

[54] **STRUCTURAL BUILDING FRAME
INCORPORATING UTILITIES**

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[51] Int. Cl. **E04b 12/00**

[58] Field of Search **52/220, 221, 648,**
52/79, 236; 137/357; 4/211, 2, 3

[56] **References Cited**

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Primary Examiner—Henry T. Klinksiek

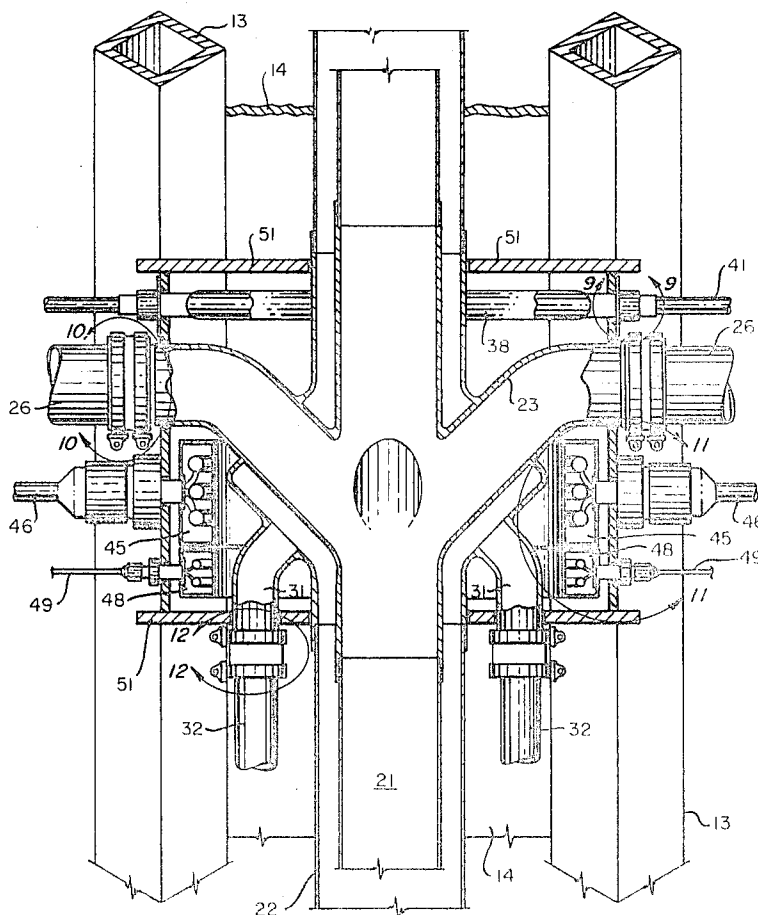
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[57]

ABSTRACT

A structural building frame in which vertical columns incorporate utilities and provide access to the utilities at each level. The frame is formed of modular components including vertical column sections incorporating utilities. The column sections may also include integral outwardly extending beams for connection with beams of an adjacent column or to interconnecting cross modules. The assembled modular components provide a frame for supporting the floors and walls of a building structure or environmental space modules.

15 Claims, 12 Drawing Figures



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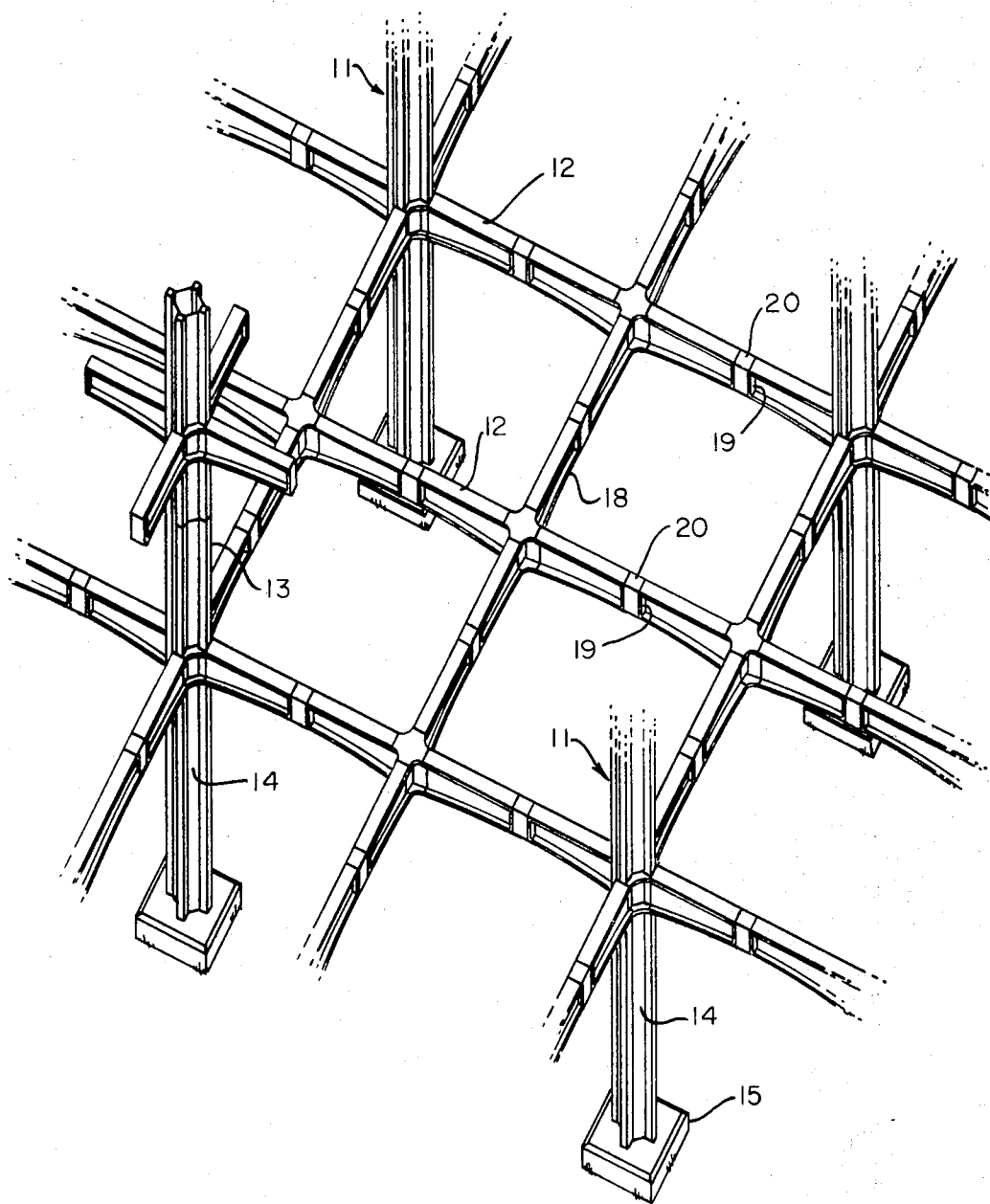


FIG. 1

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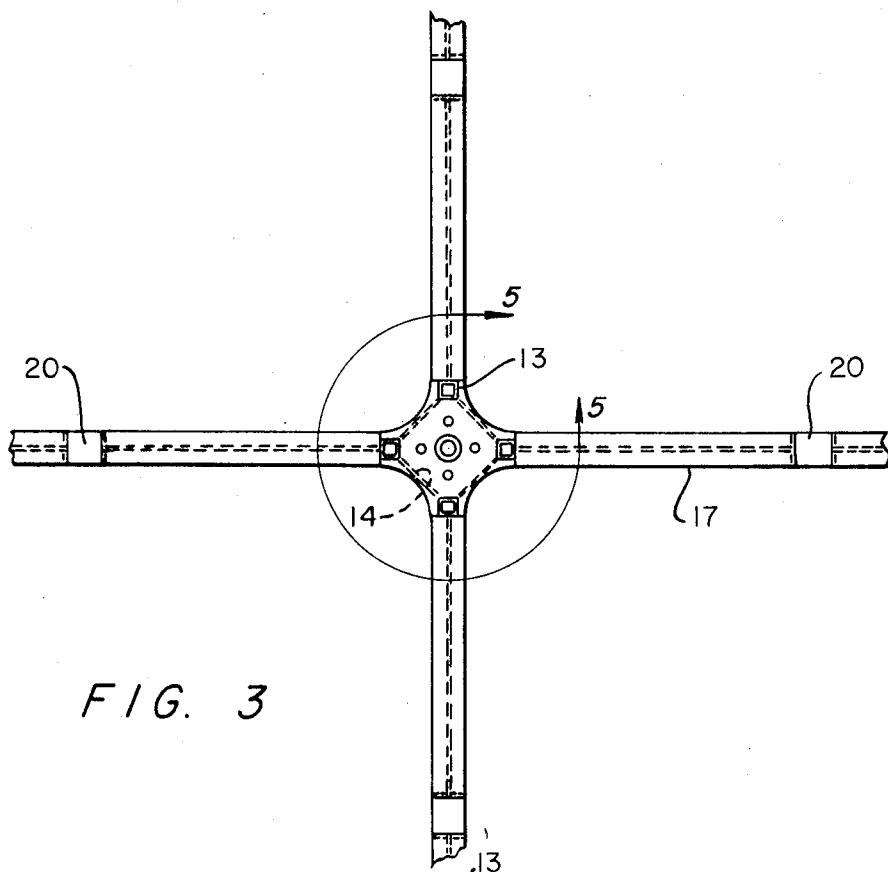


FIG. 3

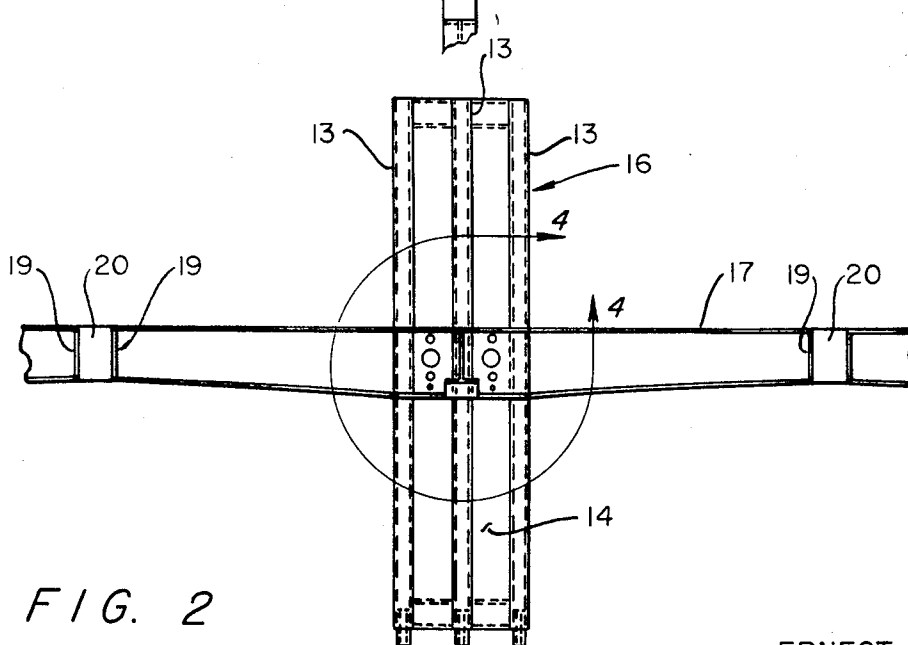


FIG. 2

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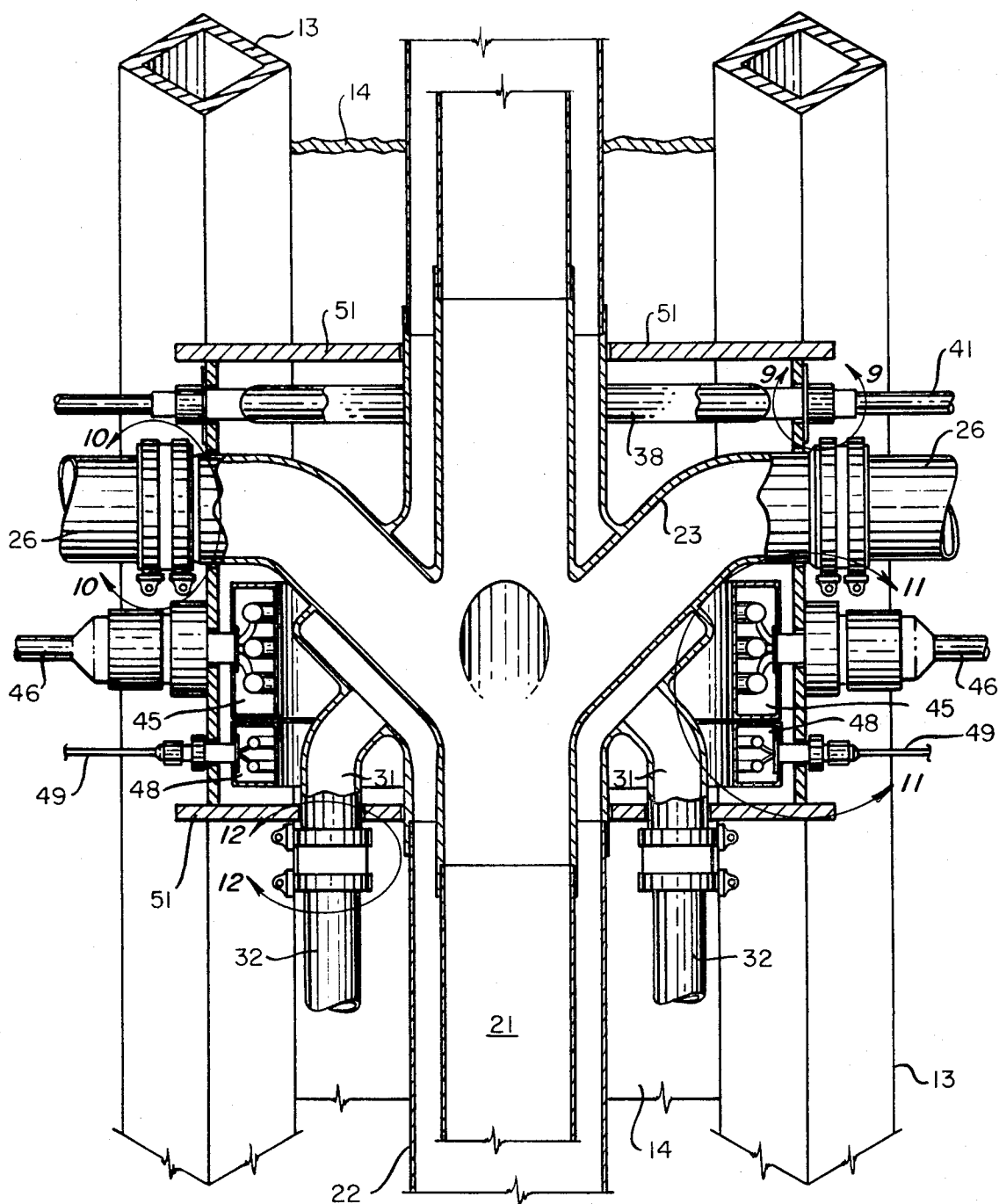


FIG. 4

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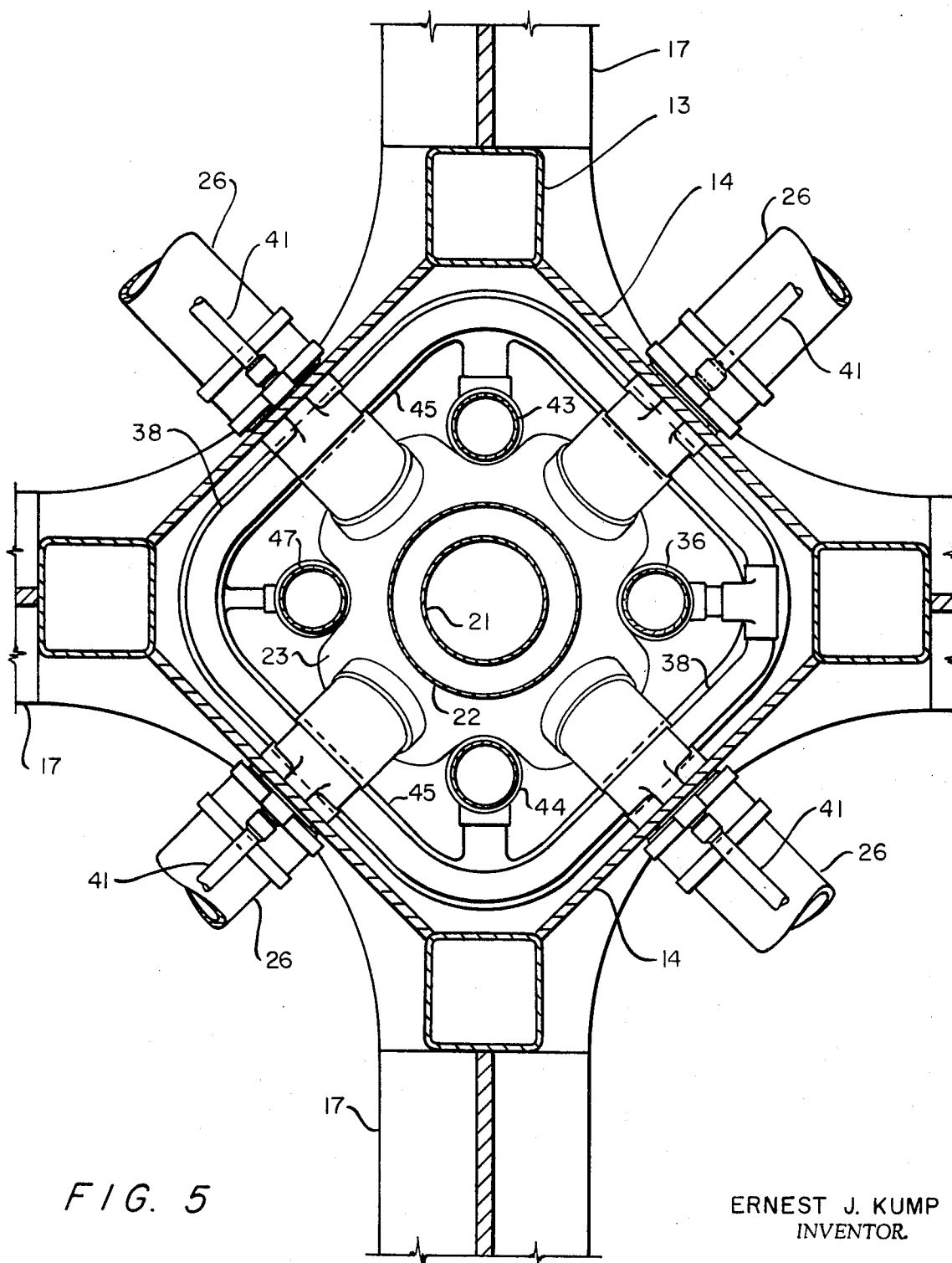


FIG. 5

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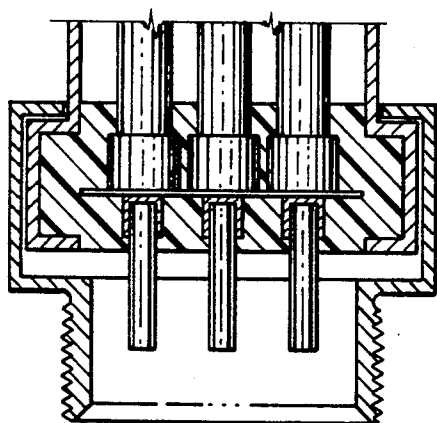


FIG. 7

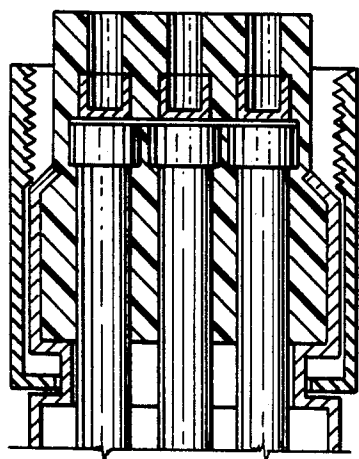


FIG. 8

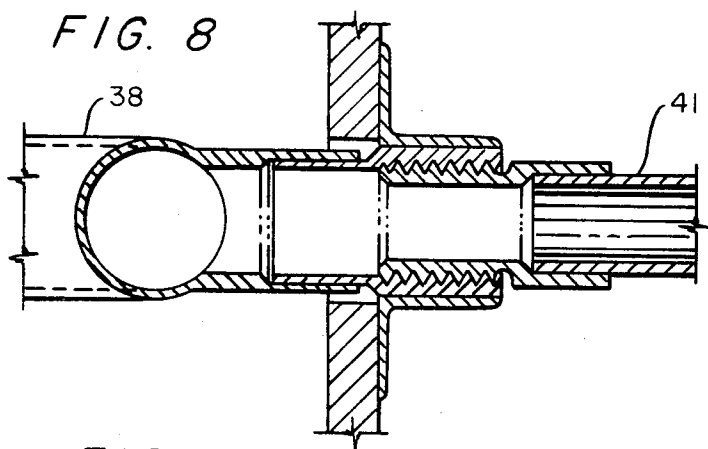


FIG. 9

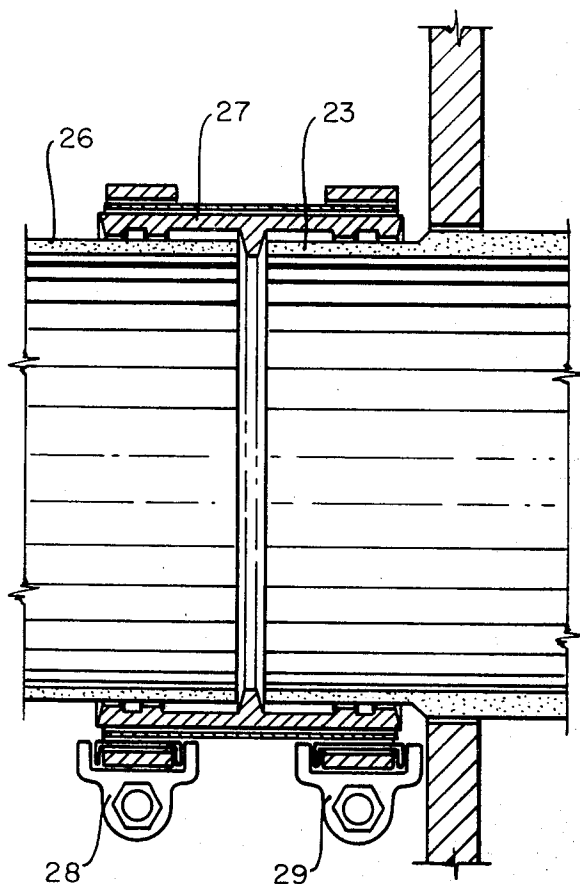


FIG. 10

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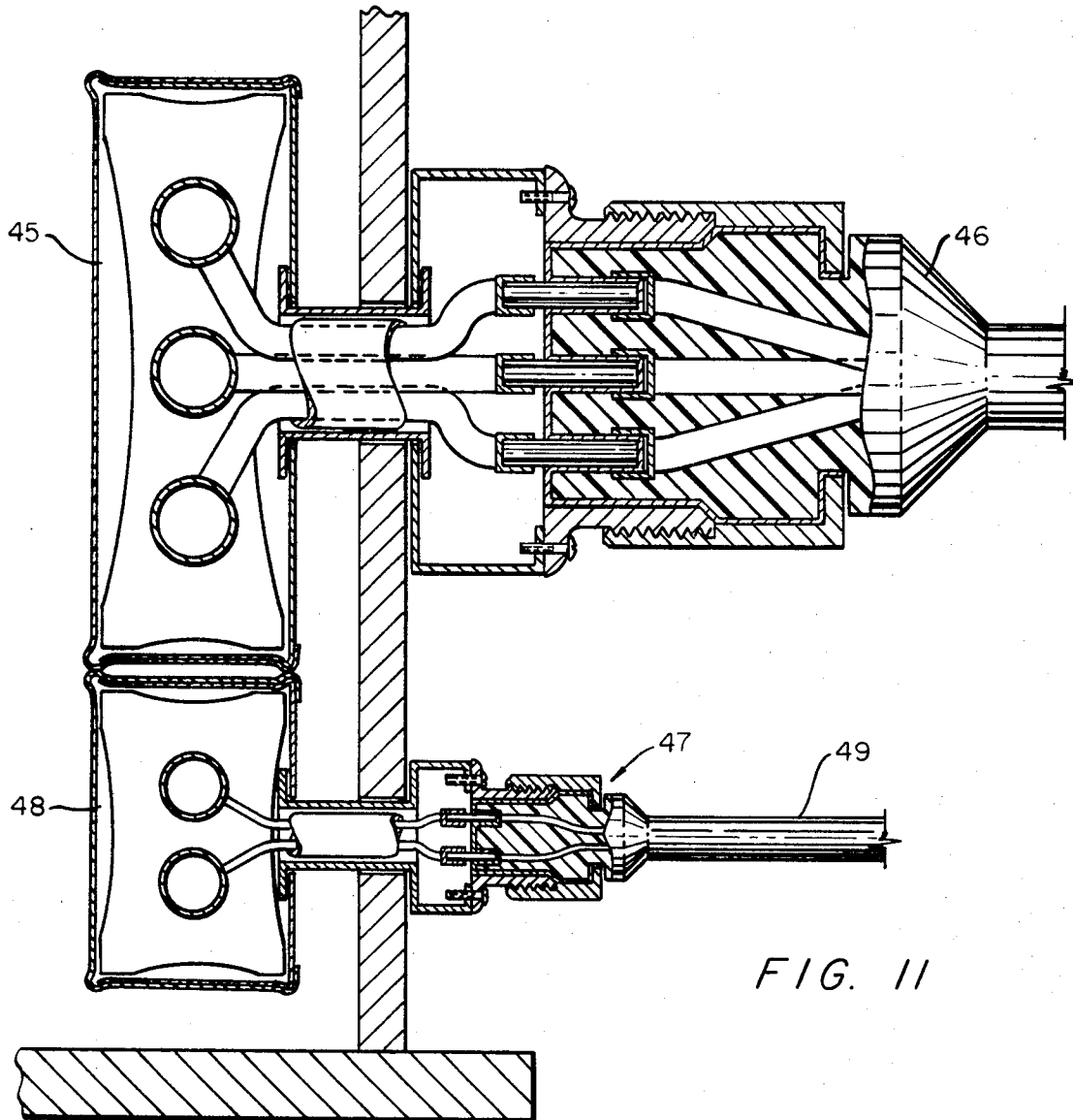


FIG. 11

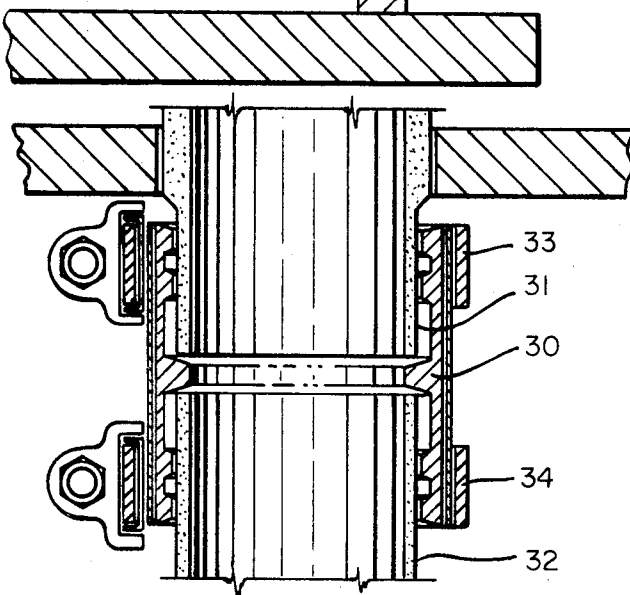


FIG. 12

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STRUCTURAL BUILDING FRAME INCORPORATING UTILITIES

CROSS-REFERENCE TO RELATED APPLICATIONS

In copending patent application Ser. No. 60,520, filed Aug. 3, 1970, entitled BUILDING SYSTEM AND COMPONENTS THEREFOR, a building system including structural frame components including column sections having vertical clusters of support members held by horizontal members which also serve to support vertical service pipes and conduits is described. Integral beams cantilever outwardly from the column sections and are adapted to be connected to beams of adjacent column sections or to cross beam modules which interconnect adjacent column sections.

BACKGROUND OF THE INVENTION

This invention relates generally to a structural building frame which may be erected at the site and more particularly to a modular building frame in which utilities are incorporated within the vertical columns and made available at each level.

In a normal building system, the structural frame is erected at the site and thereafter the necessary utilities are installed to supply utilities to the various levels of the building. In multi-story buildings, the utilities are generally installed along the vertical columns and thereafter boxed in or otherwise incorporated within the structure.

OBJECTS AND SUMMARY OF THE INVENTION

It is a general object of the present invention to provide a structural frame incorporating utilities which may be fabricated and assembled at a factory and rapidly erected at the site by joining together structural frame modules.

It is another object of the present invention to provide a modular structural building frame incorporating utilities which may be readily erected at the site and provide utilities at various levels of the structure.

The foregoing and other objects of the invention are achieved by a modular structural frame comprising column modules having a plurality of support members such as tubes with a web secured between adjacent support members to provide a hollow column, said webs also serving to provide lateral stiffening and vertical support. The hollow column incorporates utilities running along the column and a distribution means at each level for making the utilities available for connection to adjacent rooms or environmental space modules of the type described in said copending application at each floor. The modular vertical column sections may include integral outwardly extending beams adapted to be interconnected with beams of adjacent columns or to interconnecting cross modules by means of connectors.

The foregoing and other objects of the invention will be more clearly understood from the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a structural frame in accordance with the present invention.

FIG. 2 is an elevational view of the column module of FIG. 3.

FIG. 3 is a plan view of a column module with outwardly extending cantilevered beams.

FIG. 4 is an enlarged view taken along the line 4—4 of FIG. 2 showing the utility and distribution manifold at each level.

FIG. 5 is an enlarged view taken along the line 5—5 of FIG. 3 showing a plan view of the utility and the distribution manifold at each level.

FIG. 6 is an enlarged view of the ends of a modular column showing the interconnection between column sections.

FIG. 7 is an enlarged view of a male electrical connector for connecting vertical electrical sections taken along the line 7—7 of FIG. 6.

FIG. 8 is an enlarged view of the female connector for the electrical system taken along the line 8—8 of FIG. 6.

FIG. 9 is an enlarged view taken generally along the line 9—9 of FIG. 4 and showing a water outlet.

FIG. 10 is an enlarged view taken along the line 10—10 of FIG. 4 showing the soil pipe outlet.

FIG. 11 is an enlarged view showing the electrical and telephone outlets at each level of the structure.

FIG. 12 is an enlarged view of the vent connection to the concentric soil pipe.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The structural frame comprises a plurality of spaced vertical columns 11 interconnected with horizontal beams 12. The columns 11 comprise a cluster of four vertical structural tubes 13, FIGS. 1, 2, 3 and 4, which are interconnected by web plates 14. The web plates provide stiffening to resist lateral forces when necessary as well as provide additional support for vertical loads. The plates 14 at the base of a column may be thicker than the plates 14 near the top of the column thereby to support the overlying load. The base of the columns are mounted on suitable foundation members as schematically illustrated by the foundation members 15. As a result, the structural tubes 13 may be of uniform size throughout the length of the column while the thickness of the webs can be increased near the bottom to support additional structural load.

In accordance with a preferred embodiment of the present invention, the column is modular, that is, the column is made up of a plurality of sections such as the section 16, FIG. 2, which sections are joined to one another at the site by interconnecting means to form the column for a multi-level building structure. It is apparent that the columns may be fabricated and assembled at a factory and then transported to the site where they are connected to other column modules.

In accordance with one embodiment of the invention, there are provided horizontal outwardly extending beams 17 integral with each of the vertical column sections 16. The beams 17 can be connected directly to the outwardly extending beam of an adjacent column. The connecting means may comprise plates 19 secured to the end of the beams, as by welding, and a connector 20. Bolts extend through the plate 19 and through the wall of connector 20 to connect the ends of the beam. Preferably, they are connected to a cross beam module 18 to provide a support grid between vertical beam sections. The support grid is adapted to support a plurality

of space modules of the type described in said copending application or other capsulated space or to support conventional floors and walls.

Referring more particularly to FIGS. 4 and 5, the space in the interior of the column defined by the webs 14 and vertical members 13 which accommodates the utilities is shown more clearly. A soil pipe 21 extends centrally of the column. A second pipe 22 concentrically surrounds the soil pipe. The annular space between the two pipes serves as the vent which extends vertically through the structure. At each of the levels, the soil pipe includes a plurality of upwardly and outwardly extending members 23, four in the present instance, one on each side of the column. These extensions extend through and may be held by plates 14. They are adapted to be interconnected to associated soil pipes in the plumbing of the corresponding level. For this purpose, connections of the type shown in FIG. 10 may be employed, that is, a connection which serves to grip the soil pipe section 23 and the cooperating soil pipe 26 and to hold the same together. For example, the connection may comprise a sleeve 27 with clamping means 28 and 29 at each end thereof and serving to secure the sleeve to the adjacent pipe section to provide a competent seal between the same. In the event that soil pipes are not associated with the four corners of the column, the unused soil pipe may be appropriately plugged. It is apparent that other rigid or flexible connections may be used.

The concentric vent pipe is flared outwardly and surrounds extensions 23. It is provided with vent connections 31 which extend downwardly and are adapted to receive the vents 32 of the next lower level. FIG. 12 shows a typical connection for the vent pipes. The connection includes a sleeve 30, spaced clamps 33 and 34 which are adapted to be tightened to clamp the sleeve to the adjacent vent pipe sections.

Water pipe 36 extends vertically within the column and is connected to distribution pipe 38 which extends around the column adjacent the web 14. This provides a manifold which services outlet 41.

Electrical conduits 43 and 44 extend vertically of the column and provide a source of electrical power to the manifold 45 which extends around the periphery of the inside of the column and is connected to outlets 46. Telephone and television cables 47 extend vertically and are connected to a manifold 48 and telephone and television outlets 49. Typical electrical interconnections for a three wire system are shown in FIG. 11 wherein there is provided a connection between the wires in the distribution manifold and associated equipment. Typical telephone connections are shown at the lower part of the figure at 47. The pipes and conduits are held in the columnar space within the structural tubes by means of spaced horizontal plates 51 disposed at the ends and at the center of the module. The space within the column may be filled with suitable insulation. In certain building frames the column modules may not house or contain any utilities but may merely comprise vertical tubes 13 and interconnecting webs 14.

It is, of course, to be understood that the various interconnections between the utilities within the column and the associated equipment may be of types other than those illustrated.

As previously described, the column sections may be fabricated pre-assembled at a factory with all utility

pipe conduits and the like disposed within the column. The complete assembly can then be transported to a site and the column sections connected to one another. For this purpose, interconnections of the vertical components are provided. Referring particularly to FIG. 6, the interconnections between the vertical structural tubes 13 are provided by means of inserts 50 which serve to engage and align the adjacent sections. Thereafter, the tubular sections may be welded, bolted or otherwise secured to one another. The electrical connections may be made by means of sleeves and connectors such as shown at 7-7 and 8-8, and FIGS. 7 and 8, for the vertical electrical assemblies and such as shown by the couplings 52 for the soil and vent pipes. After assembly, the soil pipe may also be suitably sealed as by welding.

Thus, in accordance with the present invention, the vertical column sections are fabricated and assembled at a factory, transported to the site and erected. The horizontal beams are interconnected to form a framework which can then receive conventional floors, walls and the like, or which may receive environmental space modules of the type described in my said copending application or other types.

The horizontal beam sections 12 are preferably attached to the vertical members by welding to cantilever outwardly from the column to span from one column to the next or to a cross beam module. The beams define a supporting grid adapted to support floors and the like. The action of the cantilever branch beams associated with column sections and modular cross beams is to form a three-hinged arch support making it possible to erect a framework without the necessity of staging.

Thus, there has been provided an environmental structural space frame with modular columns and cross beam modules which can be prefabricated and assembled at a factory, transported and easily erected and connected at the site to provide the structural framework for multi-story, multilateral building structures. Furthermore, selected columns present the necessary utilities, power, water and sewage disposal at each level.

I claim:

1. A column for use in a structural building frame comprising a plurality of spaced tubular members disposed to define therebetween a vertical columnar space with the members at the corners of the space, said tubular members providing the vertical support of said building frame, utilities extending vertically within said columnar space adjacent said tubular members, and means spaced along and supported by said tubular members providing connection to said utilities at each building level.

2. A column as in claim 1 wherein said means providing for connection to said utilities comprise a manifold connected to selected utilities at said levels, and means cooperating with said manifold at spaced points around the column.

3. A column as in claim 1 including a web secured between adjacent tubular members to enclose said vertical columnar space and provide additional lateral and vertical support for said building frame.

4. A column for use in a structural building frame comprising a plurality of tubular members defining a vertical columnar space, utilities extending vertically within said columnar space, said utilities including a soil pipe extending centrally along said space, a second

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pipe surrounding said soil pipe to form an annular space serving as a vent, and means spaced along said column providing for connection to said utilities at each level.

5. A column as in claim 4 wherein said means for connection to said soil pipe comprises outwardly and upwardly extending branch pipes.

6. A column module for use in a multilevel structural frame comprising four spaced tubular members of predetermined length disposed to define a columnar space with the members at the corners of said space, said tubular members providing the vertical support of said building frame, utility means in said columnar space, means supported by said tubular members along said column module for connection to said utility means, and means at each end of said tubular members for connection to the tubular members of a vertically adjacent column module and means at the ends of said utility means for connection to the utility means of a vertically adjacent column module.

7. A column module as in claim 6 wherein said means providing for connection to said utilities comprise a manifold connected to selected utilities at said locations, and means cooperating with said manifold at spaced points around the column.

8. A column module as in claim 6 including a web secured between adjacent tubular members enclose said vertical columnar space and provide additional lateral and vertical support for said building frame.

9. A column module for use in a structural frame comprising a plurality of tubular members of predetermined length, defining a columnar space, utility means in said columnar space, said utility means including a soil pipe extending centrally along said space, a second pipe surrounding said soil pipe to form an annular space serving as a vent, means spaced along said column module for connection to said utilities, and means

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at each end of said columnar module for connecting the tubular members to members of a vertical adjacent column module and said utilities to the utilities of a vertical adjacent column module.

10. A column module as in claim 9 wherein said means for connection to said soil pipe comprises outwardly and upwardly extending branch pipes.

11. A column module for use in a structural frame comprising a plurality of tubular members of predetermined length defining a columnar space, a plurality of outwardly extending beam sections secured to said tubular members, utility means in said columnar space, means spaced along said column module for connection to said utilities, and means at each end of said columnar module for connecting the tubular members to members of a vertical adjacent column module and said utilities to the utilities of a vertical adjacent column module.

12. A multi-lateral structural frame comprising a plurality of spaced columns, each of said columns comprising a plurality of tubular members defining a vertical columnar space, utilities extending vertically within said column space, and means spaced along said column providing for connection to said utilities at each level, and horizontal beams connected to said columns and extending between said columns at each floor.

13. A structural frame as in claim 12 wherein said columns are formed from a plurality of column modules vertically joined to one another.

14. A structural frame as in claim 13 wherein said column modules include outwardly extending beam sections.

15. A structural frame as in claim 14 including cross beam modules interconnecting the ends of adjacent beam sections.

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