

Sept. 4, 1962

J. C. LONG ET AL

3,052,449

JACKING MEANS FOR BUILDING CONSTRUCTION

Filed Oct. 6, 1958

7 Sheets-Sheet 1

Fig. 1

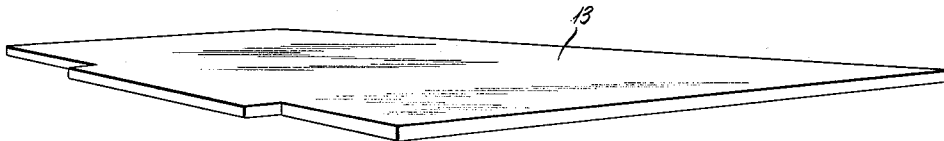


Fig. 2

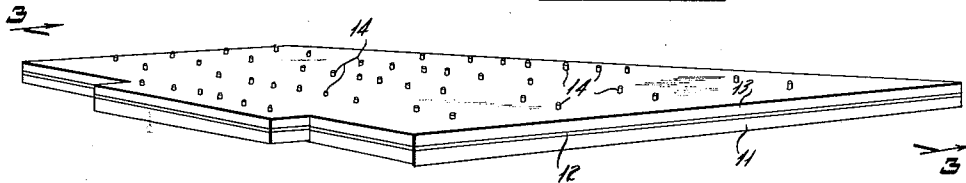


Fig. 3

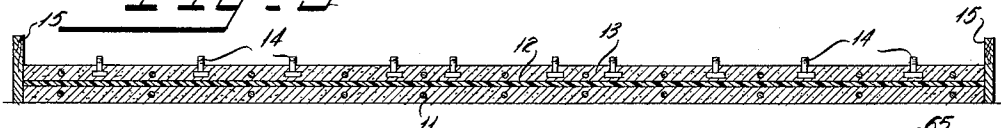
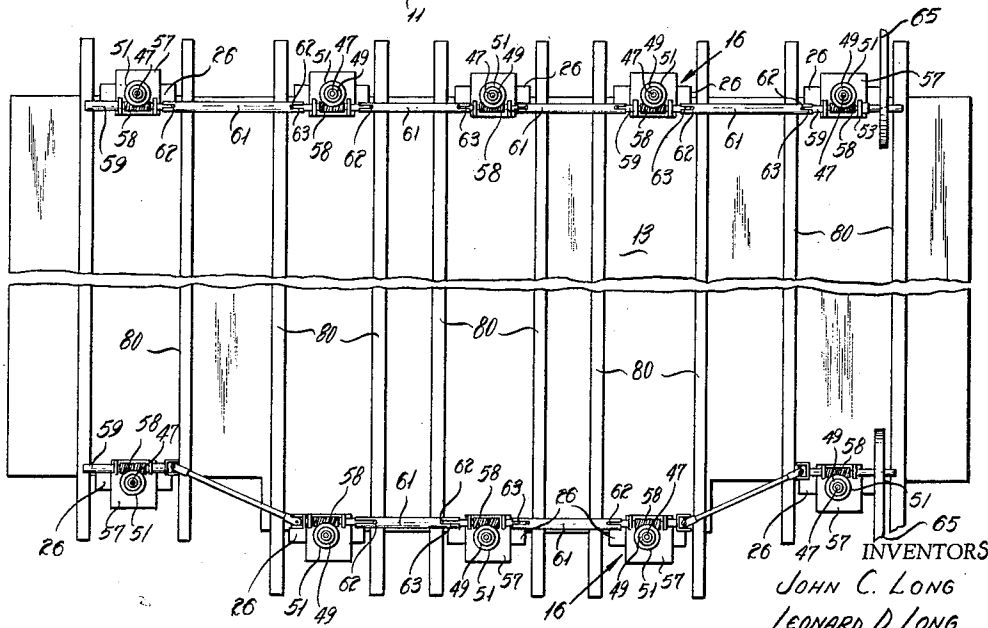


Fig. 4

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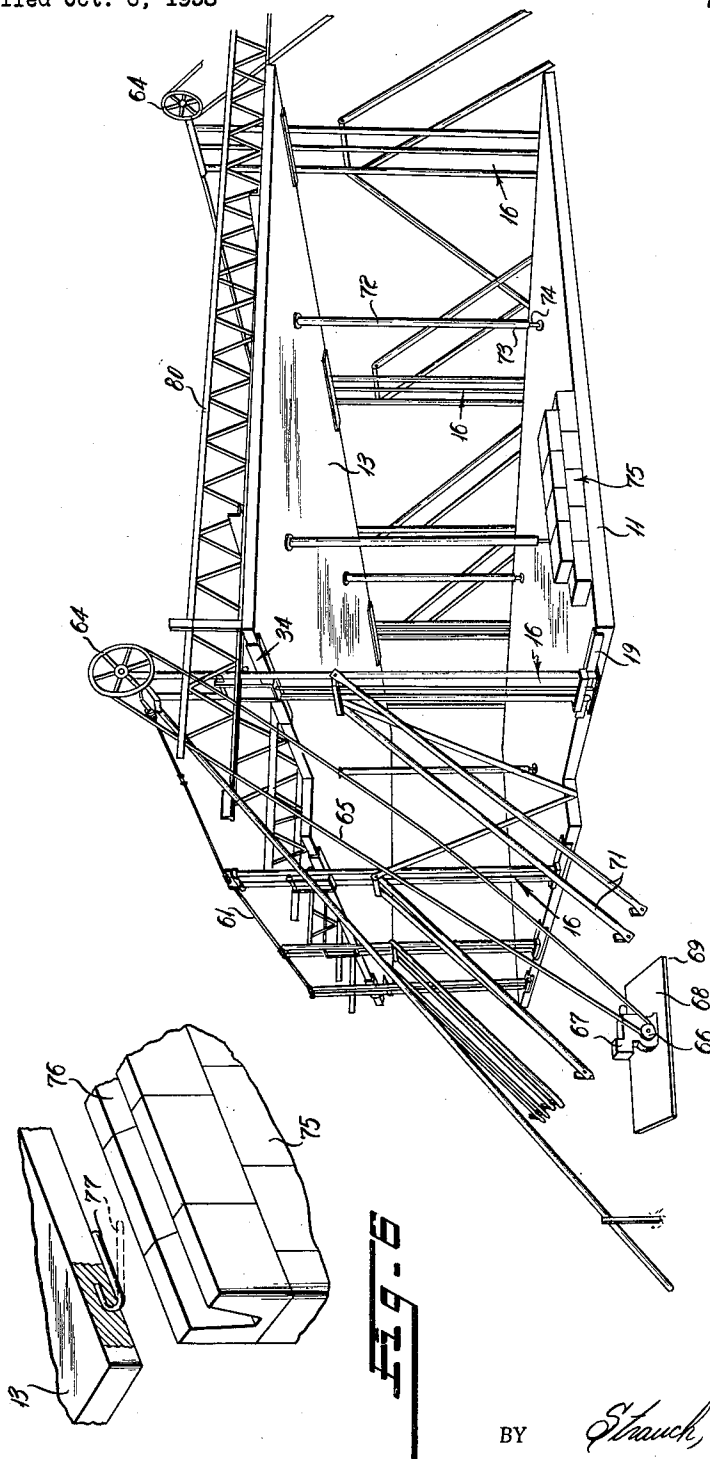


Fig. 5

Fig. 6

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7 Sheets-Sheet 3

Fig. 1

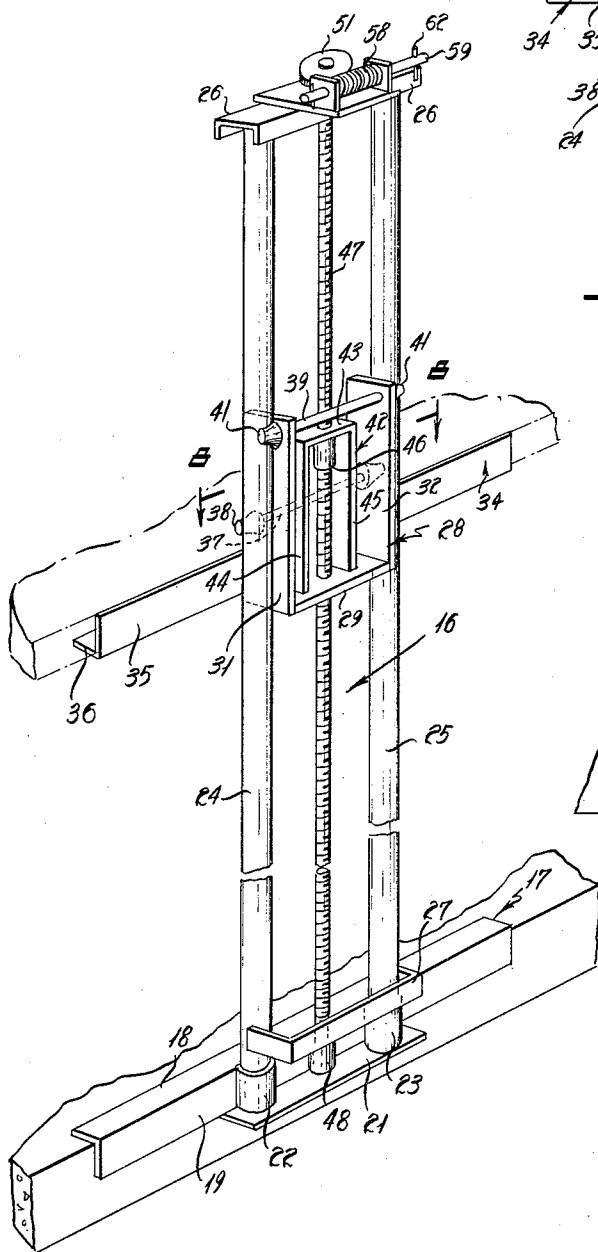
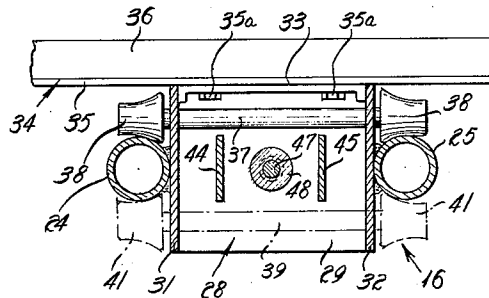


Fig. 2

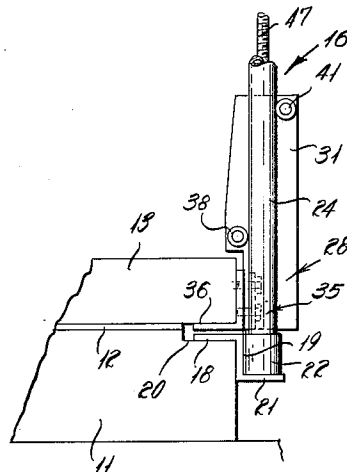


Fig. 7A

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Fig. 9

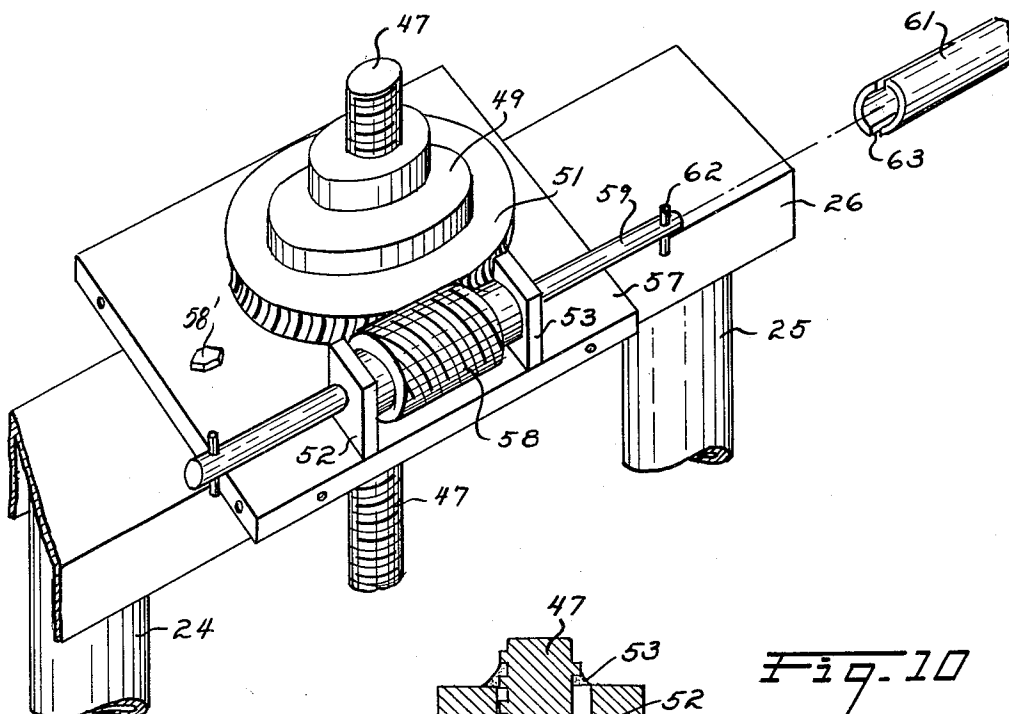
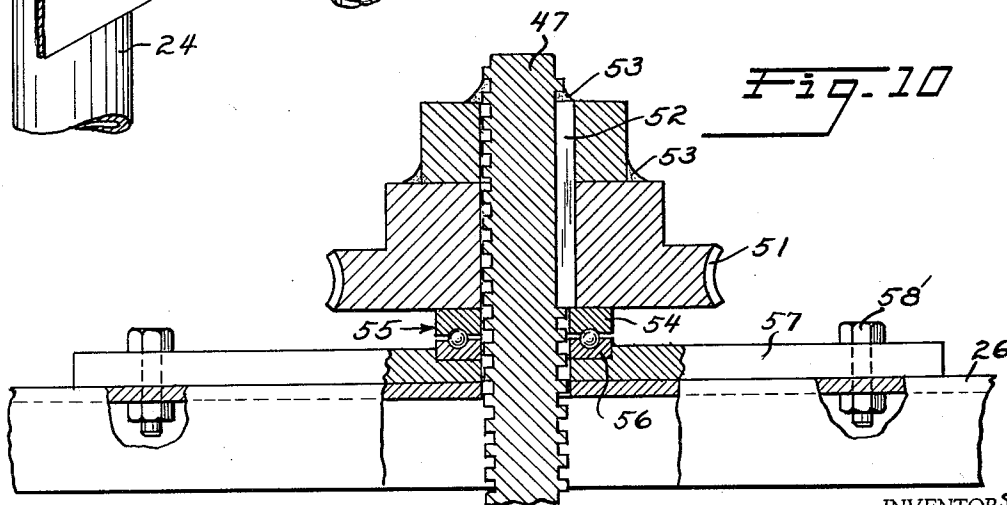


Fig. 10



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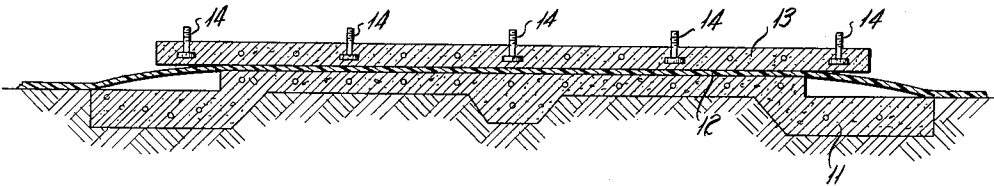


FIG. 11

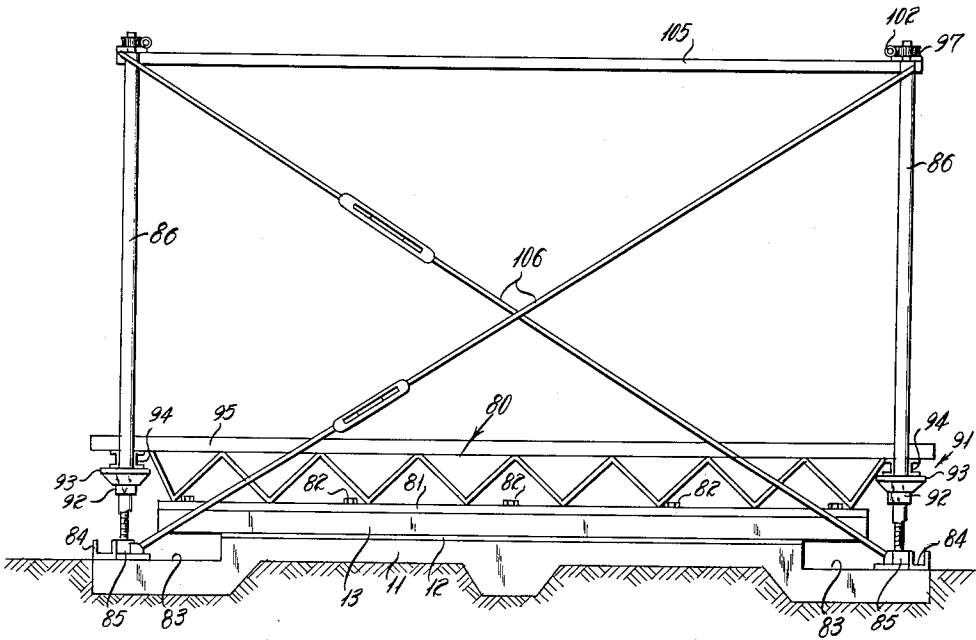


FIG. 12

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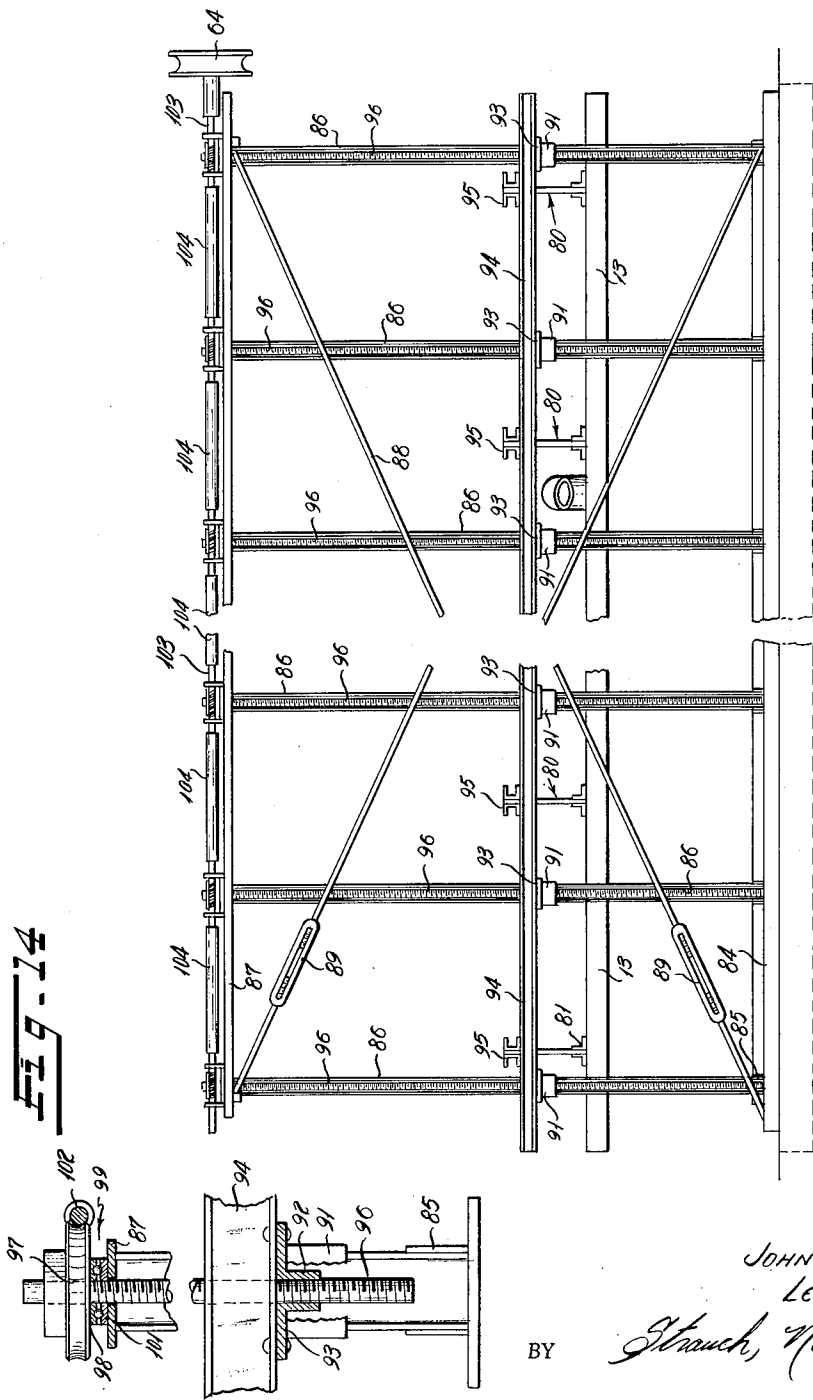
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JACKING MEANS FOR BUILDING CONSTRUCTION

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ET-73

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JACKING MEANS FOR BUILDING CONSTRUCTION

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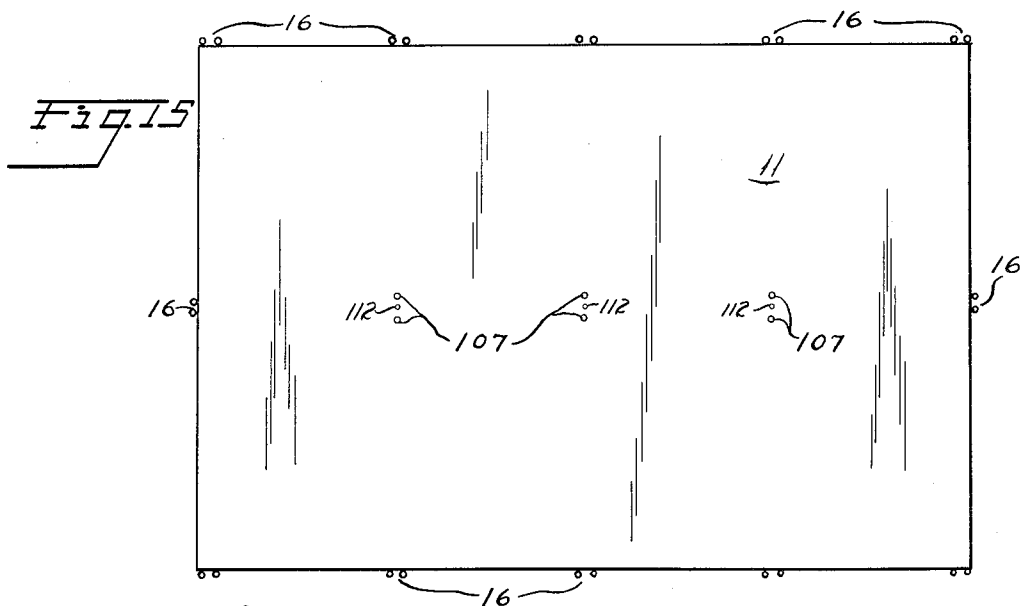
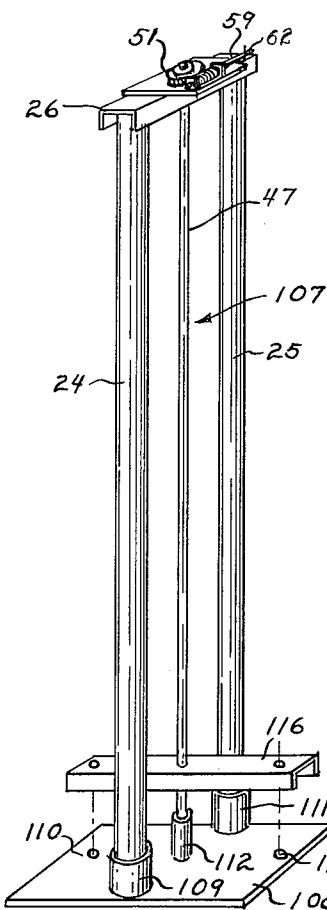
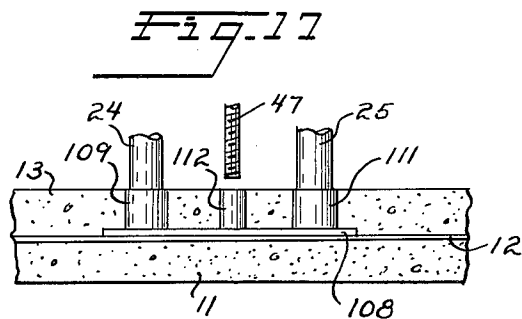
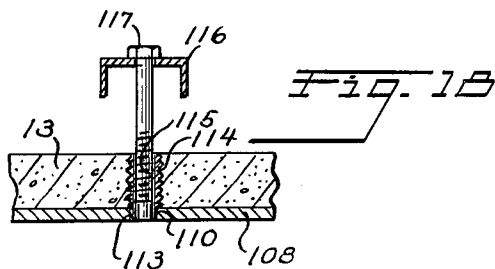


Fig. 16

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3,052,449 JACKING MEANS FOR BUILDING CONSTRUCTION

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Filed Oct. 6, 1958, Ser. No. 765,499
3 Claims. (Cl. 254—89)

This invention relates to building construction and particularly to methods and apparatus for the economic and speedy construction of buildings having concrete roofs and intermediate floors.

Prior to the invention, although the desirability of concrete roofs and intermediate floors has been accepted, there was no available manner of economically incorporating such structure into small buildings. Usually this involved the following requirement. First framing to hold the roof or floor was required. This has usually been accomplished by means of wood posts or supports upon which was placed plywood or some other type of wood decking. Reinforcing was placed on top of the decking and then concrete poured onto the decking. After a given number of days, usually 28 or more, the supports and forming were removed. In using the wood posts or supports and the plywood forming to hold the concrete, it was necessary that the thickness of the concrete be so large and the reinforcing be so increased so that there would be a clear span after the forming was removed, and it was practically impossible to build wall supports under the concrete roofs or floors while the wooden supports remained in place. The extra concrete and reinforcing to create the clear span greatly increased the costs of the concrete roofs and sometimes made them impractical.

The expense of placing the reinforcing and the concrete into the forms for the roof or upper floor was a material factor to be considered, for in the construction industry every item of material or work above ground level increases costs of construction. Another factor that had to be considered in the construction of concrete roofs or upper floors in a conventional manner of supporting the roof or upper floor by wood framing and wood supports and the use of plywood for the forming of same was the fact that it is literally impossible to secure a proper finish on the underside of the concrete roof or upper floor due to the joints between the plywood forming.

Another factor that had to be considered in the construction of roofs and upper floors in a conventional manner was the fact that in spite of most careful operations, there would be dripping and leaking of the cement onto the floors below, due either to spillage while placing the concrete on the roof or upper floor or the leaking of the cement through the joints in the plywood. Therefore, unless the spillage of the concrete was immediately removed, which proved awkward working between the wooden supports of the roof or upper floor, it would adhere to the lower floor, necessitating the removal of the same with scars on the lower floor.

In the conventional manner of constructing a concrete roof or upper floor, there was also the considerable expense of placing the framing and plywood forms in place, the removal of the forms and the depreciation of the forms due to damage by use. It has been estimated that wood forms cannot be used more than eight times, and this proved an expensive factor in itself, without the other additional costs of constructing concrete roofs and the like in a conventional manner, all of which has heretofore precluded the use of concrete roofs and upper floors in the lower price range of construction.

The invention is particularly directed to the raising of precast concrete roofs and upper floors without embodying columns in the section of the floor or roof that is being

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raised into place. The use of jacks to raise concrete slab roofs has been suggested, but in all applications known to the applicants the jacks have been located at the places where there is to be a column, and in fact in many instances the jack itself is left permanently in position to serve as the column. In this manner there is obtained a free span of roof or floor simply by lifting the slab from its side and/or end edges.

The invention contemplates raising precast second, third and more upper floors as well as the roof, from the stationary floor beneath. For example, where a two story house is to be built, the ground or first floor slab is poured in place and allowed to harden. Then the second floor slab is poured onto the top of the ground slab and raised to ultimate position when hardened according to the manner below described, and then the roof slab is poured onto the raised second floor slab and the roof slab when hardened is raised by the jacks reacting from the now stationary second floor slabs. In this manner the invention is applicable to multi-story buildings.

The invention provides the only known method which can be adapted to any location or condition of terrain, and for raising the upper floor or roof into place without the location of the jacks being determined by columns to support the floor or roof.

The invention provides particular economy of building which is especially true for small low cost houses. The jacks may be used repeatedly and they eliminate the hitherto high cost of expensive framing and temporary support structures that had to be torn down and rebuilt for each successive floor or roof.

The invention will now be described in its simplest embodiment which is the erection of a one story building having a concrete floor and a concrete roof. It will be appreciated that for a two story building for example, instead of a roof slab, a second floor slab would be separately precast onto the first floor slab, and then the roof slab similarly precast onto the raised second floor slab.

The present invention in its preferred embodiment provides an entirely novel construction involving the following procedure:

First a slab is poured to serve as the ground or first floor. Then, within 24 hours after the first floor is in place, or later if desired, coating is formed or placed over the top surface of the floor. One form of this coating may be for example a water tight tough polyethylene sheet or like unitary covering placed over the entire slab floor. This covering is pulled tight to eliminate wrinkles. After the sheet is on the floor, wire mesh or reinforcing means of appropriate size is placed on top of the covering. Alternatively to the use of such removable sheet coverings the coating upon the top surface of the floor slab may comprise a layer of some paint or wax-like liquid or other water impervious material spread like paint over the entire top surface. Such a coating, like the removable sheet type of covering, prevents the wet concrete poured onto it from adhering to it, and in the claims this coating or covering will be referred to as a layer of material effective to prevent adherence of the wet concrete to the floor beneath and to permit separation of the slabs by lifting the upper slab. The plastic sheet covering is preferable for residential dwellings because it provides a smoother bottom surface on the formed upper slab.

The wet concrete is then poured on top of the covering sheet and the reinforcing is imbedded in it, the concrete being of such thickness as has been determined appropriate for the given structure of roof or upper floor slab. At desired places there are inserted at given intervals bolts with special fasteners made especially for use in concrete.

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After the concrete has set for a given number of days, depending on the type of concrete that was used, bar joists are usually placed on the top of the upper poured slab and secured to it by means of the bolts that were imbedded in the concrete.

To raise the roof or upper floor slab there is placed on each long side a given number of special coacting screw type jacks of a character to be described in detail, varying in length from 10 to 12 feet. These special jacks may be placed on 5 foot centers, so in raising a roof 30 feet long, there would be a total of seven jacks on each side. Any center spacing practical may be used. No jacks are placed at the end of the buildings for most operations but in some instances added jacks will be used at the ends of the slabs as well as the long sides, and the bottoms of the jacks rest on the footing of the slab floor. The jack lift rods on each side of the building are connected as by a sectional tubular shaft and gearing. At the top of each jack lift rod is a worm gear, which worm gear is operated by means of the tubular shaft. On the first jack at either end of the building and on each side of the building, there is a pulley that is operated by means of a belt. This belt leads from the pulley on each side of the house to separate small gasoline or electric motors located on the ground. Alternatively only one motor may be used and the two pulleys connected by a belt to be driven together for more accurate synchronization of the lift effort at both sides.

The jacks are spaced so that they lift the slab with a practically continuously distributed effort under the edges of the slab on each side thereof. Each jack sustains as near as possible a uniform load and exerts an equal upward push on the slab being lifted. As a result there is little or no torsional or bonding strain in the slab being lifted and it does not crack.

The roof or upper floor slab is raised usually about a foot or more above the desired height of the wall below it. The jack holds the raised slab at this height until the walls below are completed. Then by simply reversing the jacks, the slab is lowered onto the wall and the freed jacks are removed. Specific and novel structure including special jacks will be described for carrying out the invention.

The major object of this invention therefore is to provide a novel simple and economical method for constructing a building wherein a roof or upper floor slab is cast in overlying relation to the floor beneath and then raised to permit building of the walls beneath it.

Another object of the invention is to provide a novel method of building construction wherein a precast roof or upper floor slab is lifted from a stationary floor slab by a special jack and drive construction which is entirely removed when the roof or upper floor slab has been lowered onto walls erected on the lower floor slab.

It is a further object of the invention to provide a novel method of building construction wherein floor and roof slabs of concrete or the like are separatively cast one above the other, the upper floor or roof slab lifted to just above desired side wall height, the side walls below it erected, and then the upper floor or roof slab lowered onto the erected walls.

A further object of the invention is to provide a novel method of building construction wherein a floor slab is cast on the ground and covered with relatively smooth layer that does not adhere to wet concrete and the upper floor or roof slab is cast over the top of said layer. The layer may be painted on or may be a sheet of such character that it is readily removed when the slabs are separated vertically.

It is a further object of the invention to provide a novel method and apparatus for building construction wherein a cast roof or upper floor slab of concrete or the like as raised with respect to a floor slab with uniformly distributed lifting effort to reduce strains in the rising slab.

A further object of the invention is to provide a novel

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arrangement of precast upper floor or roof slab lifting jacks for building construction.

It is another object of the invention to provide a novel jack structure for lifting cast floor or roof slabs and the like.

Another object of the invention is to provide a slab lifting jack of novel construction having a special lift and drive arrangement.

It is a further object of the invention to provide a novel drive arrangement for a plurality of slab lifting jacks wherein all are actuated at substantially the same rate to exert uniform lift effort along the slab.

Further objects of the invention will appear as the description proceeds in connection with the appended claims and the annexed drawings wherein:

FIGURE 1 is a substantially perspective view of a roof slab;

FIGURE 2 is a substantially perspective view showing pre-cast floor and roof slabs as separated by a non-adherent layer in the form of a polyethylene sheet;

FIGURE 3 is a section essentially through superposed pre-cast floor and roof slabs showing the separating sheet and the anchors for attaching the girders to the roof slab;

FIGURE 4 is a top plan view showing the jacks aligned along opposite sides of a roof slab and connected to be driven for lifting the slab;

FIGURE 5 is a substantially perspective view showing the entire operation in progress with a roof slab partially lifted by the jacks;

FIGURE 6 is a fragmentary substantially perspective section showing the interlocking arrangement of the edge of a roof slab with the top of the erected side wall;

FIGURE 7 is an enlarged perspective view showing a jack according to a preferred embodiment of the invention with a roof slab shown partially raised;

FIGURE 7A is a fragmentary detail showing the jack as applied to the slab prior to raising the slab;

FIGURE 8 is a section substantially on line 8—8 of FIGURE 7;

FIGURE 9 is an enlarged perspective view showing the drive shaft coupling and gearing at the top of each jack;

FIGURE 10 is a section through the drive connection and thrust bearing at the top of each jack;

FIGURE 11 is a section showing another form of pre-cast superposed floor and roof slabs wherein the roof slab slightly overhangs the floor slab;

FIGURE 12 is an end elevation of a jacking arrangement for lifting a roof or upper slab which has been cast over a floor slab wherein jacks based on the floor slab are connected to lift girders secured to the roof slab;

FIGURE 13 is a side elevation of the arrangement of FIGURE 12 showing the parts as they appear when the roof slab has been partially raised;

FIGURE 14 is an elevation partially in section showing the jack drive and thrust bearing arrangement at each jack unit of the assembly of FIGURES 12 and 13;

FIGURE 15 is a top plan view of a roof or upper floor slab according to another embodiment;

FIGURE 16 is a perspective view showing a jack for use in lifting the central part of this slab;

FIGURE 17 is a fragmentary elevation showing the jack base; and

FIGURE 18 is another fragmentary elevation partly in section showing how a roof slab is attached to the jack lift member.

According to the embodiment of the invention selected to illustrate the mode of practicing the invention a flat-topped concrete slab 11 is first cast on the ground at the site of the house to be erected. This slab is thick enough to serve as the floor of the house, and it is suitably anchored in situ. Then, after the floor slab 11 is hardened, its top surface is either covered by a removable layer such as a thin sheet 12 of tough flexible smooth moisture resist-

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ant and impervious material of such characteristics that it will closely overlie the floor slab and permit the flat concrete roof slab 13 to be poured onto it and to maintain the roof slab 13 isolated from floor slab 11 until the roof slab has hardened, or the top surface is coated with a fixed layer such as a wax-base paint that will not adhere to wet concrete. Sheet 12 is drawn tight to eliminate wrinkles. For inexpensive house construction the slabs are usually substantially rectangular, although any suitable variation in form may be provided. Slab 13 may of course be a second floor slab instead of a roof slab.

During the casting of each slab 11 and 13 suitable wire or rod reinforcement may be incorporated within them and reference to these slabs herein includes both reinforced and non-reinforced slabs. Also, during the casting of the slab 11, a series of rows of anchor members 14 are cast therein, and these may be for example headed bolt-like members having threaded shanks projecting above to the flat top surface of slab 13. Any suitable fasteners may be used as anchors.

Suitable forms for casting the slabs are shown at 15 in FIGURE 3 and these may be conventional. Care should be taken in this embodiment that the roof or other slab to be raised should have no appreciable overhang relative to the slab below it. Usually, see FIGURE 7A, the longer side edge of the rectangular floor slab 11 is formed with recessed edge shoulder means 20 which may be either a continuous groove or a series of them to accommodate the various jack bases to be later described. Alternatively this shoulder could be formed in the roof slab as a downward recess or the roof slab, by using suitable forms, may be cast to overhang the side edge of the floor slab as will be evident in the form of FIGURE 12. In any event, whether shoulder or overhang is provided, arrangement is made for jack bases to seat on the floor slab 11 along its side edge and enable the lift members of the jacks to fit under the side edges of the slab to be raised.

After the slab 13 has hardened the forms are removed and a series of jack assemblies 16 are arranged along the opposite long sides of the slabs, as shown in FIGURES 3 and 5. As shown in FIGURES 7 and 7A, each jack assembly comprises a base 17 of rigid angle iron that has a horizontal top leg 18 seated on the floor slab at shoulder 20, a vertical depending leg 19 engaging the side of the floor slab above ground level, and a horizontal outwardly extending leg 21 which may or may not be coextensive with the length of the other legs. Two tubular sockets 22 and 23 are formed on leg 21 to receive the lower ends of vertical pipes 24 and 25 which are the rigid frame side members of each jack assembly.

At the upper ends of each jack assembly a rigid frame channel 26 is fixed as by welding across the tops of pipes 24 and 25. Near their lower ends pipes 24 and 25 are rigidly joined by a brace 27 usually welded to them. Several of these braces may be used along the pipes as desired.

The lift member of each jack assembly 16 comprises a U-shaped elevator frame 28 having a horizontal bridge 29 and spaced upright vertical side plates 31 and 32. The lower ends of plates 31 and 32 are rigidly joined by a plate 33 preferably welded thereto, and a length of rigid angle iron 34 has its vertical leg 35 removably secured to plate 33 as by bolts 35a. The horizontal leg 36 extends under the edges of the roof slab as shown in FIGURE 7A, which is the start of the lift operation, and FIGURE 7 shows the roof slab partially lifted.

Each elevator 28 is laterally supported and guided for vertical movement along pipes 24, 25 by upper and lower freely rotatable roller assemblies. The lower roller assembly consists of an axle 37 with rollers 38 at opposite ends, and the upper roller assembly consists of an axle 39 with rollers 41 at opposite ends. Axles 37 and 39 are freely journaled in plates 31 and 32. Alternatively the axles may be fixed and the rollers freely rotatable. As shown in FIGURE 8, axles 37 and 39 are parallel and

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arranged in vertically displaced relation on opposite sides of the pipe frames 24, 25. The rollers 38 and 41 are so shaped as to smoothly roll along the cylindrical pipes and they are shaped and arranged to prevent any appreciable shift or tilt of elevator 28 either toward or away from the roof slab or along the roof slab, and the motion of elevator 28 is essentially only vertical.

Secured to the elevator bridge 29 is an inverted U-shaped bracket 42 having a horizontal bridge 43 and depending parallel legs 44 and 45 welded at their lower ends to elevator bridge 29. As shown in FIGURE 8 this bracket is within the lateral confines of axles 37 and 39 and does not interfere with them. Centrally of bracket bridge 43 is a depending rigid hollow boss 46 that is internally formed with a spiral screw thread. A vertical threaded rod 47 is rotatably threadedly engaged within boss 46 and extends below to seat freely rotatably within a guide or step bearing 48 on the base leg 21.

At its upper end rod 47 enters a gear assembly 49 that comprises a worm gear 51 having its hub keyed to rod 47 at 52 and welded thereto at 53 so as to be fixed axially and non-rotatably on rod 47. The gear assembly is supported on the upper race 54 of a roller thrust bearing assembly 55 having its lower race 56 fixed to a platform 57 secured on the top of channel 26 as by bolts 58. Thus rod 47 extends freely through channel 26 and is effectively suspended therefrom. Thrust bearing 55 may bear the entire weight of the rod 47 and the gear assembly and lower bearing 48 may simply be a guide. If desired lower bearing 48 may be omitted.

Platform 57 also carries a worm 58 meshed with gear 51 and fixed on a shaft 59 journaled in spaced supports 52, 53 on the platform so as to be restrained against longitudinal movement. A cover for platform 57 open only to pass the opposite ends of shafts 59 may be provided.

Referring now to FIGURE 4 it will be seen that shafts 59 of the respective jack assemblies are connected non-rotatably at opposite ends to shaft sections 61. Preferably each shaft 59 has at opposite ends fixed radial pins 62 and the shaft sections 61 are hollow and longitudinally slotted at 63 to be telescoped over and locked non-rotatably with shafts 59. This allows a considerable variation in spacing of the jack assemblies along the sides of the slabs. Universal joints are provided where the shafts are angularly related.

At one end of each side of the house a pulley 64 (FIGURE 5) is fixed on the shaft 59 and this pulley is drive connected by a belt 65 to a pulley 66 on an electric motor assembly 67 mounted on a platform 68. Alternatively motor 67 may be an internal combustion motor assembly. Platform 68 is effectively pivoted at 69 and it will be seen that in the illustrated position of FIGURE 5 it maintains belt 65 taught to drive pulley 64 but when tilted clockwise it will loosen the belt and interrupt the drive. This provides a simple variable speed drive and clutch to pulley 64. Alternatively instead of supplying two motor assemblies 67 connected to the respective pulleys 64, only one motor 67 of suitable size is used connected by belt to one pulley 64, and the pulleys 64 are connected in synchronism by a chain and sprocket drive.

Suitable rigid braces 71 may be provided to maintain the jack frames vertical.

In practicing the invention, the floor and roof slabs are cast of concrete spaced by the polyethylene sheet 13 or other layer. Then a series of jack assemblies 16 is arranged on each long side of the slabs so that the base of each jack seats on the floor slab while the leg 36 of each extends under the edge of the roof slab. Usually the jack assemblies are spaced apart about four to six feet and braced in position. Then each jack assembly is adjusted by turning its shaft 59 until leg 36 engages the underside of the roof slab under load. Then the shaft sections 61 are applied to interconnect all of the shafts 59 on each side and pulley 64 is mounted and connected to the motor assembly. Motors 67 are energized to drive each pulley

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64 so that all shafts 59 at each side are simultaneously driven at the same rate and equal and uniform lift forces are exerted by legs 36 all along both sides of the house. Any suitable means may be provided for synchronizing the drive at both sides of the house but in practice good results have been obtained by having two operators work together on opposite sides of the building watching suitable level indicators as the roof slab rises. FIGURE 5 shows the roof slab partially raised.

The roof slab 13 is raised by the foregoing arrangement to a point about a foot above the desired height of the side walls, and held there by the jacks. In FIGURE 5 are shown a series of auxiliary jacks 72 which may consist of telescoped threadedly connected relatively rotatable rods 73 and 74 adapted to be extended as the roof slab is raised to support the intermediate sections of the roof slab and keep it from sagging.

When the roof slab 13 has been fully raised the side walls are built up on the floor slab 11 as shown at 75 in FIGURES 5 and 6 to the desired height. The wall bricks at the top of each wall are of the lintel type having a continuous longitudinal groove 76 into which fresh concrete is poured. Then the jacks are reversed to lower the roof slab 13 onto the walls. There is imbedded in the concrete roof before the concrete sets, iron reinforcing rods 77, the bottoms of which are bent so as to lay flat on top of the concrete floor upon which the roof is poured. Then when the roof is lifted, these rods which are usually 1 foot to 18 inches long, are simply bent down from the roof and fixed so they will mesh into the cavity 76 of the lintel block that forms the top course of the walls. Concrete is then poured into the cavity of the lintel block and the roof is lowered and allowed to set holding the rod in place.

The jack assemblies 16 may be entirely removed when the roof slab has settled onto the walls which now support it. The polyethylene sheet 12 can be removed as soon as the slab 13 is jacked a small distance, leaving smooth floor and ceiling surfaces.

Referring to FIGURES 11-14 another structurally different embodiment of the invention is illustrated.

FIGURE 11 shows the cast floor slab 11, the polyethylene spacer sheet 12 and the cast roof slab 13, after the casting forms have been removed and both slabs are hard and ready for the roof slab raising. The first step here is to mount a number of cross girders 80 parallel to the short side of the roof slab. The lower rail 81 of each girder has openings to receive the anchor bolts 14 imbedded in the roof slab and nuts 82 are drawn tight to fasten a series of these parallel girders 80 across the top of the roof slab. Any other suitable means may be used to detachably secure the girders to the slab 13.

It will be noted that the roof slab slightly overhangs the floor slab along the long sides, and along horizontal surfaces 83 are laid bottom jack support rails 84. At spaced points along rails 84 are attached a series of jack bases 85, one below the end of each girder 80. Uprising from each jack base is an outwardly open vertical channel 86, and the upper ends of channels 86 on each side are rigidly secured together by an upper horizontal rail 87. Suitable wire braces 88 having adjustable turnbuckles 89 stiffen and align the frame comprising rails 84 and 87 and channels 86.

A jack lift member or elevator 91 is vertically slidably mounted on each channel 86, and each elevator 91 has an internally threaded boss 92 and a flat horizontal platform 93. A horizontal rail 94 is rigidly secured across all of the platforms 93 on each side of the slabs, the rail being apertured in places to freely pass the upright channels 86. Rail 94 is adapted to be located under and in supporting relation to all of the ends of top rails 95 of the girders 80.

Enclosed by each channel 86 is a vertical threaded rod 96 threadedly passing through boss 92 and having its lower extending down to the jack base 85. The upper

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end of rod 96, FIGURE 14, projects through an opening in rail 87 and has secured thereto above rail 87 a gear assembly 97 fixed to the upper race 98 of a thrust ball bearing 99 having its lower race 101 secured to rail 87. The weight of rod 96 and the gear 97 are thus suspended. Also journaled on rail 87 at the upper end of each rod 96 is a worm 102 meshed with gear 97, and each worm is mounted on a shaft 103 connected at opposite ends to the adjacent shaft 103 by telescoped extensible hollow shaft sections 104 that permit variable spacing of the jack assemblies along the slabs.

Usually the jack frames along opposite sides of the slabs may be rigidly connected at their upper ends by horizontal end rails 105 and associated turnbuckle tightened brace wires 106 for mutual support and alignment.

In this embodiment, as well as in FIGURE 5, a pulley 64 is attached to the end shaft at the top of the jack frame and when pulley 65 is driven by the electric motor as in FIGURE 5 all of the threaded rods 96 are similarly rotated to rail 94.

In practice, after the roof and floor slabs are cast, the jack assemblies are positioned and braced and each jack individually adjusted to substantially equal load by rail 94 which supports the ends of girders 80 and therefore the weight of the roof slab suspended from the girders. The roof slab is raised to the desired height, the walls built up and the roof slab lowered onto them as in the preceding embodiment.

Referring back to FIGURE 4 it will be noted that a series of girders 80 are bolted to the roof slab as described for the embodiment of FIGURE 11. These primarily stiffen and reinforce the slab for lifting. These may also be attached to certain jack assemblies as in the FIGURE 12 embodiment so that a combination of both jack structures could be used for raising the slab 13. One arrangement that has proved successful is to use the direct lifting arrangement of FIGURES 1-10 at the ends of the slabs while using at the central portions of the roof slab the lifting means of FIGURE 12 where the jacks act on the girders 80, that reducing the possibility of roof slab sag.

FIGURES 15-18 illustrate an arrangement which is a variation of the embodiment of FIGURES 1-10. As shown in FIGURE 15 the jack assemblies 16 are arranged all along the long sides of the slabs and the lift members of these jack assemblies are engaged with the roof slab as in FIGURES 1-10. Some installations, however, may require additional lifting at the center of the roof slab and in this arrangement a series of jack assemblies 107 are provided for this purpose, disposed along the longitudinal centerline of the house.

Each assembly 107 comprises a flat base 108 adapted to seat directly on the sheet 12 overlying the hardened cast floor slab 11. Rigid with the base are two hollow socket bosses 109 and 111 adapted to removably receive the jack pipes 24 and 25. A rigid plug 112 upstands from base 108 midway between the bosses. Also provided in base 108 are apertures 110 adapted to removably mount upright inserts 113 that are externally serrated at 114 and internally threaded at 115. In practice the exposed surfaces of base 108, bosses 109 and 111 and plug 112 are coated with grease or polyethylene to prevent concrete poured on to form the roof slab from sticking to the base 108. The height of bosses 109 and 111 and plug 112 is equal to the thickness of the roof slab 13, and they form holes through that slab to permit passage of pipes 24 and 25 and threaded rod 47 as the slab rises.

The threaded rod 47 which is suspended from channel 26 in the same manner as in FIGURE 7 has threaded engagement with a lift bar 116 apertured at both ends to permit passage of bolts 117 adapted to be threaded into inserts 113 that are cast with slab 13. Rod 47 also extends through the slab being raised.

The shafts 59 of the worm and gear drive at the top

of channel 26 are connected by telescoped extensible shaft sections like those at the sides and the compound shaft is driven by a separate motor to raise all three bars 116 at the same rate that the outside edges of the slab 13 are being lifted by jack assemblies 16.

When the roof slab has been lowered onto the walls the jack assemblies are detached by removing bolts 117 and then pulling the rods out through the roof. The sockets 109 and 111 and inserts 113 are filled and locally smoothed over.

The foregoing arrangement has especial advantage where there are not stiffening girders attached across the top of the roof slab 13.

In all of the foregoing embodiments it will be appreciated that the disclosure of forming and raising a roof slab applies equally well to the forming and raising of intermediate floor slabs in a multi-story building. Where the building has more than one story the second floor slab is cast onto the ground floor slab and raised to position, and the next slab (third floor or roof) is cast onto the raised second floor which now supports the jack assemblies.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A slab lifting jack construction for raising and lowering a slab structure with respect to a stationary rigid floor after the slab structure has been fabricated in directly overlying relation to said floor and comprising at least two jack lifting assemblies disposed at oppositely directed sides of said slab structure, each of said jack lifting assemblies comprising a plurality of side-by-side laterally spaced apart jacks and actuating means for said jacks, each of said jacks comprising a base detachably seatable upon the upper surface of said floor, an upright frame extending rigidly for substantially the height at which said slab structure is desired to be permanently supported above said floor when said assemblies are removed, a lift member vertically slidably mounted on said frame between a lowermost position directly overlying said floor adjacent said base and an upper position at the upper end of said frame and having a part insertable under a portion of said slab structure and being detachably connected to said slab structure for lifting and lowering said slab structure, said part being positionable sufficiently close to said floor by vertical displacement of said lift member to enable said part to be inserted under said portion of said slab structure when said slab structure is initially resting on said floor, a vertical threaded rod rotatably mounted on said frame and extending to the top thereof, means on said lift member providing a threaded connection with said threaded rod enabling said lift member to be vertically slidably displaced along said frame by rotation of said threaded rod in either direction; said actuating means comprising shaft means rotatably carried by the frames

of said jacks at the upper ends thereof in transverse relation to the threaded rods of said jacks and gear means individual to each threaded rod of said jacks and drivingly connecting said shaft means with each threaded rod of said jacks adjacent the upper end of said threaded rod to similarly rotate the threaded rods of said jacks simultaneously; and drive means associated with said assemblies for rotating the shaft means of said assemblies to impart rotation to the threaded rods of said jacks in a selected direction thereby enabling the jacks of said assemblies to exert lifting and lowering movement to said slab structure, said jack lifting assemblies engaging said floor and said slab structure solely by said detachable seating of the base of each of said jacks and by the detachable connection of the lift member part of each of said jacks whereby said jack lifting assemblies are each removable from said floor and said slab structure as a unit.

2. The jack construction defined in claim 1 wherein said frame comprises a pair of spaced apart parallel erect guide members each having a cylindrical periphery and with said threaded rod extending in parallel relation between said guide members, said lift member having a support section carrying said threaded connection to said threaded rod and disposed between said guide members, at least two shaft members carried by said support section and extending transversely of said guide members on opposite sides thereof, and a pair of rollers carried by each of said shaft members and respectively engaging said guide members to guide said support section for linear vertical displacement between said guide members.

3. In the apparatus defined in claim 1, said shaft means comprising a plurality of adjustable length sections to provide for different spacing between the jacks.

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