Nov. 27, 1962 S. GOLDBERG 3,065,573

BUILDING CONSTRUCTION

Filed Aug. 13, 1959 2 Sheets-Sheet 1

FIG. 1

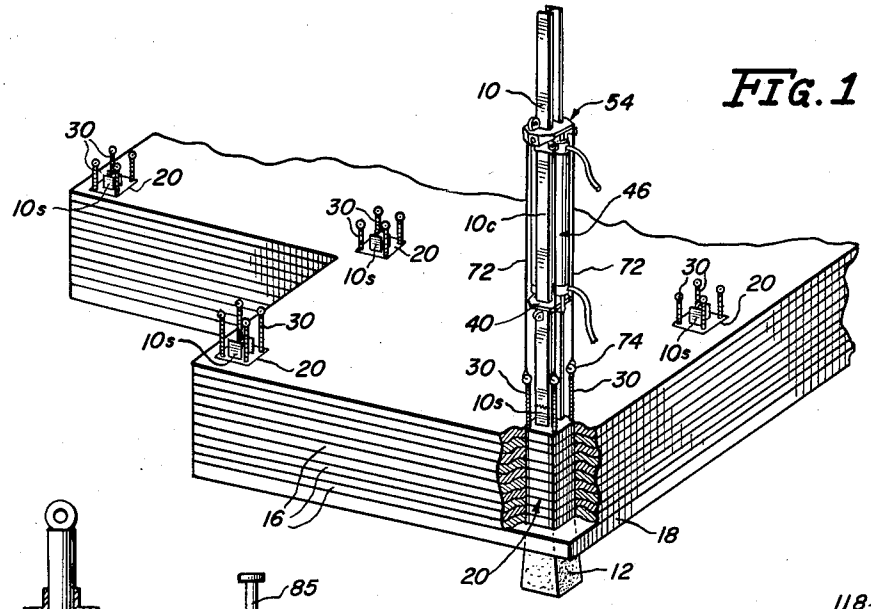
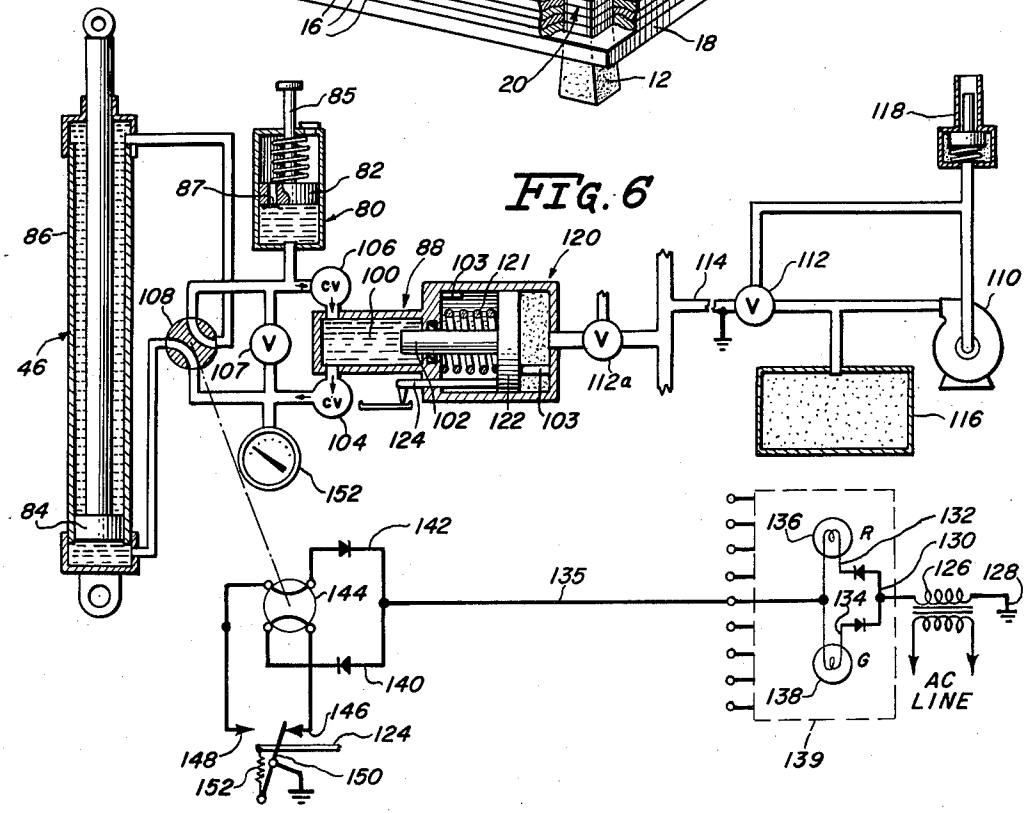


FIG. 6



INVENTOR
Samuel Goldberg
BY Paton D. Harbaugh
ATTORNEY

Nov. 27, 1962 S. GOLDBERG 3,065,573

BUILDING CONSTRUCTION

Filed Aug. 13, 1959 2 Sheets-Sheet 2

FIG. 3

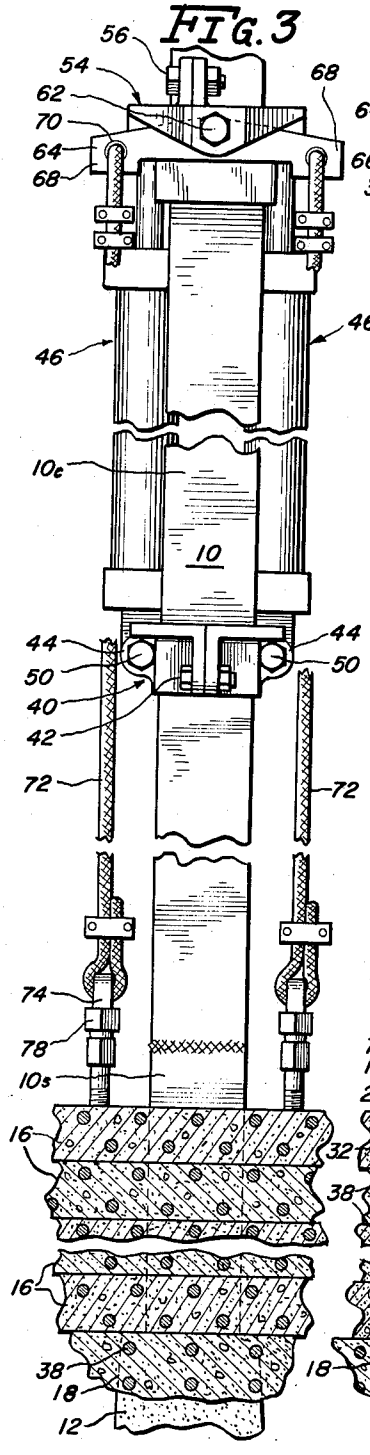


FIG. 2

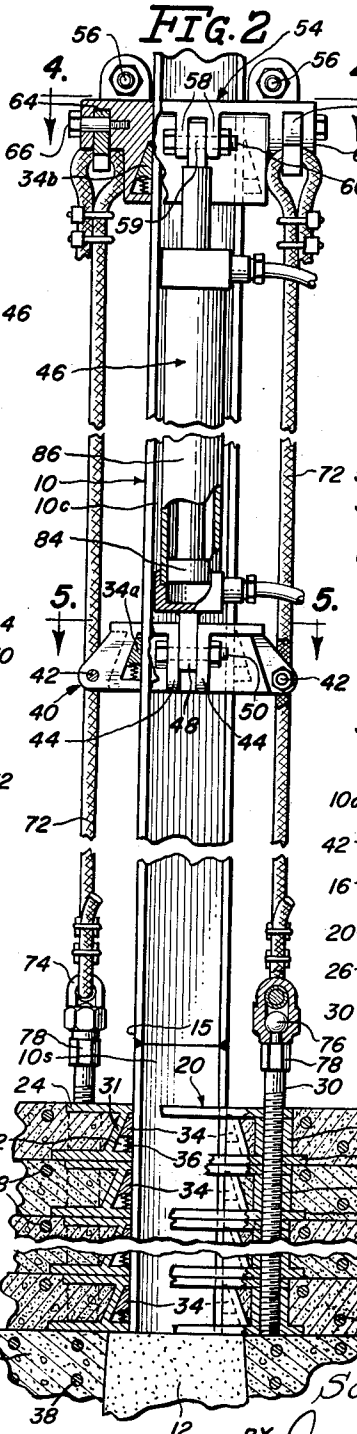


FIG. 7

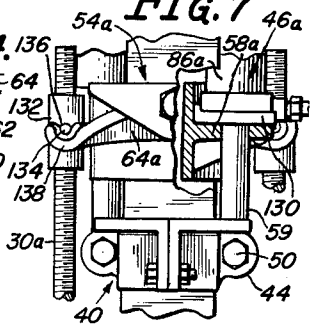


FIG. 4

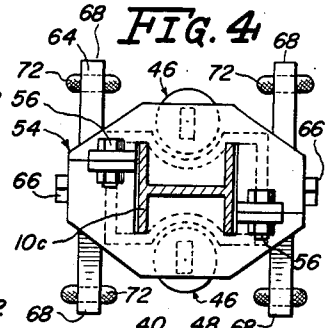
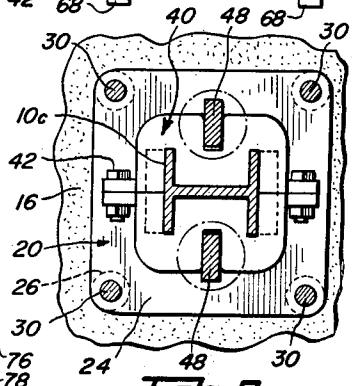


FIG. 5



INVENTOR
Samuel Goldberg
BY Victor D. Harbaugh
ATTORNEY

United States Patent Office 3,065,573 Patented Nov. 27, 1962

3,065,573

BUILDING CONSTRUCTION

Samuel Goldberg, 2901 S. Parkway, Chicago, Ill.

Filed Aug. 13, 1959, Ser. No. 833,439
5 Claims. (Cl. 50—80)

The present invention relates to a method and apparatus for erecting structures and buildings wherein all the upper portions or floors are prefabricated at the ground level as complete units, and then raised to their respective predetermined levels upon vertical columns which become permanent structural columns.

One of the objects of the present invention as representative of their structures is to preform floor slabs at the ground level one on top of the other and lift all of the floor slabs progressively as a unit upwardly on the columns by improved hydraulic lifts that move themselves up the columns ahead of the floor slabs and drop off the lowermost slabs one by one in automatically secured relationship as their respective floor levels are reached.

A further object of the invention is to provide a hydraulic lift which is slidably mounted upon an upright column to lift elements therebelow step by step and advance itself successively as a repeated operation progressively up the column in the erection of a structure.

Another object of the invention is to apply the weight load to building columns first at their lower ends and then progressively upwardly therealong without any starting weight upon the upper end of the column to cause it to buckle or bind with the floor slabs being raised.

A further object of the invention is to raise a weight load up a supporting column and progressively bracing the column from the bottom up and reducing the weight the higher the load is raised.

A further object of the invention is to brace building columns progressively from the bottom upwardly by all of the floor slabs being moved upwardly as a unit and slidably held in place during their raising to thereby automatically plumb the upper ends of the columns, and then hold them in plumb with the fastening of the first two or three lowermost floor slabs supported in place thereon.

Another object of the invention is to provide a lifting system which works completely from above the uppermost or roof slab on which it rests where all the equipment can be quickly attended, serviced and operated including the lifting equipment, the power therefor, and all additional materials and columns that will be required, thereby leaving all floors therebelow immediately available for other workmen without interference the moment the respective ceiling floors are raised.

Another object of the invention is to provide an improved, simplified and inexpensive lifting system by which preformed floor slabs can be raised with a uniform master lift pressure throughout the system regardless of the weight existing at any column and without danger of forces becoming concentrated at any particular column that might damage a slab.

Another object is to provide a floor collar slip element which will not only serve as a permanent reinforcement and anchor but also serve to support the slabs continuously and progressively during their lifting movement.

Another object of the invention is to keep all floor slabs that are being raised in continuous contact with each other in mutually rigidifying relationship to reduce the danger of any possible localized floor strains and to afford an overall height guided relationship along the columns which rigidifies the operation against side sways and misalignment.

Another object of the invention is to provide a collar

which forms a part of the reinforcement of each floor slab construction and cooperates with the vertical columns for free upward movement but frictionally blocked downward movement.

Another object of the invention is to provide improved lift slab building construction system which will operate with any vertical support column of uniform section throughout its length including rounded and flat sided steel columns and preformed monoliths of reinforced concrete.

The invention is further characterized by an integrated control and signal check system which is simple to hook up, manage and understand by moderately skilled workmen.

A further object is to provide a lift slab building construction system that is automatically safeguarded at all stages against mishaps, shut downs or power failure.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings and the appended claims.

In the drawings:

FIG. 1 is a perspective view diagrammatically illustrating the arrangement of floor slabs and vertical columns preparatory to raising the slabs into their proper position;

FIG. 2 is a side elevational view at one of the columns fragmented to illustrate the essential construction and relationship of the working parts;

FIG. 3 is a view similar to FIG. 2 taken at a right angle to the construction shown in FIG. 2;

FIG. 4 is a section taken upon lines 4—4 of FIG. 2;

FIG. 5 is a section taken upon lines 5—5 in FIG. 2;

FIG. 6 is a diagrammatical view showing the preferred control and signal system by which the apparatus shown in the previous figures is operated; and

FIG. 7 illustrates a modification of a hydraulic ram arrangement which minimizes the length of the column required above the roof slab for lifting purposes.

For a better understanding of the invention it may be noted that as a general rule in multi-story lift slab building erection, the vertical building columns are first erected either as stub or long columns, secured on prepared foundations and in the present invention need only to be loosely and temporarily braced or guyed at their top ends. Thereafter, a floor such as a basement or ground floor is laid and troweled flat on its upper surface around the bases of the columns.

If stub shafts are used to start with, and this is preferred, their length is determined by the total of the thicknesses of all floor slabs to be raised plus several feet to spare so that the lifting elements received on the columns may be easily installed before the long columns are welded in place.

Around each column a novel steel collar is placed, onef or each floor, in superposed or stacked relationship. Each collar is of a height equal to the thickness of its respective floor and all floor collars further described hereafter preferably have four angularly spaced vertically disposed bosses on them threaded to receive elongated lift bolts down through all the collars in each stack. The lift bolts when in place hold the collars in predetermined aligned and vertically fixed relationship so that after the floor slabs are poured the bolts distribute the weight of all floors along the threads of the bolts, it being appreciated that the size of the bolt and the size of the threads are so determined and arranged as to carry and sustain the maximum load which may be imposed upon it. Moreover the threading of these bolts into place prior to the pouring of the concrete makes it possible for them to be progressively withdrawn from the lowermost slabs by rotating them in a counter clock-

wise direction as each slab is raised and parked at their respective floor positions upon the columns.

Thereafter the first floor slab is laid on the troweled surface of the ground floor and each floor slab is successively poured and troweled on top of the preceding slab until all slabs are poured and rest one on top of the other including the roof slab. Upon the troweled surface of each slab is provided a coating, such as wax or equivalent, before the next slab is poured and this prevents adhesion between the slabs. Moreover, the upper surface of each slab can be troweled to any surface finish pattern desired including a waffle or ribbed one, and the bottom surface of the next slab thereabove will also receive that contour impressed upon it for ease of design in finishing both the floor and ceiling surfaces.

It will be appreciated by those skilled in the art that suitable reinforcement and conduit work for heating, plumbing and electrical work is disposed in place for each slab as required by various building codes throughout the country, before pouring the slabs and that the design or arrangement thereof does not contemplate any column heads or drop panels. Preferably the reinforcing rods are placed in part through and concentrated in close proximity to the floor collars. Thus, the reinforcement conduits and collars are integrally embedded in each floor slab.

Whether assembled before or after the vertical columns have been welded into place the lifting mechanism includes two collars or rings, a bottom ring which supports one end of one or more hydraulic rams, preferably two on opposite sides of the column, and an upper ring which engages the other ends of the hydraulic rams. The upper ring carries two cross heads on opposite sides to the outer ends of which depending lift cables are secured. The lower ends of the lift cables are fastened by swivel fastenings to swivel heads on the lift bolts where they extend above the roof slab. With this arrangement the lower rings support the hydraulic rams as they push the upper rings higher to pick up the load through the cables as balanced by the cross heads for each ram.

In this connection it will be interesting to note as the description proceeds that all of the rings and collars employed, namely the upper and lower rings and the floor slab collars carry wedges between them and the columns which permit sliding movement of the rings and collars vertically but frictionally clamp against the vertical columns to prevent downward movement of the hydraulic rams can push against the lower ring to raise the upper ring, and when they have extended themselves to a predetermined limit the upper ring will seize on the column while the hydraulic rams are reversed for retraction in their action and the lower rings are then raised to a new point of purchase upon the columns for repeat lifting operations.

Because of this arrangement the hydraulic rams may be conveniently short or conveniently long depending upon the desires of a contractor since the ram assembly progressively climbs the columns in its process of lifting the slabs whereby all the load is applied to the columns a very short distance above the stack of slabs. Therefore, there is no danger of deflecting the columns with high weight movements which occurs with conventional devices, but quite to the contrary. The upper ends of the columns are free to adjust themselves for vertical alignment, and remain plumb and straight as the floor slabs are raised enmasse and parked one by one at their appropriate levels.

Moreover, as each floor is dropped off, the wedges in the collars supporting that floor seize against the columns and support the floor until it is further secured in place if desired without delaying the continued raising of remaining floors above it. It has been found however that the action of the wedges is sufficient to support permanently in place the floor at each column, and thus there is provided a completely smooth ceiling

clear to the column with the present invention. Not only do the wedges support the floors but they rigidify the building because of broad surface contact with the sides of the columns. In this connection when H shaped columns are used it is desirable to dispose half of the columns at 90° rotation with respect to the others so that the building is braced by wedges in all quadrants.

When the roof floor is to be raised finally into place stub columns can be temporarily tacked in place on top of the long columns and the then comparatively light load of the slab to be lifted can be raised into position and secured. Thereafter the lift bolts, rings and hydraulic rams are removed, lowered to the ground and the stub columns cut off at any desired level.

In the drawings for purposes of describing the invention, the building columns shown are conventional "H-beam" columns **10**, which identification alludes to the cross-sectional contour thereof. The columns **10** are appropriately representative of any one of a number of support columns which are available including cylindrical and polygonal configurations of steel or monoliths of concrete. As indicated in FIG. 1 the columns are placed on end where they are supported erect on foundations **12** as secured thereto in any suitable manner (not shown). Preferably as seen in FIG. 2 each column is made up of a stub column **10***s* and a tall or long column **10***c* butt-welded thereto at the weld line **14** with the bead on the V-weld ground smooth at the external or flat surface **15**.

The number of such columns **10** used will vary depending upon the size and the nature of the building. For purposes of illustration however, a ten story building will be contemplated as representative of even higher buildings and the invention will be described in conjunction with only one of the columns although it will be appreciated that all columns will be so equipped and used as described herein. Generally speaking, however, the outermost columns are preferably spaced from the edges of the floors so that lift loads can be balanced around all of the columns. The floor slabs **16** can be designed with different thicknesses but for purposes of this description are approximately 8". With a ten story building the stub columns then should be approximately eight feet clear above the ground floor level. This leaves about three feet above the roof slabs when poured and thereafter only two 35 foot lengths or one 70 foot length of columns needs to be added to complete the building.

As shown in FIGS. 2 and 5 the floor collars **20** preferably have a lower annular flange or base **22** and an upper flange-like element **24** spaced therefrom as secured thereto by interconnecting sleeves **26** threaded as at **28** to provide Acme threads to receive the lift bolt **30** in threaded engagement. The central portion of the floor collar preferably has two opposite sides generally following the contour of the walls of the column at the top and bottom. Interconnecting the top and bottom, downwardly diverging walls **31** are so shaped and inclined with respect to the vertical as to provide spaces **32** therein on opposite sides of the column which are narrow at the top and wide at the bottom to receive wedge elements **34**. These wedge elements are spring urged upwardly by a compression spring **36** to keep the wedge elements **34** in contact with the inclined wall **31** and the adjacent face **15** of the column. Thus as the collars move upwardly the wedges **34** release themselves to permit free upward movement of the collars while at the same time urging the wedge elements **34** into place to lock them in position whenever the upward movement ceases.

The wall **31** and the shape of the wedge elements **34** may be of any mating contours such as flat, curved and cylindrical, or any other vertically smooth configuration which might be found upon vertical columns for a building of this type. Even rack or cog-like contours may be present, provided, the outer edges thereof define a recti-

lineal path along which the wedge elements may slide in frictional engagement.

As already mentioned the collars **20** are stacked initially on the stub shafts **10***s* with all the threaded openings **28** in alignment to receive lift bolts **30**. When this is done the lift bolts **30** are threaded into the four threaded openings viewed in FIG. 5 until the lower end thereof extends through to the bottom of the lowermost collar which rests upon the basement floor **18**. Thus all the floor collars are held in place as a unit for the pouring of the concrete slabs. Concrete vibrators and rough treatment will not disturb the collars, and each collar is supported in weight bearing relationship the moment that the bolt is lifted. In this connection it should be noted that, if desired, the opening **28** may be cylindrical and large enough to receive an internally threaded sleeve rivet which can be adjusted for any discrepancies in the lead characteristic of the threading between collars. In this instance however, there is no assurance that the load of each collar is uniformly carried by the bolt.

In the pouring of the slabs, reinforcement elements **38** are disposed through and around the collar where they become embedded in the cement along with the collars and after the slabs have been poured and cured successively, one on top of the other, the building is ready to receive the lifting apparatus on the columns above the roof slab.

There is first placed upon the stub shaft **10***s* a lower ring **40** preferably made in two halves as indicated in FIG. 3 which are identical and are bolted together by bolts **42** so that they rigidly encompass the column **10** and are freely slidable thereon. The ring is provided with inside wall and shape contours, including a wedge element similar to that which was described in connection with the floor collar **20** and corresponding numbers identify like parts in this respect with the suffix *a* added thereto for purposes of convenience in describing the operation of the apparatus. Opposite the open sides of the H-column **10** are provided two ears **44** to receive between them an eye **48** on the lower end of the hydraulic jack ram assembly **46** which is secured in place by a through bolt assembly **50**. Thus, the hydraulic ram **46** can exert an upward force on the ring **40** and that ring can support the ram against a downward force thereon.

Next received upon the stub column **10** is an upper ring **54** also made in two parts as indicated in FIGS. 2 and 4, bolted together by bolts **56** to provide a rigid ring encompassing the column and closely following the contour thereof. Here again, ears **58** are provided to receive a through bolt **60** which secures or fastens the upper end **59** of the hydraulic ram **46** in position to transmit to the upper ring an upward thrust or downward pull thereon. Also the ring **54** is provided with wedge elements and wedge contours the same as the ring **40** in which like numbers refer to like parts with the suffix *b* added thereto.

Overhangs **62** are provided on the ring **54** to support cross beams or cross heads **64** held in place by bolts **66** in a position whereby the ends **68** of the cross heads are directly above the openings **28** in the floor collars. Eyelets **70** are provided in the ends of the cross heads **64** to receive lift cables **72** that are secured in clamped relationship thereto in suitable manner, the lower ends of which carry swivel members **74** that releasably engage swivel heads **76** upon the lift bolts **30**. Below the swivel heads **76** the bolts are provided with suitable wrenching surfaces as indicated at **78** so that a wrench can be applied thereto to unthread the bolt from the lowermost floor collar each time the lowermost floor slab and collars reach the intended position upon the column.

It will be noted that the cross heads **64** provide for an equalizing of the load exerted upon the two depending lift cables fastened thereto, and it will be noted in this connection that the upper collar **54** is sufficiently loosely carried by the column **10** that the bolts **60** serve to provide balance between the two hydraulic rams. The respective pairs of ears **58** and **44** are shown disposed radially for the ready mounting of the ram in a radial direction. They can be disposed either radially or tangentially to the column if desired, but preferably as shown with H-column.

After the upper and lower rings are positioned upon the stub columns **10***s*, the long columns **10***c* are butt-welded in place as already mentioned and the upper ring **54** is pushed upwardly thereon the length permitted by the lift cables **72**, where it will hold itself due to the action of the wedges **34***b*. The hydraulic ram **46** is then secured at the top by the bolt **60** and the lower collar is slid upwardly until the bolt **50** is fastened in place. Preferably in doing this the rams are in a retracted condition ready to start lifting. However, this is not necessary because one of the advantages of the present invention is the operation in which the rams in going to their fully retracted position will raise the lower ring **40** to provide a footing or support for the lifting action, as will be hereinafter described further. As the hydraulic ram extends itself the first time the slack on the lift cables is taken up and they are tensioned and balanced. Thereafter, the hydraulic ram can then be retracted to raise the lower ring to its first working support position.

From the description thus far it will be seen how the hydraulic rams operate. The extension and retraction of the ram **46** first moves the upper ring upwardly to lift the slabs with the cables **72** and then pulls after it the lower ring **40** to repeat the lifting operation, etc., until all of the slabs have been raised to their proper position and dropped off one by one by wrenching the lift bolt at **78** to release each lowermost slab in its proper position.

It will also be noted that with this arrangement there is never any top heavy weight disposed upon the column which might cause it to buckle or deflect and as the floor slabs are parked one by one the column is plumbed, strengthened and rigidly held in place progressively upwardly for the completion of the building.

It is highly desirable to employ a hydraulic system because of its simplicity, and, a hydraulic system embodied in the present invention is one in which all of the hydraulic rams are identical in their work characteristics. However, it will be appreciated that the loads carried by the respective rams throughout the building at the different columns in the lifting operation are not the same and for that reason the hydraulic rams must be operated so that they will raise the same distance in the same increment of time irrespective of the work load imposed upon them. This is preferably done in an improved novel manner.

As shown in FIG. 6, each hydraulic ram **46** is a closed unitary hydraulic system having an oil reservoir **80** with a spring pressed piston **82** therein to take up for the differential between the working surfaces of the main piston **84** in the main cylinder. A lift handle **85** is a combination level indicator and fill device through check valve **87** when the main piston **84** is fully retracted.

A constant stroke pump **88** pumps oil from the reservoir **80** to either end of the booster cylinder **86** selectively and the displacement of oil in the working cylinder **100** is always the same for each thrust of the piston rod **102**. This is carefully controlled by stops **103**. The oil delivered under pressure is trapped in the cylinder **86** by a check valve **104**. The replenishing oil for the chamber **100** is admitted through the back flow check valve **106** when the piston **102** is retracted preparatory to the next stroke. A valve **108** is provided for movement between two alternate positions to determine to which end of the cylinder **86** the oil under pressure is conducted. If it is conducted to the lower end of the cylinder (FIG. 6) the hydraulic jack extends itself to lift floor slabs whereas if it is conducted to the upper end of the cylinder the hydraulic jack retracts itself to lift its footing ring **40** to a new position. Therefore, movement of the valve **108**

will determine whether or not the hydraulic jack will climb the column or lift the floor slabs. A manually opened bleed valve **107** from one side of the piston **84** to the other permits minor adjustment of the piston position, if desired.

Preferably compressed air is used to drive the piston **102** and it is supplied by a pump **110** through a combination valve **112** which applies the air pressure to all hydraulic rams **46** through a main conduit **114** in one position and delivers the air under pressure from the main conduit back to the intake of the pump for suction and recompression in the pressure tank **116**. An outflow check valve **118** is provided to prevent the escape of air pressure to the intake of the pump **110**, yet, if the pump **110** begins to pull a vacuum the valve **118** relieves that vacuum with air from the atmosphere.

Second valves **112***a* are provided at the inlet of each cylinder **120** to apply air pressure thereto selectively and bleed it to atmosphere if desired. It will be noticed that the area of the working piston **122** in cylinder **120** is much greater than the working area of the hydraulic piston **102** which displaces the fluid from the cylinder **100** to the hydraulic ram. Thus with low air pressure from 60 to 120 p.s.i., high enough pressures can be attained to operate the hydraulic ram at pressures of 60,000 to 120,000 p.s.i. and the air lines can be connected with conventional quickly detachable couplings.

The non-working side of the piston **122** is engaged by a compression spring **121** which forces it to its retracted position and the space is also vented to atmosphere for free movement. Furthermore there is fastened to the piston **122** and carried thereby a push rod **124** by which the relative position of the piston **122** can be noted upon visual inspection. Not only may the push rod **124** serve as a visual indicator at the column, but it is so constructed and arranged as to operate as a unit in a signaling system which will now be described.

In the signaling system, A.C. current is employed through a transformer which steps down the voltage for safety and signal wiring codes to a 12 to 24 volt level. One end of the secondary transformer is connected to ground **128** on to the metal shielding of the air hoses **114** and the other end is connected to a rectifier system **130** which will pass current out of the lead **132** in one phase and pass current through another lead **134** during the other phase of the current. The leads **132** and **134** are respectively connected in circuit with a red light **136** and a green light **138**. The other ends of the light connections are joined and a single wire is run from the centralized distribution and indicating panel **139** of which the lights are a part to one of the columns where a second rectifier system for each ram **46** is provided. The second rectifier system includes one rectifier **140** which in cooperation with the rectifier **134** will pass current energizing the red light and the other rectifier **142** will in cooperation with the rectifier **134** pass current through the green light.

A polarity reversing switch **144** is connected upon the same actuating shaft as the hydraulic reversing valve **108** as connected between the rectifiers **142** and **140** and two spaced contacts **146** and **148** alternately engaged by an over-center snap armature or switch blade **150** controlled through a spring **152** by the push rod **124**. With this system only one pressure hose **114** and one signal wire **135** is run to each hydraulic ram and all of the parts represented to the left of the valve **112***a* and the numeral **135** in the electrical circuit can be mounted as a unit upon the housing of the cylinder **86** of the hydraulic ram.

The operation of the device is apparent from the description and it only remains to be pointed out that a pressure gauge **152** is connected into the output line of the hydraulic pump beyond the back flow check valve **104** to indicate the lifting load carried by the piston **84** of the hydraulic ram.

Whenever the meter valve **112** is opened to apply air pressure to the cylinder **120** the piston **122** is driven to the left as viewed in FIG. 6 a predetermined distance to displace a predetermined amount of hydraulic fluid from the cylinder **100** and drive it into the cylinder **86** below the head **84**. This is true of all of hydraulic rams throughout the system for every column. The pistons **84** are lifted or driven upwardly a predetermined distance which is constant for all hydraulic rams each time the valve **112** is opened. With the closure of the valve **112** and release of the air to the inlet of the compressor pump **110** the springs **121** force the pistons **122** to retracted position to draw in further hydraulic fluid from the reservoir **80** as the released air is drawn through the inlet of the pump and recompressed in the storage tank **116** with little loss of power.

In the resting position of the cylinder **122** the push rod **124** will be in its retracted position with the blade **150** controlled thereby in contact with the contact **148**. This permits current to flow through the green lights **138** to indicate that all of the piston **122** are in fully retracted position upon the signal panel **139**. When the valve **112** is opened the air pressure forces the piston **122** to its protracted position carrying with it the push rod **124** to the position shown in FIG. 6 where the blade **150** is in contact with the contact **146** to energize the red lights, thus indicating that the retraction of the pistons **122** is fully compleed.

In event one of the lights does not change, the operator is warned that with respect to the hydraulic jack identified by that light, something is wrong and the same can be checked to be sure that it is in operation before another application of air pressure is made.

When however it is desirable to retract the hydraulic jacks to raise the supporting collars **40** to a new position the valve **108** and switch **144** at each ram **46** are moved to their alternate positions and then the starting position of the piston **122** is reversed insofar as the signal system is concerned. Thus, each forward movement of the piston **102** pumps oil into the cylinder **86** above the piston **84** and with the effective area thereof reduced by the diameter of the piston rod itself the retraction of the hydraulic system is accomplished with fewer strokes of the piston **102** than was required to extend the hydraulic jack. Moreover it will be observed that when the ram is fully protracted or retracted, the piston **102** is blocked against movement and the action of the lights will indicate this.

By way of assisting in checking the operation and the load bearing characteristics of each hydraulic jack for the respective columns, the pressure gauges **152** may be marked with the respective pressures they are expected to carry to raise their portion of the weight of the floor slabs and any deviation thereafter is a visual indication that either the hydraulic jack is carrying more of a load than it should or is not carrying enough of a load. If by any chance it is not carrying enough of a load then the next time that the valve **112** is opened to apply pressure and the piston **122** has made one stroke, the valve **112***a* can be opened to vent the piston to atmosphere and permit it to retract and then reclose the valve to get in an extra stroke for the piston **122** over and above those delivered by the other hydraulic systems. This can be repeated until the pressure 150 in the gauge **152** comes up to the level which it should or some other check is made to determine whether or not the floor slabs are being maintained at a constant level.

On the other hand if the pressure in the pressure gauge **152** is too high the valve **107** can be momentarily actuated to equalize or the valve **112***a* can be turned off during one cycling of the valve **112** to keep the piston **122** idle long enough for the other hydraulic rams to catch up.

Referring now to FIG. 7, the construction of hydraulic ram and its action is quite similar to that described in connection with FIG. 2. The essential difference is that the ram **46***a* has been inverted with the eyelet end **59** of the piston secured to the ears **44** and bolt **50** of the

lower ring 40. Instead of the closed end of the cylinder 86 being secured to the upper ring 54, the cylinder 86*a* in FIG. 7 is modified to have a flange 130 around the piston end of the cylinder and the ears 58 on the upper ring 54 of FIG. 2 are modified as to 58*a* on the ring 54*a* of FIG. 7 to receive the body of the cylinder 86*a* in clamping relation immediately above the flange 130. With this arrangement the vertical spacing of the rings on the columns is greatly reduced for their work cycle and thus the extra length of the column above the roof slab position is greatly reduced, which in conjunction with the shortened cable arrangement shown in FIG. 7 enables minimized working heights above the roof slab it bein gnoted that the lift cables 72 may be dispensed with when the lift bolts 30*a* are threaded directly through lift sleeves 132 which are mounted by gimbles 134 in notches 136 disposed in the upper edges of the two yoke arms 138 of the cross heads 64*a*. Not only does the sleeves 132 permit height adjustment of the rams but the height above the top slab is automatically maintained at all times because the lift bolt threads itself upwardly through the sleeve as it is being unthreaded from the lowermost slab to leave it at its appropriate position on the column. The vertical positioning of the sleeves 132 need only be high enough on the upper ends of the lift bolts 30*a* to accommodate the thrust of the ram before the top floor slab engages the lower ring. In lifting the roof slab, shorter hitches can be taken as the upper ends of the columns are reached.

Thus, it will be readily apparent to those skilled in the art how the objects of the invention are accomplished, and how various and further embodiments of the invention may be made, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In an apparatus for lifting and securing unitary concrete floor slabs at predetermined heights on a plurality of horizontally spaced vertical columns having uniform external sectional contours throughout their lengths, the combination of a plurality of superposed floor slabs resting on one another, a permanent vertical support column having oppositely facing walls uniform throughout the length of the column extending through said floor slabs, a floor slab supporting collar embedded in each floor slab at the column and slidably mounted thereon, wedge means interengaging each of said collars and said oppositely facing walls on said columns for supporting each collar upon said column against downward movement, a support ring slidably mounted upon the column above the uppermost floor slab, wedge means interengaging said support ring and said walls on said column for supporting the support ring upon said column against downward movement, a lift ring slidably mounted upon said column below the top thereof and a distance from the support ring less than the floor height between slabs, wedge means interengaging said lift ring and said walls on said column for supporting the lift ring upon said column against downward movement, lift means interconnecting said collars at said column and the respective lift ring in floor slab supported relationship including threaded lift bolts each threadedly engaging through all of said collars in supporting relationship and rotatable for unthreading disengagement with the lowermost collar supported by them, load equalizing means interconnecting said bolts and said lift ring, hydraulic means interconnecting the lift and support rings on said column for forcing the lift ring upwardly with respect to the support ring to lift the floor slabs upwardly beneath the support ring, and means for controlling said hydraulic means to retract it and lift the support ring below the lift ring while said slabs are supported on said lift ring.

2. The combination called for in claim 1 in which the said control means includes means for applying fluid under pressure intermittently to the hydraulic means to force the lift ring upwardly in increments of its total movement, and means applying fluid under pressure to the hydraulic means to lift the support ring on the column.

3. The combination called for in claim 1 in which said wedge means disposed to engage said oppositely facing walls are provided for the collars to support them against downward movement on the column at whatever permanent level they are disposed upon the column and said lift ring is disposed above said support ring.

4. The combination called for in claim 1 in which the said collars have spaced, threaded, aligned openings and said load equalizing means on said lift ring comprises an equalizing lever, said threaded lift bolts being connected one to each end of the lever and threadedly engaging at their other ends in said aligned openings, the threads on the bolts and in the openings carrying the weight of each of said slabs upon said equalizing lever.

5. In an apparatus for lifting a plurality of unitary concrete floor slabs stacked on top of one another and securing each at predetermined floor levels progressively from the bottom of the stack on a plurality of horizontally spaced vertical columns having uniform external sectional contours throughout their lengths, the combination of a plurality of superposed floor slabs resting on one another, a floor supporting collar embedded in each slab and superposed upon one another in face to face relationship at one column and slidably mounted thereupon, wedge means interengaging said column and each respective collar for supporting the collars and respective floor slabs on the column against downward movement, a lower ring slidably mounted upon said column above said slabs, wedge means interengaging said lower ring and said column for supporting said lower ring upon the column against downward movement, an upper ring slidably mounted upon said column, wedge means interengaging said upper ring and said column for supporting said upper ring upon the column against downward movement, lift means interconnecting the upper ring and the collars in the superposed floor slabs at said column in releasable floor slab supported relationship from the bottom collar upwardly to the topmost collar, and hydraulic means interconnecting the respective upper and lower rings for selectively forcing the upper ring upwardly varying distances to lift the stacked floor slabs upwardly as a unit beneath the lower ring and lift the lower ring below the upper ring, said lift means including threaded lift bolts each threadedly engaging through all of the collars at said column in weight bearing relationship and rotatable only to relinquish its support of the slab supported by it from the bottom, one at a time, to the wedge means of the collar of the respective bottom most slab.

References Cited in the file of this patent

UNITED STATES PATENTS

2,200,392	Goldberg	May 14, 1940
2,686,420	Youtz	Aug. 17, 1954
2,758,467	Brown et al.	Aug. 14, 1956
2,830,788	Bentley et al.	Apr. 15, 1958
2,863,313	Youtz	Dec. 9, 1958
2,920,870	Suderow	Jan. 12, 1960

FOREIGN PATENTS

138,865	Australia	1950
1,108,787	France	1955
1,109,975	France	1955