing being only sufficiently secure to maintain these elements in position during the pouring operation.

The cement is elevated to the top of the building and poured into the form, the horizontal limits of the floor being defined by the form pieces 20 (FIGURE 1). The concrete will flow directly into contact with the flanged sides of the columns 10 and will be prevented from flowing into the open sides of the columns by the form pieces 27. The floor is finished in the usual manner and allowed to completely set and harden, whereupon the bolts 35 of all of the saddle plates 34 will be removed, leaving the entire form structure supported by the various jacks, one of which is preferably employed in connection with each of the columns as indicated by the presence of the screw 41 within each column in FIGURE 1. With the saddle plates 34 disconnected from the columns, the form structure is lowered by operation of the jacks.

To prevent any binding of the form with the columns, the strips 25 and 26 are lightly nailed to the nailing strips 22. In the lowering of the form structure, if any binding action occurs, the strips 25 and 26 are easily pulled loose so that the form structure may be easily lowered. At the next floor level, as further described below, the strips 25 and 26 are reapplied. The strips 26 are notched to fit around the straps 33. As previously stated, the "pop-out" plates 29 are employed in the vertical planes of the braces 11. As the form structure is lowered, therefore, the plates 29, also lightly nailed in position, are relatively free to be knocked upwardly out of the form structure to permit the latter to pass the braces 11. The plates 29 are replaced in position prior to the next pouring operation.

As previously stated, the form structure is lowered by operation of the jacks, and when the next lower floor position is reached, the openings for the bolts 35, previously drilled, will be aligned and the bolts 35 will be placed in position and tightened so that the form structure will be supported relatively to the columns 10 independently of the jacks. The screws 53 are then removed and the jacks are lowered to the next level of operation, whereupon the bolts 53 are attached to the next lower series of openings 54, as will be apparent from FIGURE 5. With the "pop-out" plates 29 and strips 25, 26 and 27 in position, the pouring of the next floor may be carried out in the same manner as described. Of course, the reinforcing rods 57 are placed in position prior to the pouring operation, and as each floor is poured the shear head structures 32, being between the planes of the top and bottom of the floor, will be embedded in the concrete and will serve effectively as a permanent connection between the floor and each column 10.

Except where the braces 11 and 12 are provided, the "pop-out" plates 29 need not be used as indicated in FIGURE 1, the structure in FIGURE 6 being employed at each column.

From the foregoing it will be apparent that the present method permits the use of a fabricated floor form structure at the top floor of a building, and the same structure, without being disassembled, may be used for each successive lower floor throughout the height of the building. There is no removal of any part of the apparatus during movement thereof from one floor to the next lower floor except for the popping out of the plates 29, where employed, and the loosening from the nailing strips 22 of the strips 25 and 26 to eliminate any binding action of the parts with respect to any column, thus permitting the form structure to be readily lowered from each floor after the latter has been poured and set. The replacing of the strips 25 and 26, and the plates 29, where employed, is a relatively simple operation. Accordingly, it will be apparent that successive concrete floors of a building may be poured much more cheaply than with any prior methods and in substantially less time, thus effecting a substantial saving in the erecting of the building.

The procedure and structure described and shown are representative of the invention, but it is intended that the disclosure be illustrative rather than definitive, the invention being defined in the claims.

I claim:

1. Apparatus for pouring the floors of multi-story buildings having pre-erected vertical supporting columns, comprising a floor form having vertical form edges defining the limits of the floor slab to be poured, means beneath the form engaging and supporting it adjacent each column, detachable means connecting such supporting means to at least a plurality of the columns, and jack means connecting the supporting means to the columns independently of said detachable means whereby, after a floor slab has been poured in the form, said detachable means may be disconnected and said form and its supporting means lowered to the next adjacent lower floor for detachable re-connection of said supporting means with said columns.

2. Apparatus for pouring the floors of multi-story buildings having pre-erected vertical supporting columns, comprising a floor form having vertical form edges defining the limits of the floor slab to be poured, means beneath the form engaging and supporting it adjacent each column, detachable means connecting such supporting means to at least a plurality of the columns, and suspension jack means connected at its lower end to each of said supporting means and at its upper end to an adjacent column, whereby, after a floor slab is poured, said detachable means may be disconnected from said columns, and said form and its supporting means may be lowered by said jack means to a position corresponding to the desired level of the next lower floor and said detachable means may be connected again to said columns to support said form for the pouring of such next lower floor.

3. Apparatus for pouring the floors of multi-story buildings having pre-erected supporting columns at least certain of which have continuous vertical channels, comprising a horizontal form extending between and around the columns and closing the channels in said certain columns, and having form pieces defining the limits of the floor slab to be poured, supporting means arranged beneath and engaging said form around at least a plurality of columns, detachable means for connecting said supporting means to each of said plurality of columns to support said form during the pouring of concrete in the form, and a plurality of jack means for supporting said supporting means with respect to said plurality of columns independently of said detachable means, said jack means having portions extending vertically through the channels of said certain columns, and each of said jack means being connected to the associated column and to said supporting means, whereby after the pouring of a floor, said detachable means may be disconnected from the columns and said form and said supporting means lowered to a desired position for the pouring of the next lower floor, whereupon said supporting means may be again detachably connected to said plurality of columns during the pouring of such next adjacent lower floor.

4. Apparatus for pouring concrete floors of a multi-story building having pre-erected supporting columns, comprising a form having horizontal bed and vertical form pieces defining the horizontal plan shape of the desired floor, structural supporting means beneath said form bed for supporting it with concrete therein, said structural supporting means comprising elements surrounding each of at least a plurality of said columns, said structural supporting means further comprising par-

allel elongated structural members extending throughout one horizontal dimension of said form, and means extending between said elongated structural members and engaging and assisting in supporting said bed, detachable means for connecting to the adjacent column each of the supporting means surrounding such column, and jack means supporting said structural supporting means with respect to each of said plurality of columns independently of said detachable means whereby, after the pouring of a floor slab, said detachable means may be disconnected and said form lowered by said jack means to the next lower predetermined floor level, whereupon said detachable means may be connected to said plurality of columns for the pouring of such next adjacent lower floor.

5. Apparatus according to claim 4 wherein said parallel structural members comprise pairs of such members arranged at opposite sides of each series of columns aligned in one direction, said means extending between said parallel structural members comprising beams connected between each of the structural members at one side of one series of aligned columns and the parallel structural member arranged at the near side of the next series of aligned columns.

6. Apparatus constructed in accordance with claim 4 wherein said detachable means comprises a saddle plate fixed to the portion of said supporting means surrounding each column, each saddle plate being bolted to the adjacent column.

7. Apparatus constructed in accordance with claim 4 wherein said detachable means comprises a saddle plate fixed to the portion of said supporting means surrounding each column, each saddle plate being bolted to the adjacent column; said parallel structural members comprising pairs of such members arranged at opposite sides of each series of columns aligned in one direction, said means extending between said parallel structural members comprising beams connected between each of the structural members at one side of one series of aligned columns and the parallel structural member arranged at the near side of the next series of aligned columns.

8. Apparatus constructed in accordance with claim 4 wherein each jack means extends vertically upwardly from said supporting means and is connected at its lower end to said supporting means and at its upper end to the adjacent supporting column.

9. Apparatus constructed in accordance with claim 4

wherein each jack means extends vertically upwardly from said supporting means and is connected at its lower end to said supporting means and at its upper end to the adjacent supporting column; each supporting column having a vertical channel, each jack means having a stem arranged in such channel, certain of said form pieces closing said channels to prevent concrete from flowing thereinto.

10. Apparatus according to claim 4 wherein said form bed comprises a plurality of strips in the plane of such bed and relatively closely surrounding each column, said strips being relatively freely movable upwardly relative to said bed when the latter is lowered to prevent said bed form binding against said columns.

11. Apparatus according to claim 4 provided with nailing strips carried by said structural supporting means at opposite sides of each column, said form bed comprising in part horizontal strips defining a rectangle surrounding each column relatively close thereto and lightly nailed to said nailing strips whereby, when said form is lowered, said strips relatively easily pull loose from said nailing strips to prevent said form bed from binding with respect to said columns.

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