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Finsterwalder et al.

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[54] **MULTI-STORY BUILDING AND METHOD OF CONSTRUCTION THEREFOR**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **52/745,** 52/126, 52/236

[51] **Int. Cl.** **E04h 1/04,** E04g 21/00

[58] **Field of Search** 52/745, 83, 126, 122

[56] **References Cited**

UNITED STATES PATENTS

1,150,232	8/1915	Starr	52/122
3,342,008	9/1967	Frey	52/745
3,546,831	12/1970	Romd	52/83

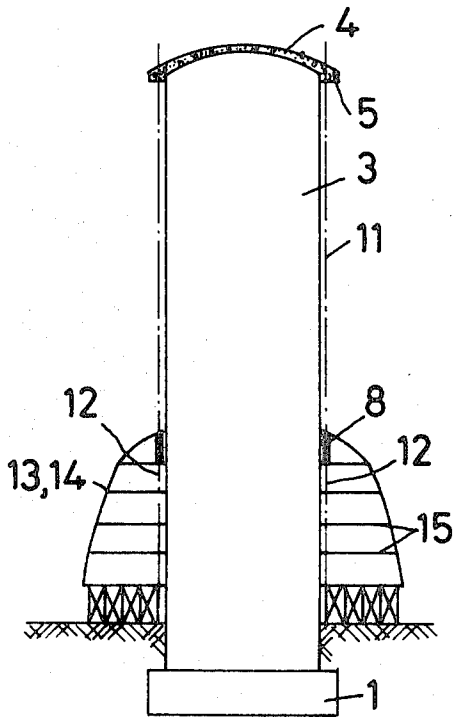
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[57] **ABSTRACT**

Multi-story building having a central column of reinforced concrete at the upper end of which the story ceilings that surround the column are anchored by means of suspension members and which has a shell that expands outwardly from the upper end of the column, within which extend the suspension members that are anchored on the upper end of the column.

2 Claims, 9 Drawing Figures



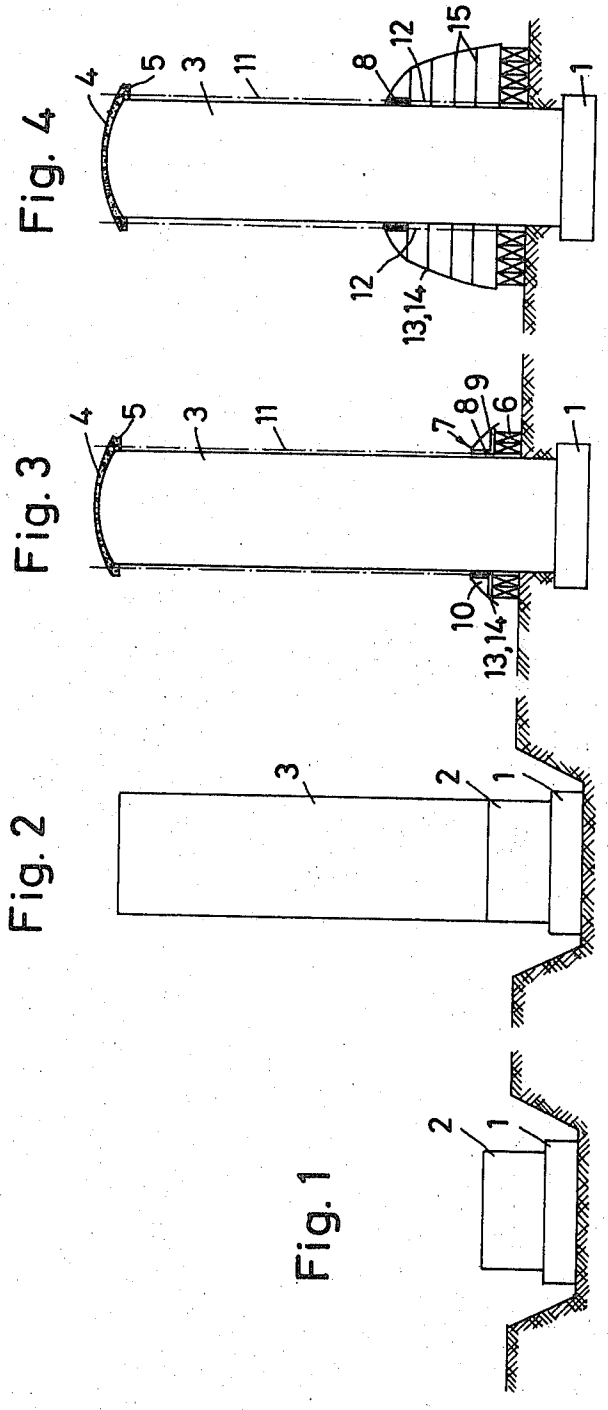

Fig. 4
4
5
3
11
8
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15
1
12
13,14
Fig. 3
4
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10
13,14
Fig. 2
3
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1
Fig. 1
2
1

Fig. 7

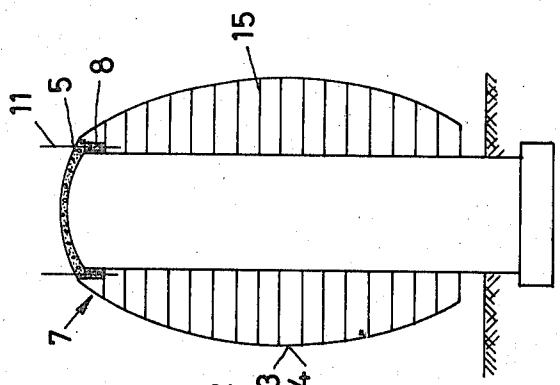


Fig. 6

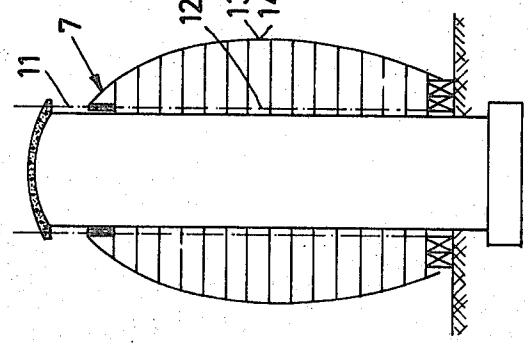


Fig. 5

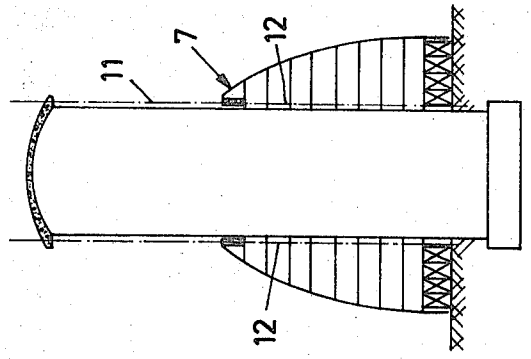


Fig. 8

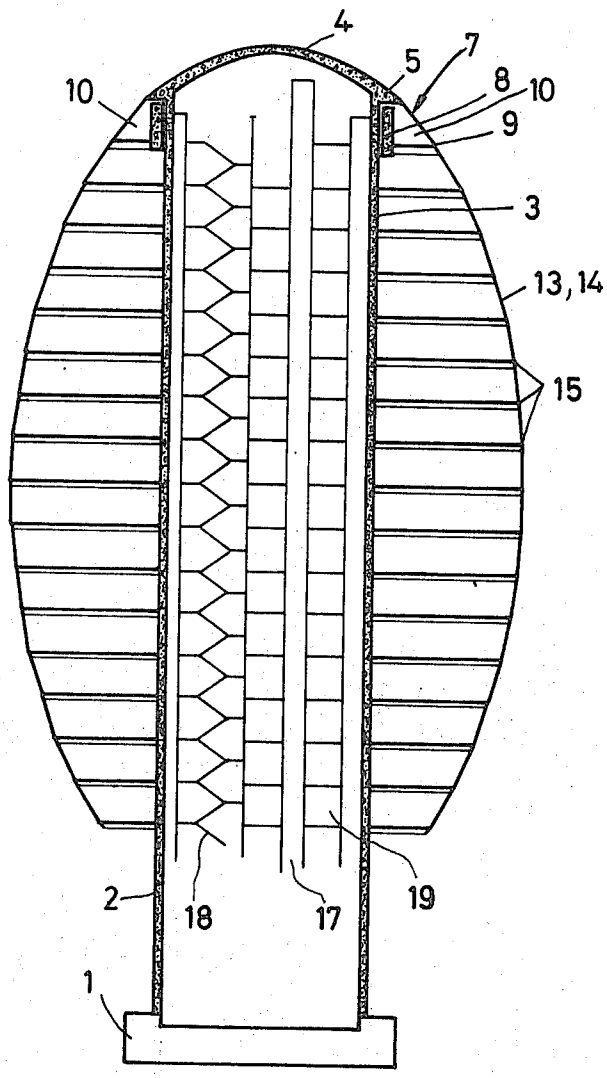
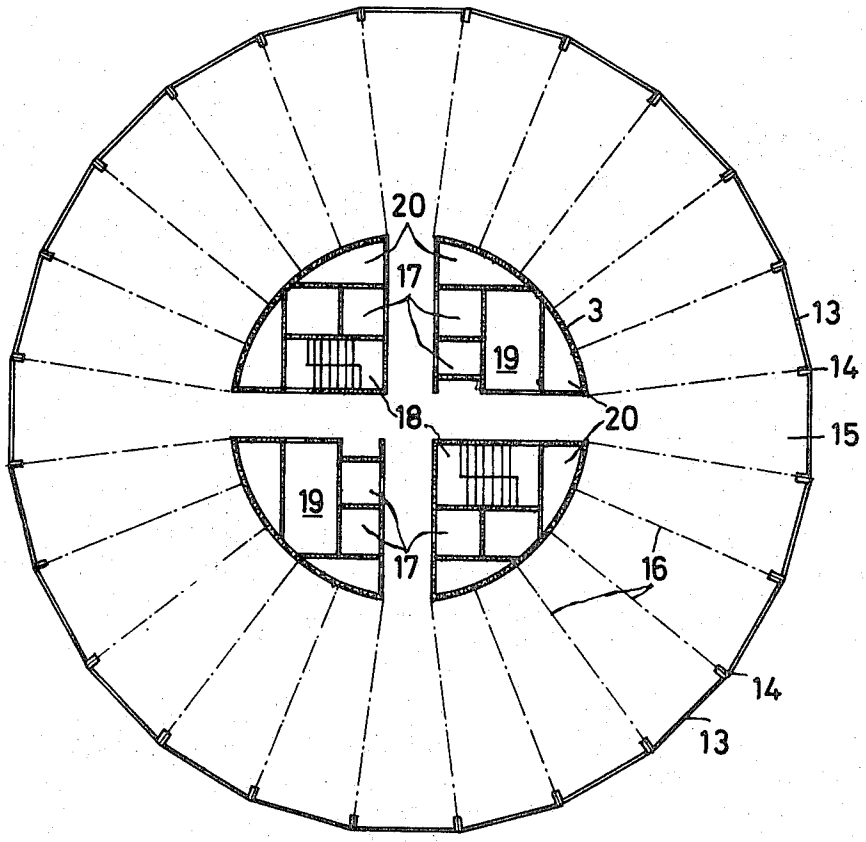


Fig.9



MULTI-STORY BUILDING AND METHOD OF CONSTRUCTION THEREFOR

The invention relates to the construction of multi-story buildings. More in particular the invention is concerned with a multi-story building having a central column made of reinforced concrete, at the upper end of which the story ceilings surrounding the column are suspended by means of suspension members, as well as to a method for producing a multi-story bulding of this type.

Multi-story buildings of this type are referred to as "suspension buildings." They differ from other buildings in that the leads are not introduced directly into the foundation but are first introduced in opposite direction upwardly, are collected there, conducted to a concrete column, and are then summarily applied to the foundation of this column. Statically such a building involves a composite system where the load is absorbed on the one hand by the suspension construction that is subjected to tension, and on the other hand by the concrete column which is subjected to pressure. Nevertheless this system has advantages, and this on the one hand, because the expenditures for suspensions are lower than those for supports that are subjected to pressure, where it is necessary to consider the danger of buckling because the column is prestressed by loads introduced at the upper end, so that the expenditure of steel for the armoring against wind or pressure loads becomes smaller, and because by virtue of a common foundation the effects of any possible irregular settling of individual foundations on the building structure are precluded, which is of importance especially in connection with mountain slide or earthquake areas.

Suspension buildings of this type are subject to the shortcoming that they were mostly constructed in cylindrical form, so that the heavy loads of the story ceilings had to be introduced by way of the suspension members by diversion into the head of the column. For this purpose relatively expensive structural features in the form of frame or lattice work, contilever beams, etc., are required, to which the suspension members must be connected in a more or less advantageous manner.

It is an object of the invention to provide a form of construction for such a suspension building where the problem, particularly the anchoring of the suspension members and the introduction of the forces into the upper part of the column, is solved in a statically and structurally advantageous manner.

In accordance with the invention the problem is solved in that the multi-story building has an outer shell which expands from the upper end of the shaft downwardly, within which the suspension members extend that are anchored at the upper end of the column.

Suitably the building is in the form of a rotational solid where the rotational body suitably has a continually curved generatrix. The suspension members which extend in the outer shell are suitably anchored at their upper ends in a carrier ring that encompasses the column. The column proper may be closed at its upper end by a dome that has a border carrier or support that extends beyond the shaft.

The carrier ring is suitably anchored in the border carrier by vertical tension members. The carrier ring proper consists advantageously of a cylindrical support and an annular plate disposed at its lower end. Between the carrier and the plate, triangularly shaped disks may be provided for stiffening, in which the suspension members which extend into the outer shell are anchored.

The advantage of the construction of such a multi-story building in accordance with the invention resides in the first place in that the suspension members, which extend from the upper end of the column into the outer shell that expands downwardly, converge at the upper end of the column and there can be anchored directly in the area of the column without it being necessary to provide expensive diverting structures. This type of anchoring of the suspension members, respectively the suspension of the building, necessarily results in a downwardly expanding cross-section of the building, which suitably is in the form of a rotational body. In this connection a shape approaching that of an egg is of particular advantage. This has a series of operational advantages that favorably affect the utilization of the building. Thus, the story work areas of each story are free of obstructive supports or columns, which improves the use of the spaces. Stories are formed having different space depths and differing dimensions of the window axes, which may be adapted particularly well to the requirements of an administration building. Thus, for example, the administration requires normal space depths which are present in the upper stories, while the employees working at drawing or writing desks in large office rooms must have at their disposal greater space depths and differing window distances.

The shape of a rotational body is also advantageous due to particularly favorable streamlining, whereby the loads on the column and the foundation are reduced as compared to known structures.

The special form of the suspension building in accordance with the invention provides furthermore a particularly advantageous possibility of construction which resides in that after the raising of the column to the structural height above the ground level, first the supporting ring and then one after another the story ceilings are produced, which on the one hand are suspended in suspension members disposed in the outer shell and, on the other hand, at inner suspension members, and that the building part thus formed is pulled up during construction of the story ceilings by means of tension members anchored on the one hand on the carrier ring and on the other hand on the border support at the upper end of the column. Upon reaching the end position the story ceilings are connected with the column and the structural features of the inner suspension members are completed.

The particular advantage of the method resides in that due to the outer shape of the multi-story building the loads of the part of the building disposed outside the column are concentrated in a supporting ring at the top thereof which can be suspended on tension members which are conducted upwardly in the immediate area of the column without considerable lateral cantilevering and can be anchored at the head of the column in the border support orcarrier. This supporting ring is pulled up with the outer building part that is under construction in the manner of a sleeve along the column, and which is anchored at the upper end of the column after completion of the lowermost story ceiling.

Further details and advantages of the invention are explained hereinafter in greater detail with reference to the embodiment illustrated in the drawings, in which

FIGS. 1 to 7 show a number of different structural conditions during the construction of a multi-story building,

FIG. 8 is a longitudinal section and

FIG. 9 is a horizontal section of the multi-story building.

In constructing a multi-story building in accordance with the invention the column foundation 1 having an extension 2 of the column is first established in the foundation pit (FIG. 1). Then the column is built up to the required height (FIG. 2), for which purpose the known manner of sliding construction is utilized. At the same time the elevator installations 16 and stairways 17, as well as further built-in facilities, can be constructed inside the column 3.

After completion of the column 3 the closure is built at its top, which in the embodiment illustrated comprises a dome shell 4 having a border support 5 that extends beyond the outer diameter of the column 3.

After filling in the foundation pit and construction of a suitable armoring 6, the supporting ring 7 can simultaneously be built at the lower end of the column 3 (FIG. 3). The supporting ring 7 is in the form of a cylindrical carrier 8 which encompasses the column 3, and has an annular plate 9 at its lower end, and they are stiffened by radial disks 10 of substantially triangular shape. The tension members 11 are anchored on the cylindrical carrier 8 by means of which after completion the supporting ring 7 is pulled up by amounts corresponding to the height of one story. The forces required for this are introduced at the top of the column 3 where the tension members 11 are anchored in the border support 5. This frees the armoring 6 again so that on it the ceiling which constitutes the floor for the uppermost story can be built.

The story ceilings and thereby the entire outer part of the building are supported on the one hand by suspension members 12 which are likewise anchored in the cylindrical carrier 8 in extensions of the tension members 11, and on the other hand by outer suspension members 13 which are anchored in radial reinforcements 10 and located in the outer shell of the suspension building. The story ceilings 15 are thus supported during the building process on the outer and inner borders, but independently of the column 3 (FIGS. 4 to 6).

Upon reaching the highest position of the outer building part and after continuous shortening of the tension members 11, the cylindrical carrier 8 is disposed immediately below the border support 5 in which the ends of the tension members 11 can be anchored. In this condition the story ceilings 15, which are suitably constructed as rib ceilings of steel or reinforced concrete having radially extending ribs (in FIG. 9 only the axes of the ribs 16 are shown), are anchored in the wall of the column 3, so that the inner suspension members 12 can be rigged out. The placing of the story ceilings 15 in the wall of the column 3 is suitably effected in a manner that the radial ribs are extended in the direction of the column and placed into recesses or perforations that have been provided therein. At the outer border the story ceilings 15 are suspended on the outer suspension members 14 which are located in the outer shell 13 of the structure, and consequently they do not appear in an unattractive manner.

Within the column 3 the elevator facilities 17, stairways 18, as well as WC installations 19 are accommodated. In the remaining spaces 20 that are substantially triangular, the air-conditioning equipment or the like can be installed.

Having now described our invention with reference to the embodiment illustrated in the drawings, what we desire to protect by letters patent of the United States is set forth in the appended claims.

We claim:

1. Method for constructing a multi-story building comprising the steps of erecting on a foundation a column rising above the level of the building site, providing a border support at the upper end of said column and a supporting ring around the lower end of said column, installing inner suspension members around said column between said border support and said supporting ring, constructing a story ceiling on said supporting ring, providing an outer shell connected to the upper end of said supporting ring, securing the outer periphery of said story ceiling to said shell and pulling the completed story ceiling while supported on said border support upwardly by an amount corresponding to the height of one story and continuing the method of constructing story ceilings and pulling them upwardly until the desired number of story ceilings is installed around said column.

2. Method in accordance with claim 1, where upon reaching final positions said story ceilings are connected to said column and said inner suspension members are rigged out.

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