Jan. 14, 1969 M. G. WHITFIELD 3,421,271

CONSTRUCTION OF BUILDINGS CARRIED ON AT FIRST FLOOR LEVEL

Filed June 8, 1966 Sheet 1 of 2

Fig. 1

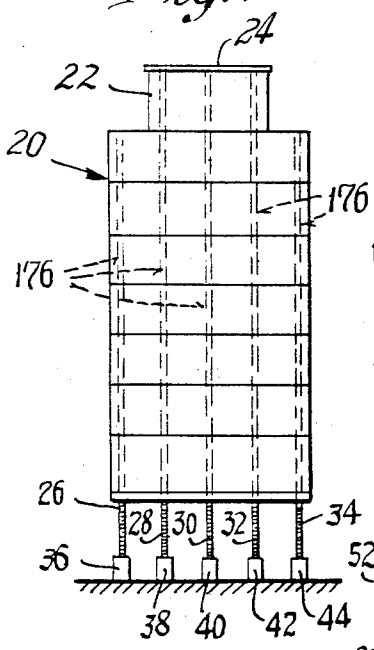


Fig. 2

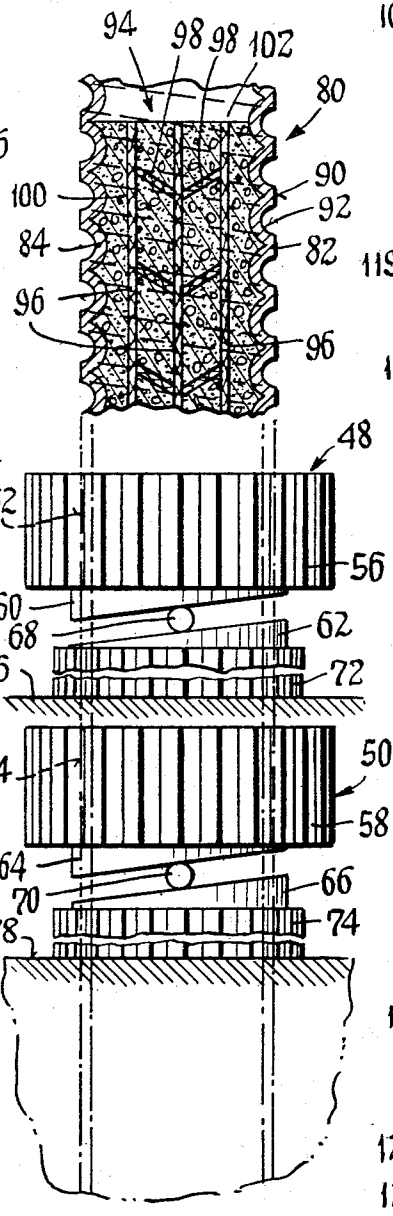


Fig. 3

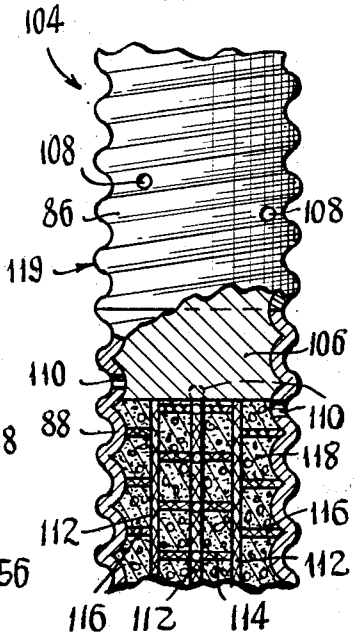


Fig. 5

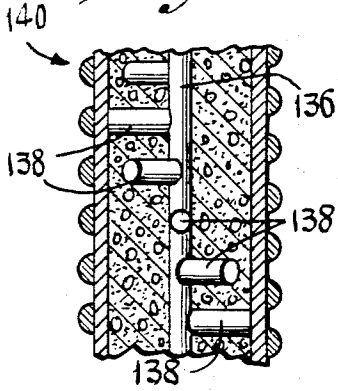


Fig. 4

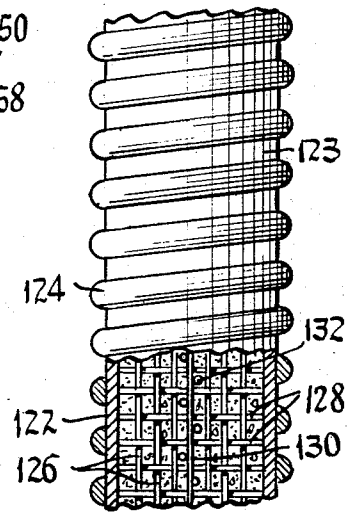
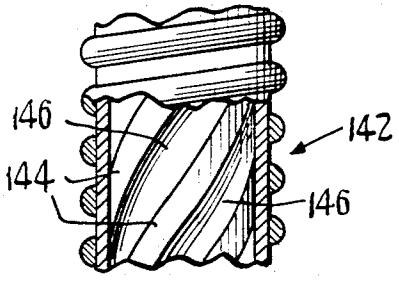


Fig. 6



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CONSTRUCTION OF BUILDINGS CARRIED ON AT FIRST FLOOR LEVEL

Filed June 8, 1966 Sheet 2 of 2

Fig. 7

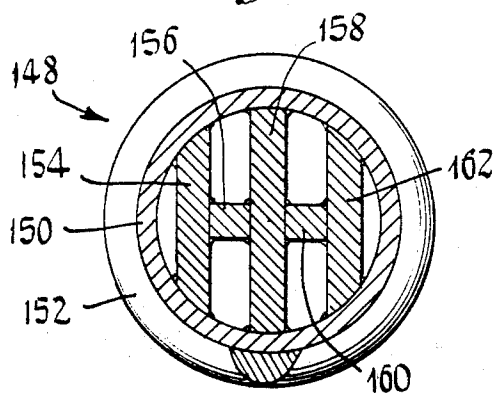


Fig. 8

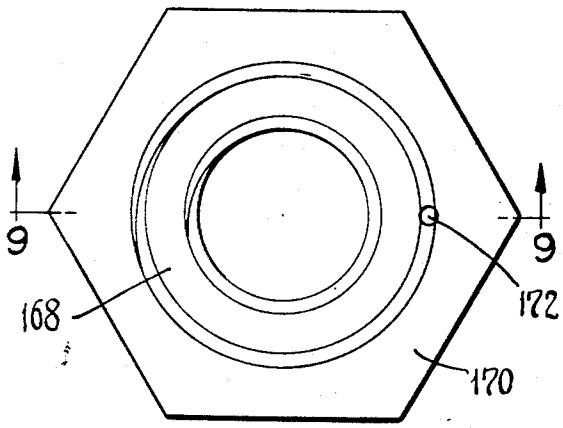


Fig. 9

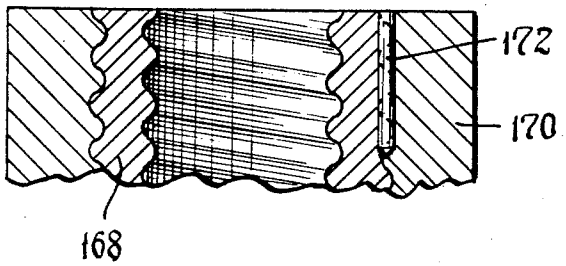


Fig. 10

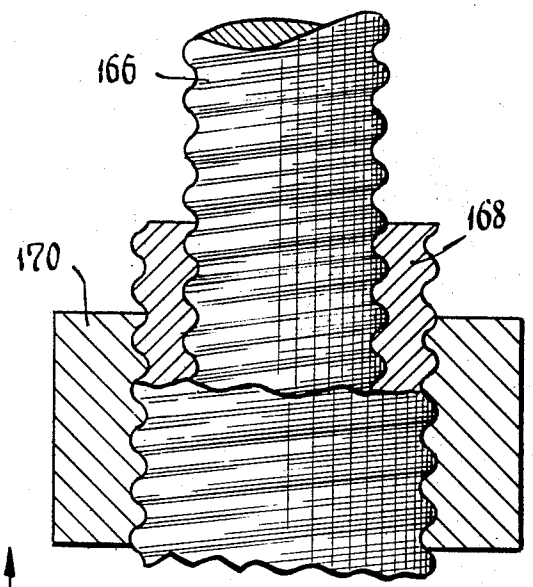
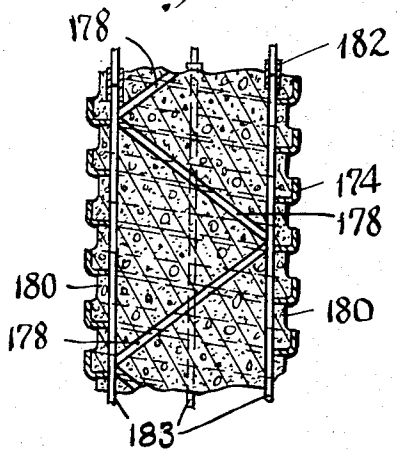


Fig. 11



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3,421,271

CONSTRUCTION OF BUILDINGS CARRIED ON AT FIRST FLOOR LEVEL

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U.S. Cl. 52—126 15 Claims
Int. Cl. E04g *21/00;* E04d *15/00*

ABSTRACT OF THE DISCLOSURE

Building industry construction comprising a building structure which is under construction and is periodically hoisted higher above the ground, new stories being added always at the bottom, the hoisting being done by hollow segmented jack screw shells having incompressible fillers and exterior threads. The jack screws constitute a part of the building framework and remain in place as a permanent part of the building.

This invention relates to building construction, and more particularly to the fabrication of buildings by successively adding stories always at the bottom.

Background

Heretofore various procedures have been proposed, by which buildings were fabricated by constructing the top floor at ground level, then raising the same at least a story, constructing the next-to-top floor at ground level below the raised top floor, etc. While the system has had a limited measure of success, it is not at present widely or universally utilized for the reason that the special equipment needed was costly and not completely universal, lacked sufficient strength and efficiency for the construction of many-storied buildings, and involved special problems dealing with the framework or skeleton structure.

Summary

The above disadvantages and drawbacks of prior building structures of the kind indicated are obviated by the present invention, and a main object is to provide an improved building construction and improved fabricating equipment, which involve comparatively simple devices including compression type columns remaining as part of the building framework, to effect economies in cost, flexibility in application and great strength enabling many-storied structures to be fabricated with greater ease and facility.

This is accomplished by the provision of powerful, fabricated columns constructed as lifting or jack screws, said columns becoming permanent parts of the building framework and being made as independent sections joined end-to-end by compression-type nipples. The columns are of tubular metal construction with external threads and with internal compression cores which may be of reinforced poured concrete. Such jack screws in conjunction with heavy lifting nut devices operating substantially at ground level constitute particularly simple yet strong and powerful lifting frameworks particularly suitable for the construction of buildings by the method of fabricating one story at a time at ground level, then raising the entire story, fabricating a lower story underneath the raised story, etc.

Other objects of the invention are to provide novel and improved building structures and cooperable equipment for carrying out the fabrication of buildings by a building-structure raising and supporting technique whereby work is always done substantially at ground level as above set forth, wherein great strength and reliability is had enabling the construction to be carried out with the maximum degree of safety and security; to provide structures and equipment as above, characterized by novel massive lifting screws adapted to be retained in the building as permanent structural members or columns thereof; to provide improved combination lifting-screw building-column constructions for the above-specified purposes; to provide improved methods of building fabrication involving construction processes which are carried on mainly at the first-story level; and to provide improved structural column members for use with the above methods and techniques.

Other features and advantages will hereinafter appear.

In the drawings:

FIG. 1 is a diagrammatic view, on a greatly reduced scale, illustrating the method for fabricating a building by successively adding stories always at the bottom or first story level.

FIG. 2 is a fragmentary view of a threaded lifting column and powered lifting means, the column being shown in axial section and being of the compressive stress type adapted to be permanently incorporated in the building structure while and after performing its lifting function.

FIG. 3 is a view partly in elevation and partly in axial section, illustrating a modified form of screw column as provided by the invention.

FIG. 4 is a view partly in elevation and partly in axial section, of another type of screw column as provided by the invention.

FIG. 5 is an axial sectional view of still another type of screw column.

FIG. 6 is a view partly in elevation and partly in axial section, of still another type of screw column.

FIG. 7 is a transverse sectional view of yet another type of screw column.

FIG. 8 is a top plan view of a compound-type screw column and lifting nut organization as provided by the invention.

FIG. 9 is a fragmentary axial sectional view through the column and nut of FIG. 8.

FIG. 10 is a sectional view like that of FIG. 9, but showing the screw column in partially extended condition.

FIG. 11 is a fragmentary axial sectional view of still another form of column made in accordance with the invention.

Referring first to FIG. 1 there is diagrammatically illustrated a building structure **20**, such as an office building having an uppermost story **22** with a suitable roof or covering **24**. The building **20** is shown as comprising a relatively large number of stories, and the lowermost portion of the building is carried on a plurality of screw columns **26**, **28**, **30**, **32**, and **34**, there being additional screw columns disposed behind those shown and therefore not visible in the view given.

The screw columns **26**, **28**, **30**, **32** and **34** are shown as supporting the building structure **20**, said columns extending into lifting screw-jack devices **36**, **38**, **40**, **42** and **44** respectively.

The screw columns **26** etc. as shown in FIG. 1 may be constituted in a manner illustrated in FIGS. 2–10, being characterized by an external machine screw configuration. Each of the jack devices **36** etc. may comprise a pair of lifting nuts **48**, **50** with internal threads **52**, **54** and with external gear teeth **56**, **58** respectively.

Associated with the nuts **48**, **50** are lifting cams **60**, **62** and **64**, **66** respectively, together with rollers **68**, **70**. The cams **62**, **66** have gear teeth **72**, **74** respectively, and are rotatable on supporting tables or surfaces **76**, **78**.

The nuts **48**, **50** alternately carry the load of the threaded column **80**, which has powerful external machine screw threads **82** engaged with the threads **52**, **54** of the nuts. When one nut is not turning but is supporting and

lifting the column **80** by virtue of the cams associated with it, the other nut is being turned so as to travel along the threads of the column. Thereafter, the said other nut is held against turning and now takes the load of and lifts the column **80** by virtue of operation of the cam elements associated therewith, while the first nut, now being relieved of the load, is turned and traverses the threads of the column **80** to a new position. Thereafter, the said first nut stops turning and assumes the load on and lifts the column by virtue of operation of its associated cams, and the second nut is relieved of the load and again turns and travels along the column.

An actuator device embodying alternately lifting nuts such as those described above, and which device would be suitable for use in conjunction with the lifting column **80**, is described in detail and claimed in Patents Nos. 2,836,985 and 2,928,289 isued to Arthur M. Maroth. Accordingly, no further details of the operation of the nuts **48**, **50** and associated cam mechanisms are given herein.

Referring now to the screw column **80**, this comprises a plurality of elongate tubular metal shells one of which is shown in FIG. 2 and indicated by the numeral **84**. In FIG. 3, two shell **86**, **88** are shown, and it will be understood that the threaded column may comprise as many individual shells coupled together in end-to-end relation, as will be found necessary for the stated purpose.

The shell **84** preferably has the thread **82** rolled in it, said thread comprising flat crest portions **90** and rounded grooves **92**.

In accordance with the invention, each elongate tubular shell such as the shell **84** has a core indicated generally by the numeral **94**, of substantially incompressible structure, which fills the shell almost to the end portions thereof. The core **94** includes elongate structural steel reinforcement means which in FIG. 2 comprises solid longitudinaly extending bars or rods **96** and also relatively short transverse metal bars **98** interconnecting the rods **96**. In FIG. 2, either three or four of the longitudinal rods **96** may be employed, and the said rods as well as the transverse bars **98** are embedded in concrete **100** which completely fills the interior of the shell **84** and extends to points adjacent the end portions of the shell, as for example the end portion **102**.

Referring now to FIG. 3, the threaded column **104** illustrated therein is seen to comprise in addition to the shells **86**, **88** a threaded nipple member **106** which screws into the end portions of the shells and brings these into abutting relationship whereby the helical machine screw configurations of the shells constitute an essentially continuous screw thread. In FIG. 3, the nipple **106** is shown as comprising a solid steel plug. However, it may also comprise a hollow shell structure which is filled with concrete, reinforced.

The column shells **86**, **88** are provided with holes **108**, **110** respectively to permit a grouting or filler substance to be forced into the joint and around the ends of the nipple **106** for the purpose of effecting a solid non-compressible joint therewith.

In FIG. 3, three longitudinally extending reinforcement rods **112** are illustrated, interconnected by transverse bars **114**. Also, the longitudinal rods **112** have other transverse bars **116** which extend to and back up the inner surfaces of the shells **86**, **88**. As with the column **80** of FIG. 2, concrete **118** fills the shells **86**, **88** and surrounds the reinforcement rods and bars **112**, **114** and **116**. The machine screw thread configuration **119** may be rolled in the shells or otherwise formed, and is shown as having rounded crests and troughs.

Another form of screw column is illustrated in FIG. 4, wherein a straight sided tubular metal shell **122** has welded to its exterior a spiral steel semi-circular-section element **124** which constitutes a relatively accurate machine screw thread. The shell **122** has internal reinforcement means comprising longitudinal rods **126** and transverse bars **128** forming a mesh or honeycomb. Also, additional longitudinal rods **130** and transverse rods **132** are disposed at right angles to the mesh or honeycomb formed by the rods **126**, **128**. The entire interior of the shells **122**, **123** is filled with concrete, which surrounds the mesh formed by the wire rod and bars.

Another form of screw column is illustrated in FIG. 5, wherein the reinforcement means comprises a single centrally disposed rod **136** having secured to it transverse bars **138** which are disposed in a helix having the rod **136** as an axis. The interior of the column **140** in FIG. 5 is likewise completely filled with concrete except for the end portions which receive the connector nipples.

FIG. 6 illustrates yet another form of threaded column, designated **142**, wherein the reinforcement means comprises an iron member having longitudinal ribs **144** and flutes **146**, said member being twisted so that it has a configuration very like a large-diameter twist drill. The twisted reinforcement member completely fills the inside space of the column **142** except for the flutes, said member engaging the interior walls. The flutes are filled with concrete, as with the other forms of columns.

In FIG. 7 there is illustrated a threaded column **148** comprising a shell **150** having welded to its exterior a spiral thread element **152**. Inside the shell **150** there is a steel girder configuration formed of longitudinally extending members **154**, **156**, **158**, **160** and **162** which are secured together so as to have a cross-sectional configuration somewhat like the letter H with the letter I disposed midway between the sides of the H.

With this form of column the structural steel reinforcement is made sufficiently strong and rigid to eliminate the necessity for adding concrete on the inside of the shell **150**.

In FIGS. 8, 9 and 10 the screw column is shown as comprising a pair of telescoping sections, an inner column section **166** and an outer column section **168**, the latter being both internally and externally threaded. The internal threads of the sleeve of outer member **168** engage the external threads of the inner column member **166**. The outer member or sleeve **168** also engages the internal threads of a turnable nut **170** which does the lifting in a conventional manner. A temporary lock between the nut **170** and the sleeve **168** is effected by removable pins **172** as shown in FIGS. 8 and 9. Initially, the nut **170** and the member **168** are locked together, whereby the inner column member **166** is raised. After the inner member has reached a certain desired height, the locking pins **172** are removed, and thereafter the actuator comprising the nut **170** will raise the outer column member **168** while relative turning movement is prevented between the two column members **166**, **168** in any suitable manner, as by welding these to each other.

Referring again to FIG. 1, as each story of the building **20** is built at substantially the ground level, the supporting screw columns **26** etc. are permanently incorporated in the structure.

Upon completion of each lowermost story of the building around the screw columns **26**, etc. the lifting jack devices **36**, etc. will be made to simultaneously raise the columns, junctions will be effected with additional column sections at locations below the lifting jack devices, and the entire building will be raised a complete story, to enable an additional bottom story to be applied, incorporating the newly added screw columns which have passed through the lifting jack devices.

It will now be understood that the invention provides a novel method of fabricating a building, which includes the steps of constructing the upper story and roof portion of the building first at substantially ground level, then raising said construction by approximately a story's height with powerful, reinforced screw columns, and then constructing the next lowest story portion at substantially ground level, utilizing the supporting rugged screw columns as permanent support members in the said next low-

est story portion. As seen in FIG. 1, the dotted lines **176** indicate screw columns which have been previously utilized and incorporated in the upper stories of the building structure **20** as the work progressed. The screw columns **176** are all continuations of the columns **26** etc. which are visible, and accordingly each complete column comprises a substantially incompressible, strong steel and concrete structural member which constitutes a permanent portion of the completed building.

Another embodiment of the invention is shown in FIG. 11. The column of this embodiment comprises a generally tubular formation in the form of a rolled helix **174** formed by rolling a metallic section into a rectangular thread shape as shown. Within the helix a steel reinforcement is provided, comprising longitudinal bars **183** braced by connecting diagonal steel braces **178**. The remainder of the column comprises concrete **180**, which is cast to fill the helical thread and to have a helical groove **180** whereby the column has in its outer surface an accurate machine thread configuration. The bars **183** strongly reinforce the helix **174**, and provide an internal backing therefor, as will be understood. Welding of the helix to the bars **183** may be done, to maintain the accuracy of spacing of the convolutions. Connector sleeves **182** join ends of adjoining rods **183**, being welded thereto.

It will be seen from the foregoing that I have provided a novel combination building structure having incorporated in it and extending vertically through it a plurality of upright substantially incompressible structural columns, each of said columns constituting an essential, powerful supporting part of the building structure and said columns comprising threaded tubular metal shells made up of sections joined end-to-end, and cores disposed in the said shells, of substantially incompressible structure. By virtue of the said improved method, it becomes unnecessary to haul building materials to high elevations, and unnecessary for workmen to perform their tasks at said high elevations. Instead, all of the work is performed at substantially ground level and the materials are utilized at the said level, thus effecting a considerable saving of time, manpower and labor.

In the specification and in the claims the term "machine screw configuration" has been used to describe the external thread provided on the columns. This term is intended to apply to any continuous screw thread of constant helical configuration, which will be fully cooperable with a mating threaded part such as machine screw nuts, for example the nuts **48** and **50** of FIG. 2.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. In combination, a building structure disposed above the ground and having incorporated in it and extending downward from it a plurality of upright structural columns, each of said columns constituting an essential supporting part of said building structure and comprising: a plurality of elongate tube-like metal formations disposed end-to-end and metal connectors located respectively at adjoining end portions of the metal formations, said connectors having interfitting means securing said end portions against separation and relative movement; cores of substantially incompressible structure, respectively filling said formations to said end portions thereof, said cores including elongate structural steel reinforcement means extending throughout the lengths of the formations; said connectors being engaged with the ends of said cores to effect therewith continuous compression strut means within said formations; said formations comprising on their exteriors correlated helical machine screw configurations constituting an essentially continuous screw thread; and means including metal nuts disposed on the columns and having machine screw threads engaged with said continuous screw threads of the upright columns at locations below said building structure, for raising said columns and building structure to enable additions to be made to the building structure at the underside of the same.

2. The combination of claim **1**, wherein,

(a) the metal formations comprise tubes, and

(b) the machine screw configurations are rolled in the tubes,

3. The combination of claim **1**, wherein:

(a) the reinforcement means comprises elongate vertical metal rods and relatively short transverse metal bars interconnecting said metal rods.

4. The combination of claim **3**, wherein:

(a) short transverse metal bars connected to said rods extend to the inner surfaces of the formations.

5. The combination of claim **4**, wherein:

(a) the rods and bars are fabricated in the form of a grill.

6. The combination of claim **3**, wherein:

(a) the transverse metal bars are disposed in a helix.

7. The combination of claim **1**, wherein:

(a) the reinforcement means comprises twisted sections forming helical flutes.

8. The combination of claim **1**, wherein:

(a) the reinforcement means comprises an elongate metal girder structure engaged with the inside surfaces of the formations.

9. The combination of claim **1**, wherein:

(a) the means for raising the columns include intermediary, internally and externally threaded sleeve members engaged with the formations and with the nuts.

10. The combination of claim **9**, wherein:

(a) means are provided, for releasably locking the intermediary sleeve members to the nuts.

11. The combination of claim **1**, wherein:

(a) the machine-screw configurations are rolled metal shapes.

12. The combination of claim **1**, wherein:

(a) the machine-screw configurations comprise helical metal elements welded to the exteriors of the formations.

13. The combination of claim **1**, wherein:

(a) the cores include substantially incompressible concrete substance in which the steel reinforcement means are embedded.

14. The method of fabricating a building which includes the steps of constructing the upper story and roof portion of the building at substantially ground level, raising said construction by approximately a story's height with threaded screw columns, and constructing the next lower story portion at substantially ground level and incorporating into the said next lower story portion the same said screw columns as permanent support members therein.

15. The method of claim **14** and including the additional step of alternately applying lifting forces to different vertically-spaced portions of the threads of said screw columns, to effect the lifting of the columns and building portion.

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U.S. Cl. X.R.

52—236, 725, 745