United States Patent

Jenner

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[45] **Apr. 4, 1972**

[54] MOUNTING ARRANGEMENT FOR ERECTED BUILDING MODULES

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[52] **U.S. Cl.** **52/296**

[51] **Int. Cl.** **E02d 27/00**

[58] **Field of Search** 52/292, 294, 296, 297

[56] **References Cited**

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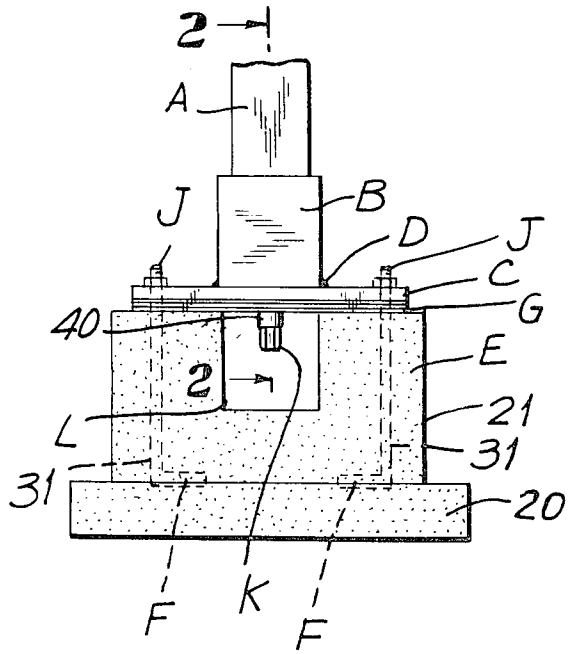
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[57] **ABSTRACT**

Legs of modular components of building structures, in the form of hollow columns of rectangular cross-section, are anchored to a base by having their lower ends received in sockets rising from that base. Within each socket, which may be designed to accommodate one or more columns, two pyramidal spreaders with oppositely sloping surfaces are coaxially disposed above and below a median plane within each column end and are positively engaged, via dovetail couplings, with respective sets of wedge-shaped shoes contacting their outer surfaces; a turnbuckle-type leadscrew, passing axially through these spreaders, engages them with two oppositely threaded stem portions to move them toward or away from each other while the shoes are held by tension springs against an interposed annular spacer. Rotation of the turnbuckle in a predetermined direction thus moves the shoes apart and against the column walls upon which they bear via narrow ribs, thereby clamping the column in position within the socket.

10 Claims, 5 Drawing Figures



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SHEET 1 OF 2

FIG. 1

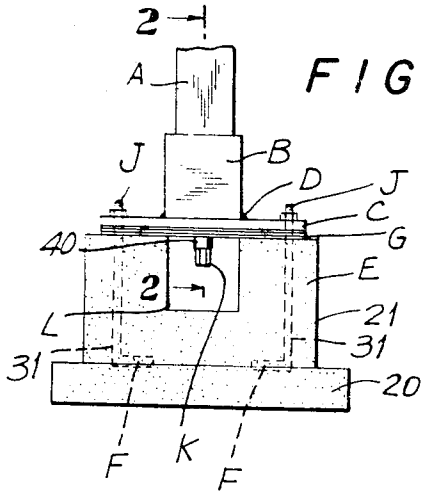
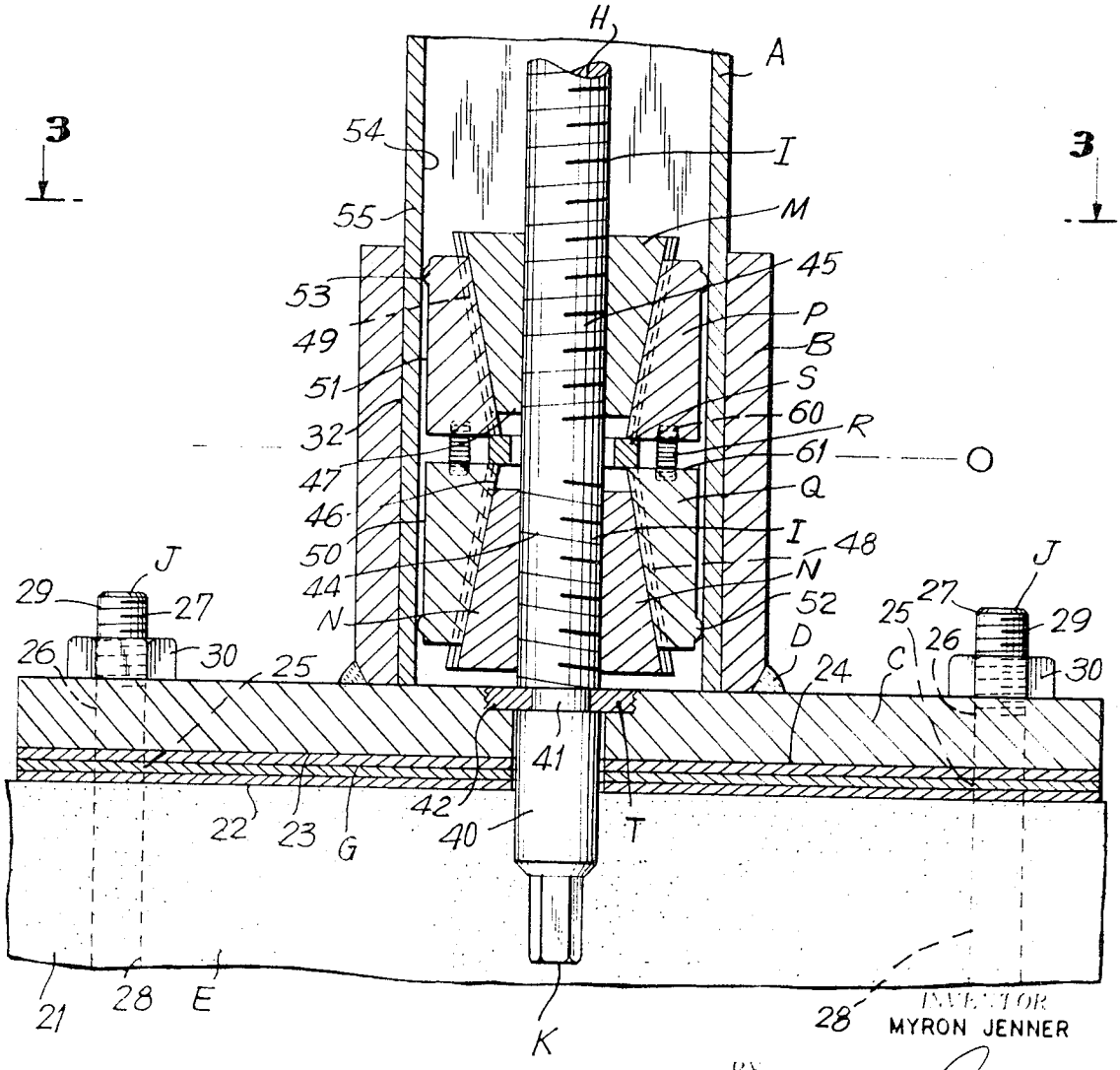


FIG. 2



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FIG. 3

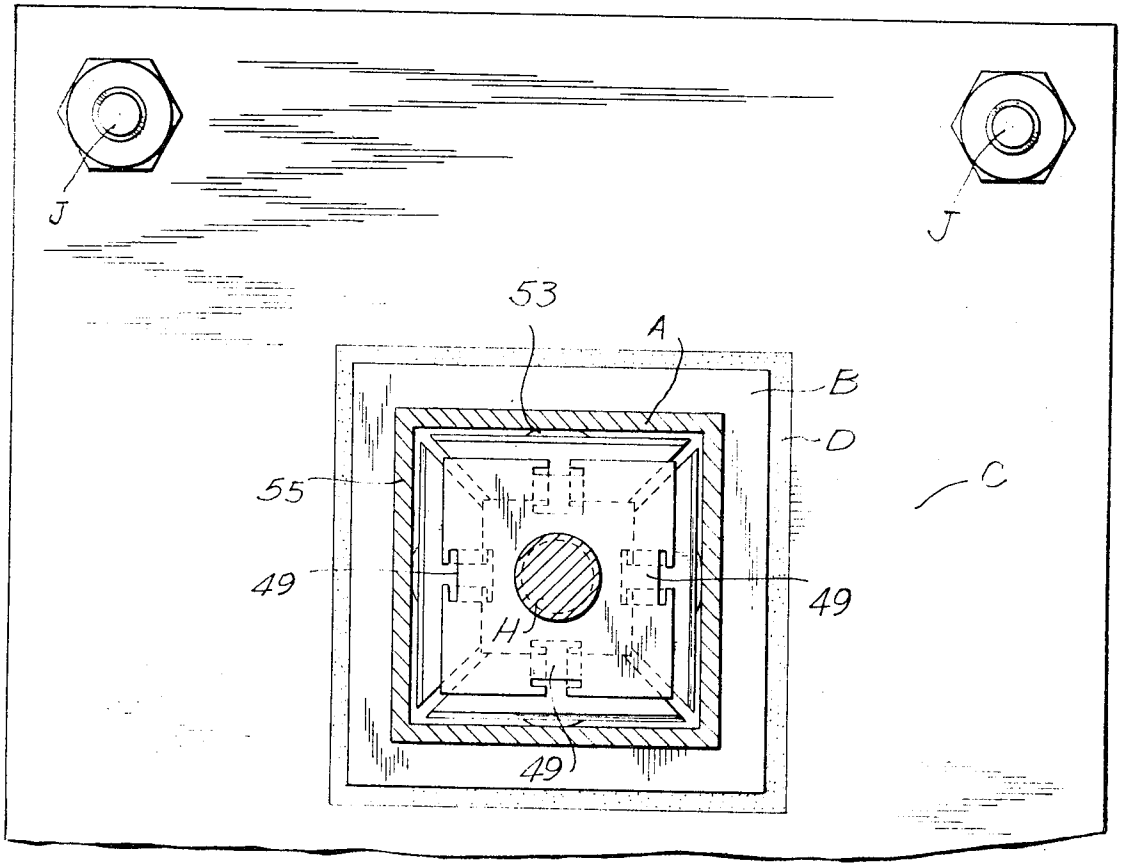


FIG. 5

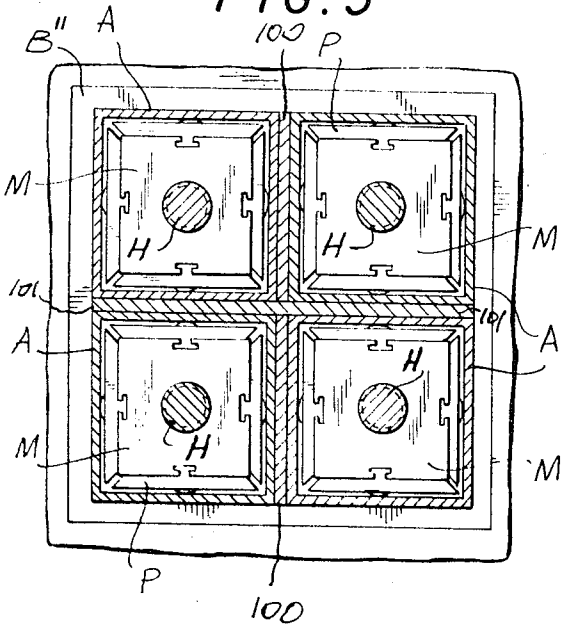
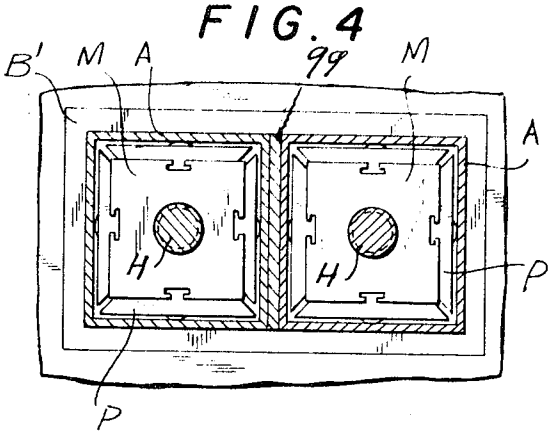


FIG. 4



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MOUNTING ARRANGEMENT FOR ERECTED BUILDING MODULES

DESCRIPTION OF THE INVENTION

The present invention relates to base mountings for vertical building modules which have been erected together to form a multi-story frame having, say, from three to six stories in height.

Although not limited thereto, the present invention will be particularly described as applied to a mounting for multi-story modules, preferably six stories in height, in which there are four hollow vertical corner columns formed of sheet metal and having a square or rectangular cross-section, which are connected at each floor or story by transversely beams of similar rectangular cross-section on which the flooring and ceiling are supported, with the external and interior walls in turn supported by means of metal plates, interior panels or the like.

These modules desirably have their interior partitions, plumbing, electrical and other facilities already installed as far as possible, requiring only final connection at the base of the module at the erection site. The lower ends of the columns preferably are inserted in sockets which rise from a base and are designed to receive one, two or four lower column ends in close juxtaposition. These lower ends, in a final erection operation, are fixedly mounted in the shoes so as to rigidify the entire building structure.

A primary object of the present invention is to provide a simple, durable, permanent and readily manipulated system of mounting elongated vertical building modules so as permanently to secure them in their sockets in a manner enabling them to resist any wind or other force acting on the side of the building in which the modules have been erected and assembled.

Another object of the present invention is to provide means in such mounting for positively maintaining the vertical position of each leg or column in the supporting socket structure.

Still further objects and advantages will appear in the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

In accomplishing the above objects, I have found it most satisfactory, according to one embodiment of the present invention, to provide the column receiving socket with internal wedge means which, when actuated, bear from within upon the lower ends of the columns so as to expand them slightly but sufficiently to press the column walls against the inner wall surface of the rectangular socket, as well as against the adjacent walls of other columns (if any) received in the same socket. Shims are provided between the lower ends of adjoining columns to enable these ends to be compressed together. These shims are advantageously made of a softer steel or other metal than the modular columns.

The mounting means according to my invention comprises pairs of upper and lower wedge-shaped or beveled shoes of opposite inclination fitting within the hollow columns at their lower ends and within the socket along with two coaxial complementarily wedge-shaped expansion members in positive engagement therewith. With the aid of a turnbuckle-type leadscrew, these wedge members may be moved in such a way as to spread the associated shoes which contact the column walls only along narrow upper and lower projections above and below the horizontal median plane of the wedge structure.

The leadscrew or bolt may be manipulated through a tool from beneath a base plate which carries the socket. The latter is welded onto or otherwise permanently fixed to a base plate, which in turn is mounted by heavy bolts onto a concrete supporting structure embedded in the ground or in a foundation. The leveling of the mounting surface is achieved by shims positioned between the plate and the top of the concrete structure.

By turning the central bolt or screw in a predetermined direction, the beveled shoes may be curved radially outwardly against the column walls to clamp them in place. Thereafter, the tool access may be sealed to make the connection permanent.

BRIEF DESCRIPTION OF DRAWING

In the accompanying drawing wherein like reference characters denote corresponding parts throughout the several views:

FIG. 1 is a diagrammatic side-elevational view, on a reduced scale of a mounting arrangement for a leg of a modular building frame;

FIG. 2 is a sectional elevation taken on the line 2—2 of FIG. 1 but drawn to a relatively enlarged scale;

FIG. 3 is a cross-sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is a cross-sectional view, similar to FIG. 3 but on a reduced scale, showing a modification designed for a two-column leg; and

FIG. 5 is a cross-sectional view similar to FIG. 4, showing the arrangement as applied to a four-column leg.

In FIGS. 1 and 2 there is shown the lower end of a frame leg A in the form of a column of the taller leg A. This leg may consist of a hollow rectangular or square cross-section. This column consists of a sheet of metal folded into a prismatic tube with two abutting edges along one interior side of the prism, welded together to form an airtight, weather-tight and water-tight enclosure along the full height of the column A.

The lower end of the column A is inserted into a prismatic socket B, several such sockets being positioned at the corners of the erected building. This socket of rectangular or square cross-section may be similarly formed of a sheet of steel folded to form a short prismatic tube or casing.

This socket member B is welded to a base plate C at D. The base plate C is attached to a concrete block E by L-shaped bolts J which are embedded in the concrete block E as indicated at F, traversing a series of shims G which can be selectively added or removed to vary the height of the plate C and of the socket B.

Axially disposed within the column A is a turnbuckle-type bolt H having a stem I with opposite left hand and right hand threads below and above a median horizontal plane O, respectively. This bolt has an adjustment head K of hexagonal shape which is readily accessible through a transverse opening L extending through the block E. The inversely threaded portions **44**, **45** of bolt H are screwed into two four-sided pyramidal wedge members M and N, which are separated or brought together by turning the bolt head K in one or the other direction.

The outer surface of the wedge members M and N, converging toward the midplane O, bear upon respective sets of beveled shoes P and Q, which are biased by springs R toward each other. A loose collar S keeps the members P and Q from touching, while a snap-on washer T prevents vertical movement of the turnbuckle H.

When drawn together, the wedge pieces M and N drive the complementary elements P and Q outwardly against the inner well surface of the lower end of the column A. It will be noted that the upper shoes P rest by gravity on the ring S, spacedly surrounding the double-threaded member H.

In the locking position of FIG. 2, the thin walls of the hollow four-sided column A are expanded by the camming engagement of elements M, N and P, Q, so that they will tightly grip the socket B rigid with mounting plate C.

The concrete block E is embedded in the ground or forms part of a foundation and has an enlarged base portion **20** and a reduced-diameter upper portion **21**. Upon the top face **22** of this reduced-diameter portion are placed the adjusting shims G, whose number (here three) may be varied from one to six or seven, depending upon the level desired for the base plate C.

This enables the mounting for the sockets B to be adjusted so that they all lie at the same level. The top face **23** of each stack of shim plates G supports the bottom face **24** of the base plate C. The shim plates G are provided with openings **25** and the base plate C is provided with aligned bores **26** to receive the upper end **27** of the shanks **28** of the bolts J bearing threads **29**.

These threaded upper ends mate with nuts **30** to clamp down the base plate C and the shim plates G. The unthreaded lower portions **31** as well as the in-turned portions F of the bolts J are embedded in the concrete down to the level of the top of the enlargement **20**, as indicated in FIG. **1**.

Normally, the lower end of the hollow modular column A is inserted into the socket B after the expanding clamp assembly H, M, N, O, P has been placed therein, so that it will slip into position between that assembly and the inner wall surface **32** of the socket B. The plates C have previously been leveled and axially aligned with the columns A so that the lower ends thereof may be rapidly and precisely set in place. The clamping assembly is then expanded to grip the lower end of the column A, the bolt head K being turned for this purpose by a wrench.

This bolt K has a shaft **40** separated from the threaded stem I and held in position by the reduced-diameter portion **41** fitting into and freely turning in the snap-on washer **42**, which is positioned in a central recess **43** in the top of the base plate C.

It will be noted from FIG. **3** that the four elements P and the four elements Q are of trapezoidal outline and have centrally positioned tenons **49** in dovetailed engagement with mortises **48** on the sloping faces of the pyramidal wedge elements M and N. The vertical outer faces **50** and **51** of the elements P and Q are provided with bottom and top projections **52** and **53**, in the form of short horizontal ribs, which bear upon the inner surface **54** of the column A to force the yieldable column walls **55** into close contact with the interior of the socket B.

The springs R tend to draw the eight upper and lower pressure members P and Q onto opposite faces of annular spaces S so that the unit P-Q occupies the smallest rectangular outline during insertion of the foot of the column into the socket B.

In assembly, after the spreaders M and N have been threaded onto the leadscrew H on opposite sides of the intervening collar S, the four upper shoes P and the four lower shoes Q are slipped into position with the coil springs R therebetween to bias them into contact with collar S, the ends of the coil springs being lodged in recesses **60** on the confronting faces **61** of the members P and Q. The bolt head K will have been turned in a sense driving the spreaders M, N apart to draw the members P and Q inwardly so that they will permit free movement of the column end into position; this ingathering of the shoes P, Q is possible by virtue of their positive interengagement with the spreaders M, N at the dovetail couplings **48, 49**. That positive guidance also prevents rotary entrainment of the spreaders by the leadscrew H in any operating position thereof.

The upper rims of the sockets B may be slightly flared or bend outwardly for easier introduction of the lower ends of the modular columns.

As the bolt head K is turned by means of a wrench inserted through the opening L, the members P and Q will be forced outwardly with the projectors **53** deforming the walls of the column A as explained above. This will prevent any turning movement, applied to the modules of which the legs A form a part, from tending to dislodge the legs from the sockets B and will greatly rigidify and strengthen the structure of the building.

In FIGS. **4** and **5** I have shown larger sockets B', B'' designed to accommodate instead of one column end as required at the corners of the erected building frame, two column ends (FIG. **4**) at the junctions of modules along the outside faces of the building, and four column ends within the interior of the building as shown in FIG. **5**.

The columns are separated within the socket by compressible inserts or plates **99**, **100** and **101** designed to prevent the formation of any intervening voids.

As many changes could be made in the above-disclosed anchorage for erected building modules, and many widely different embodiments of this invention could be made without departure from the scope of the claims, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An anchorage for a leg of a building structure, said leg having a lower end in the form of a hollow prism with deformable walls, comprising:

a mounting plate for supporting said leg;

an upwardly open prismatic socket for said leg rising from said mounting plate and rigid therewith;

turnbuckle means journaled in said mounting plate and extending vertically into said socket, said turnbuckle means having oppositely threaded upper and lower portions on a common stem;

wedge-shaped upper and lower spreaders with inversely converging outer faces threadedly engaged by said upper and lower portions, respectively, for relative displacement by said turnbuckle means upon rotation of said stem; and

upper and lower pressure members positively guided on oppositely sloping outer faces of said upper and lower spreaders, respectively, and received in said leg together with said spreaders and said oppositely threaded portions for radially outward camming against adjoining walls of said leg upon rotation of said stem in a predetermined sense, thereby firmly clamping said leg in said socket, said turnbuckle means being accessible from without for performing such rotation.

2. An anchorage as defined in claim **1** wherein said pressure members and said spreaders are provided with dovetailing formations along contacting surfaces thereof.

3. An anchorage as defined in claim **2** wherein said upper and lower spreaders converge toward a common midplane, further comprising biasing means tending to draw said pressure members toward said midplane along said contacting surfaces.

4. An anchorage as defined in claim **3**, further comprising spacer means interposed between said pressure members in the region of said midplane.

5. An anchorage as defined in claim **2** wherein said pressure members are provided with narrow outer projections bearing on said adjoining walls upon an outward camming by said spreaders.

6. An anchorage as defined in claim **1** wherein said leg is a four-sided column, said turnbuckle means comprising a leadscrew extending axially within said column, said spreaders having the shape of four-sided pyramids, said pressure members forming two four-member sets contacting respective faces of said pyramids.

7. An anchorage as defined in claim **1** wherein said leg consists of a plurality of closely juxtaposed four-sided columns, said turnbuckle means comprising a leadscrew extending axially within each column, said spreaders having the shape of a pair of four-sided pyramids on each leadscrew, said pressure members forming within each column two four-member sets contacting respective faces of said pyramids.

8. An anchorage as defined in claim **7**, further comprising compressible means inserted between adjoining columns within said socket.

9. An anchorage as defined in claim **1**, further comprising a supporting base for said mounting plate provided with an access opening, said turnbuckle means extending into said base for engagement by a tool via said access opening.

10. An anchorage as defined in claim **9** wherein said stem terminates in a polygonal head within said access opening.

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