Jan. 5, 1971 H. I. GRETCHENLIEV ET AL 3,552,080

METHOD FOR ERECTING MULTISTORY BUILDINGS

Filed Jan. 21, 1969 3 Sheets-Sheet 1

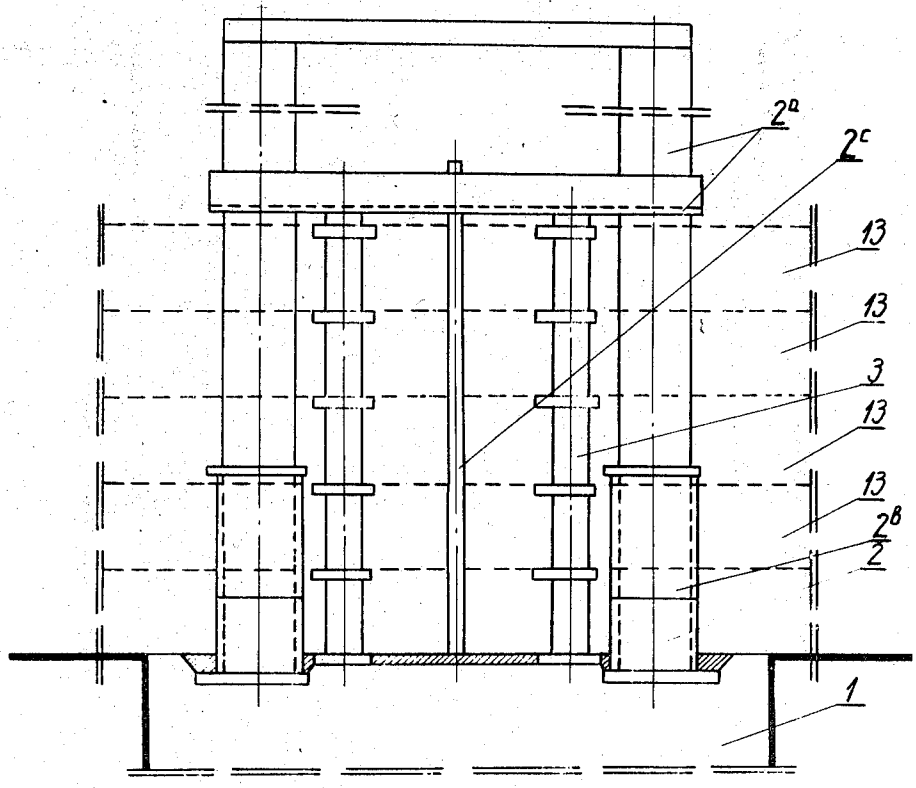

Fig. 1

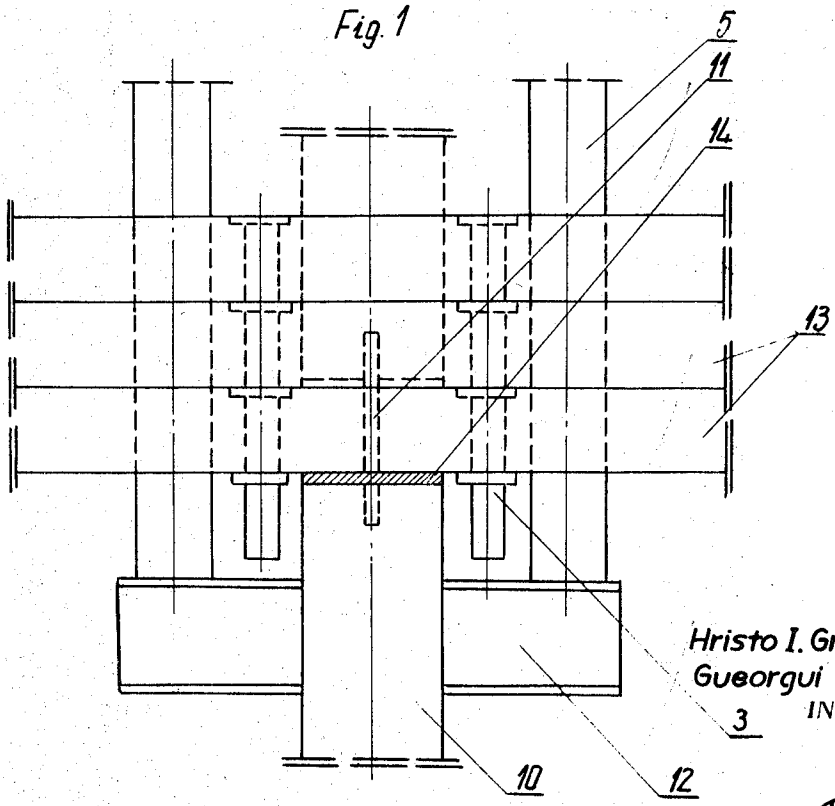

Fig. 5

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METHOD FOR ERECTING MULTISTORY BUILDINGS

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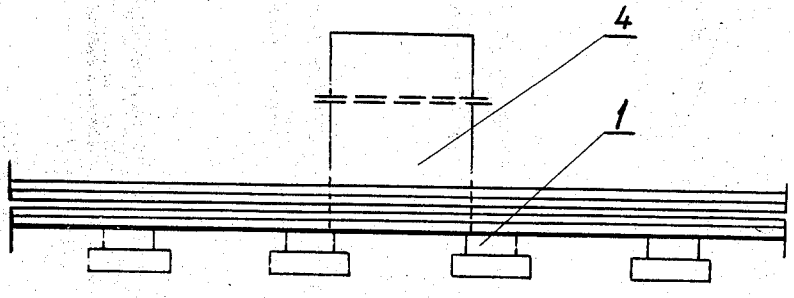

Fig. 2

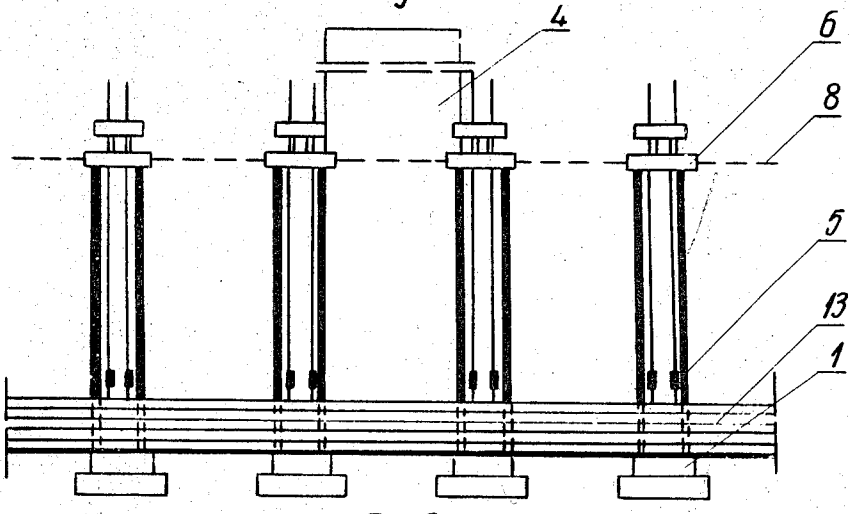

Fig. 3

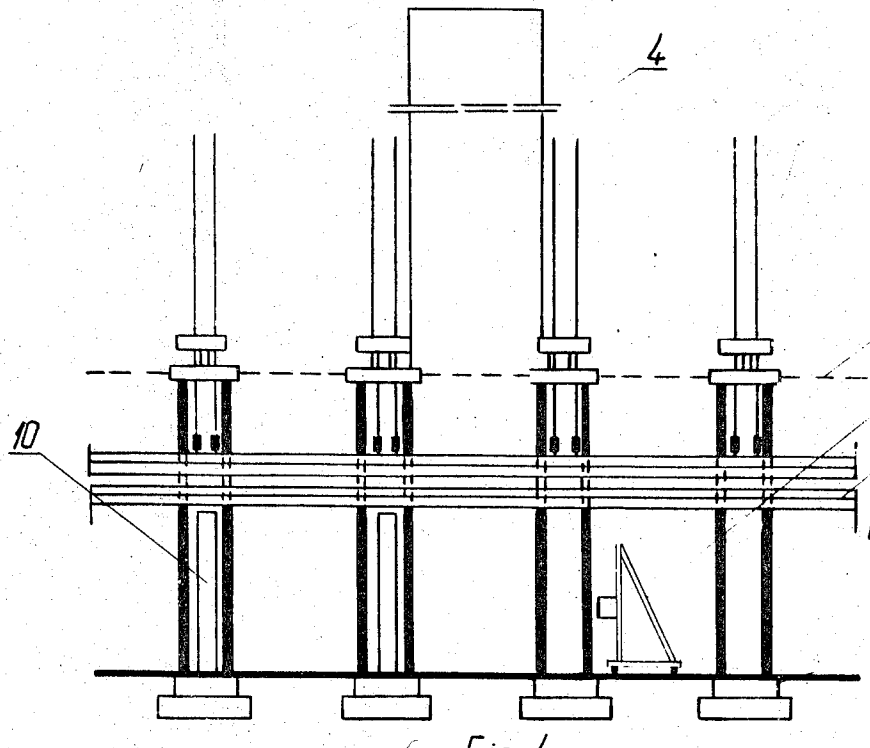

Fig. 4

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METHOD FOR ERECTING MULTISTORY BUILDINGS

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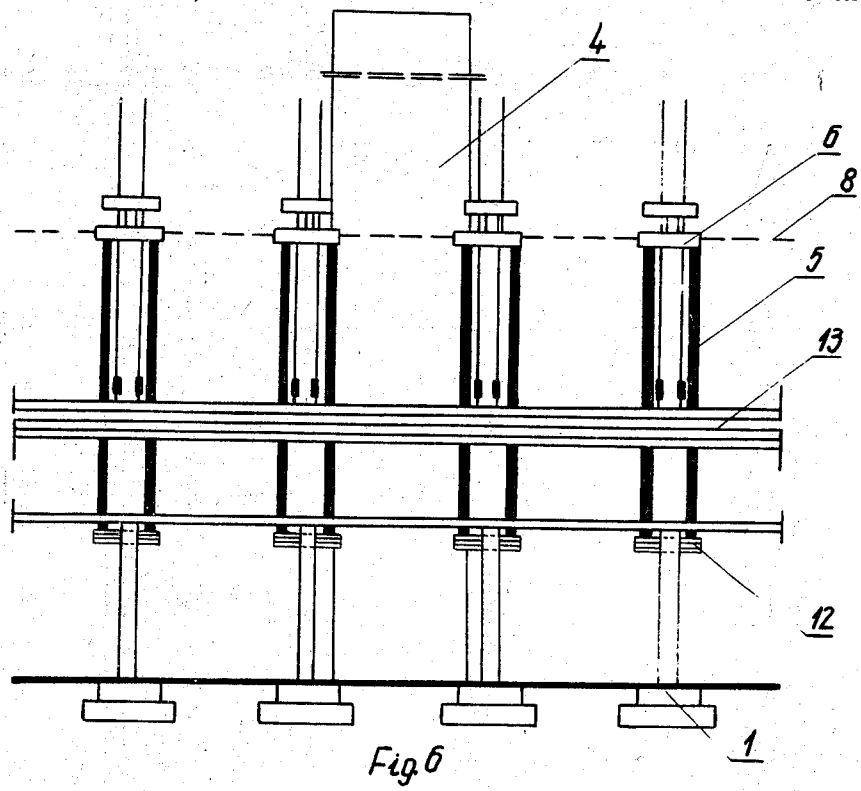

Fig. 6

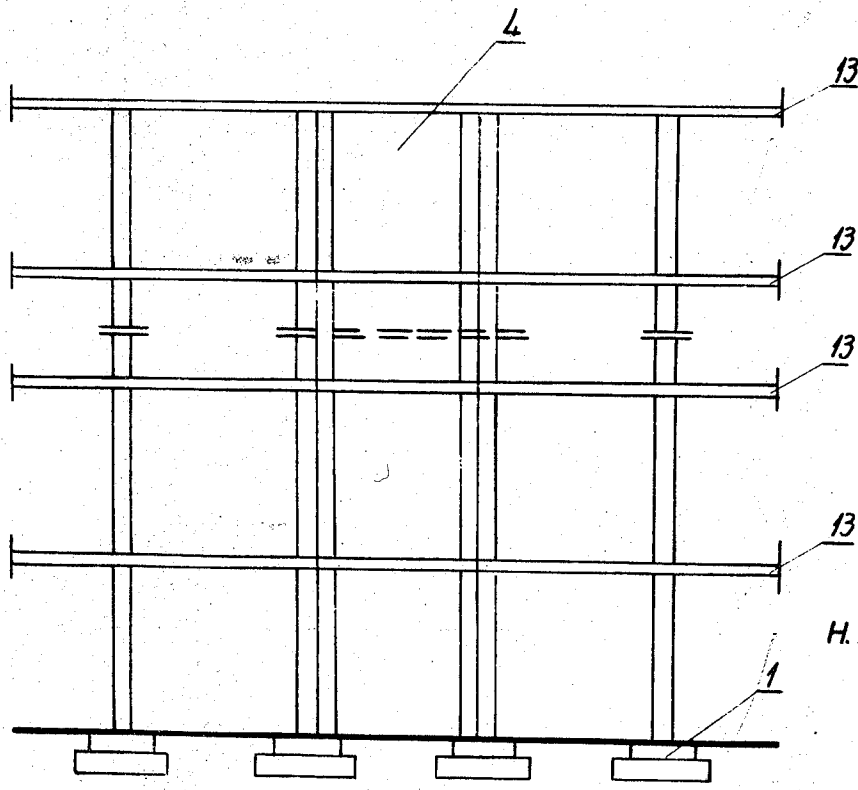

Fig. 7

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METHOD FOR ERECTING MULTISTORY BUILDINGS

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Claims priority, application Bulgaria, Jan. 25, 1968, 9,298
Int. Cl. E04b 1/35
U.S. Cl. 52—745 7 Claims

ABSTRACT OF THE DISCLOSURE

A method of erecting multistory structures in which a plurality of floor slabs and the roof slab are stacked above the foundation on the construction site and are coupled together for joint movement. Steel-support members extend through the stack and serve temporarily to retain the entire stack at each successive tier, whereby the lowermost slab is propped against these steel members, a column is inserted beneath the lowest slab, the lowest slab is detached from the stack and the remaining slabs eliminated to the next tier.

This invention relates to a method of erecting multistory buildings by simultaneously lifting, to their final positions precast floor slabs and roof structures and their supporting precast bearing columns.

A method for erecting multistory buildings is known, wherein the lifting of the flooring slabs, upon casting at the construction site, is carried out successively, i.e. one-by-one or not more than two flooring slabs in a single lifting operation. The lifting is carried out by the use of service or bearing steel stanchions or reinforced-concrete columns, the last being as high as the number of stories. This method is popularly known as the "lift-slab method."

In accordance with the lift-slab method, the lifting of the flooring slabs is accomplished by means of special lifting equipment. The method is characterized also by providing apertures in the floor slabs, intended for receiving steel collars and by the use of bearing columns as high as two or more stories. This known method has several disadvantages. For example, an increased need for profiled steel. It is necessary to utilize for the erection of said bearing columns some assembly means, such as lorry-mounted cranes or the like. Furthermore, the successive lifting of the floor slabs necessitates a provisional prop up of every slab in its final position.

Other methods are known, whereby the enclosing panels, provided as face and partition walls of the building, are mounted before the lifting of the slabs. A disadvantage of these methods is, again, the increased steel requirements, as in the lift slab method hereinbefore, as is necessary for securing the floor slabs on the bearing columns.

The main object of the present invention is to overcome the above drawbacks of the known methods for erecting multistory buildings and more particularly the high requirements for steel profiles. In accordance with the method and by means of the devices of the present invention it is possible to lift simultaneously, i.e. in the form of a stack, all the floor slabs and the roof-structure slab of the building and to prop up every flooring slab and the roof structure by means of precast reinforced bearing columns, each as high as the clear height between the floors of the building. The devices used in the present invention comprise provisional stock steel stanchions, provisional stock steel parts for forming small

apertures in the flooring slabs and for the independent suspension of the flooring slabs on the lifters and a set of special lifting equipments. The key feature of the invention is that the flooring slabs are cast without openings in the area of the bearing columns, so that the reinforcement of the flooring slabs is not interrupted in these areas. With such construction there is no need to embed in the concrete a heavy steel collar, as hitherto provided for securing the flooring slabs on the bearing columns. Furthermore, it is possible to erect the single bearing columns, being of a reduced height and light in the weight, by means of the usual mobile equipment, such as a mounting carriage, a small mounting crane or the like present at construction sites.

The method of erecting multistory buildings in accordance with the present invention is realized in the following manner:

After the excavation work and the casting of the foundation is complete, there follows the casting of the basement flooring in the height of the upper level of the top foundation block. All provisional stock steel-made parts are mounted then. In such a way of working ground is made ready, whereupon all flooring slabs and roof structures of the multistory building under construction are cast on the site and as successively stacked one on the other. The reinforcement and the forming of the flooring slabs and the roof structure are done in accordance with the respective constructive projects of the building. On reinforcing every single slab, appropriate steel-parts are mounted in the area of every bearing column, these parts being intended for the connection of the flooring slabs to the bearing columns of the building to be erected. Each slab surface is sprayed or covered with a separating medium, such as shuttering oils, paraffin, paper or the like, in order to prevent adhesion. Simultaneously with the execution of the flooring slabs and the roof structure, all vertical blocks of the building, such as the staircases, the lift shafts or the like, are built up. All the flooring slabs and the building roof structures being completed, provisional stock-steel stanchions are mounted on both sides of every bearing column of the building, the stanchions being as high as the respective stories plus the thickness of the stacked slabs and the technological clearance. The lifting equipment, which is of a type used particularly for this purpose, is mounted upon the erected provisional stock steel stanchions. By equalizing the load in every lifting device, i.e. by making the best use of the hoisting capacity of the lifting equipment, the whole stack of precast on the site flooring slabs together with the roof structures are raised, as high as the projected top level of the first story. The bearing columns of the respective first story are erected then in their final position by means of a movable mounting carriage. The bearing columns are as high as the clear height of the respective story. The erection of all bearing columns of the first story being completed, the stack of the slabs and the roof structure are dropped down to abut on the bearing columns. By unscrewing the respective auxiliary stock steel parts, i.e. the lowermost links of the "garlands," as hereinafter described in accordance with the present invention, the lowermost slab of the stack is released. Now the flooring slab of the first story lies upon the bearing columns as erected. Steel parts embedded on the top and the lower ends of the bearing columns during the casting, are now welded by means of intermediate steel plates to other steel-made members, which have been embedded previously in the concrete of the floor slabs. After that, the provisional stock steel stanchions are pulled through small apertures provided in the flooring slabs, in a further mounting position, by means of a small auxiliary crane without dismounting the main lifting equipment. In this further mounting position, the stock steel stan-

chions are supported upon the already stabilized bearing columns of the first story, by means of transversal steel beams, located in an opening provided in the bearing columns. The main lifting equipment is operated again and the remaining flooring slabs together with the roof structure are now lifted in the second mounting level. It is possible then to pull out the lowermost links of the garlands from the already erected floor slab. There follows as hereinbefore described, the mounting of the bearing columns, the releasing of the respective lowermost flooring slab by screwing off the respective links of the garlands, the securing of the flooring slab in its final position on the bearing columns, the pulling out of the provisional stock steel stanchions and a new lifting procedure. In such a manner all the floor slabs and the roof structure of the building are erected in their final positions and secured on the respective bearing columns of the stories.

The set up of the face and partition walls of the building is carried out after the erection of every story, said walls being of brick masonry or of wall panels. The other interior work can be also done.

In accordance with the method of the present invention, the roof structure of the building can be lifted and erected in a sloped position, so that the roof of the building can have one or two slopes. This characteristic feature of the invention is due to the fact, that the bearing columns of the building do not extend through the flooring slabs.

The devices used for the realization of the present method comprise provisional stock mounting steel stanchions; steel cups used as supporting means for the erection of the provisional steel stanchions upon the foundation blocks; steel tubes, used as opening means which provide openings in the flooring slabs for the drawing of the provisional steel stanchions, as hereinbefore described; steel pins used as means for providing apertures in the flooring slabs for centering the bearing columns during erection; steel beams for supporting the provisional steel stanchions upon the bearing columns; and the so-called "garlands" used as suspending means for the stacked flooring slabs and the roof structure on the lifting equipment. A "garland" comprises a plurality of steel-made cylindrical hollow bodies, provided with an internal thread and a respective number of flanges, the single cylindrical body and the flange thereon being bolted internally to the adjacent cylindrical body by means of a nipple, so that a determined number of hollow bodies bolted together with their respective flanges one on the top of the other form a linked device or the so-called "garland." The garland members used as suspending means are embedded on casting in the stacked flooring slabs.

The invention itself both as to its method and its device will be best understood from the following description of a specific embodiment when read in connection with the accompanying drawings, in which:

FIG. 1 is a front elevational view of the entire set of auxiliary and special parts mounted upon the uppermost foundation block;

FIG. 2 is a front elevational view of a stack of floor slabs for a four-story building, with a single staircase;

FIG. 3 is a front elevational view of the stack of flooring slabs, the staircase and the lifting equipment mounted upon the steel stanchions;

FIG. 4 is a front elevational view of the staircase of the building and the stack of flooring slabs positioned upon the top level of the first story, as well as of the bearing columns in their final positions.

FIG. 5 is a front elevational view illustrating the prop ring of the steel stanchions during the erection of the second floor;

FIG. 6 is a front elevational view showing an operative position, after the erection of the first floor; and

FIG. 7 is a front elevational view of the building after the erection of the flooring slabs and the roof structure.

Referring now to the drawings, it will be seen that the building to be erected is a four-story structure, with a single staircase and 24 bearing columns founded on single independent foundation blocks **1**. On the uppermost step of the foundation blocks are mounted the auxiliary stock parts **2**, **2***a*, **2***b* and **2***c*, as well as the garlands **3** used as suspending means and as securing devices during the lifting procedure of the stacked flooring slabs and the roof structure of the building. The stock steel stanchions **5** and lifting equipment **6** are mounted after pouring of the flooring slabs and the roof structure and after the erection of the staircase **4**. The stock steel stanchions are secured by means of provisional connecting means **8**. As shown in FIG. 4 at operating the lifting equipment **6** the whole stack comprising the flooring slabs and the roof structure is lifted as high as 3–5 cm. over the projected upper level of the respective floor. The bearing columns **10** are thrust under the lowermost flooring slab **13** and are erected in their final position by means of a movable mounting carriage **9**. The bearing columns are secured in their final position by means of the studs **11**, located in the centering holes formed in the flooring slabs on casting, by means of the auxiliary stock parts **2***c*. After the erection of all 24 bearing columns of the respective story cement mortar or polystyrene or other plastic is put on the top and side of the bearing columns **10**. The stack of slabs is dropped down to abutment on the bearing columns **10**. The lower most elements of the garlands **3** are dismantled and the flooring slab **13** is detached from the stack. The connecting parts, not shown in the drawings, which are previously embedded on both end side of the bearing columns **10** and also in the flooring slabs more particularly in the areas of the bearing columns are welded together by means of auxiliary intermediate plates, not shown, in order to secure the whole structure.

The margins between the individual slabs and the staircase are filled with concrete cast in situ in order to secure the structure of the building against horizontal reaction, such as wind forces and earthquake.

The stock steel stanchions **5** are pulled out through the holes providel by the auxiliary stock parts, the calibres **2***b*, by means of a movable mounting crane and are secured in a further mounting position, as shown in FIG. 6, being supported here by means of the stock transversal beams **12** upon the already stabilized bearing columns **10** of the preceding floor. In such a manner all the flooring slabs **13** and the roof structure of the four-story building are erected in their final positions, as shown in FIG. 7.

In accordance with the project of the building to be erected the roof structure can be single or double.

What is claimed is:

1. A method of erecting a multistory structure, comprising the steps of:

(a) forming a stack of floor slabs and a roof slab upon a foundation;

(b) releasably interconnecting all of said slabs and jointly lifting all said slabs to a position slightly above the end position of the floor slab of the initial tier;

(c) erecting beneath the floor slab of the initial tier a plurality of support columns and detaching the lowermost slab from said stack while securing the lowermost slab to said column;

(d) elevating the remainder of said stack while supporting same on the columns erected in step (c) by members extending through said slabs to position the lowermost slab of the remainder of said stack at a level slightly above that corresponding to the position of said second tier, disposing supporting columns between the originally lowermost slab and said lowermost slab of the remainder of said stack and securing the latter slab to the corresponding column;

(e) temporarily supporting the stack of slabs on the

columns introduced in step (d), withdrawing said members through the slab released in step (c) and temporarily fixing said members to the columns introduced in step (d); and

(f) repeating steps (d) and (e) until all of said slabs are disposed at respective tiers of the structure, and thereafter withdrawing said members through the last-positioned slabs.

2. The method defined in claim 1, further comprising embedding tubular bodies in said slabs for slidably receiving said members.

3. The method defined in claim 1 wherein said slabs are interconnected by embedding threaded bodies in said slabs in vertical alignment and interconnecting said bodies by threaded nipples, said slabs being released from said stack by unthreading said nipples.

4. The method defined in claim 1, wherein each of said slabs is secured to the principal columns by embedding steel bodies in said slabs and welding said bodies to said columns.

5. The method defined in claim 1 wherein said slabs are secured to said columns by disposing a mortar therebetween.

6. The method defined in claim 1 wherein at least the columns supporting said roof slab are of different length to define a slope therefor.

7. A method of erecting a multistory structure comprising the steps of:

(a) assembling a stack of floor slabs and a roof slab of monolithic concrete construction unperforated at respective bearing locations along said slabs and provided with respective openings symmetrically on opposite sides of said locations whereby the openings of said slabs or said stack register with one another;

(b) releasably interconnecting the slabs of said stack for joint elevating displacement;

(c) elevating said stack upon posts inserted through said openings and flanking said locations to a level wherein the underside of the lowermost slab of said stack is disposed approximately at the underside of the first story;

(d) temporarily supporting said stack from below on said positions;

(e) permanently inserting a column below each of said locations of the lowermost slab of said stack;

(f) releasing the lowermost slab from said stack;

(g) drawing said posts through said openings of said lowermost slab and supporting said posts upon said columns close to the tops of said columns;

(h) repeating steps (c)–(g) until each of said slabs is mounted upon respective columns positioned at said locations; and

(i) thereafter withdrawing said posts through the openings of the uppermost slab.

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