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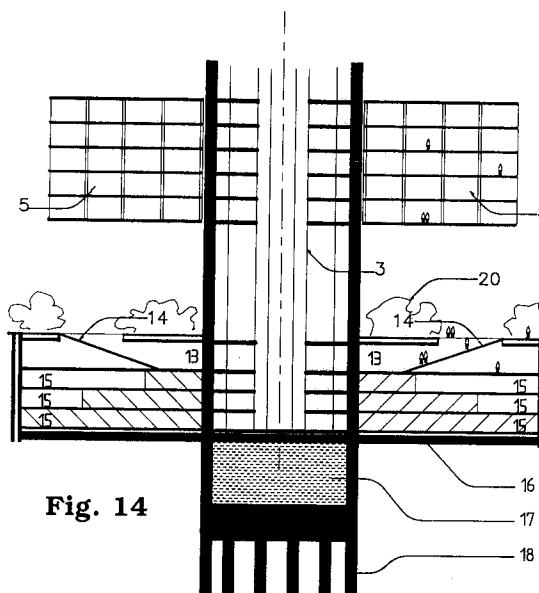
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(54) **Building and its construction method.**

(57) A high-rise building comprises several vertical supports, made of cells corresponding to the floors, on its foundation. The ground floor is dedicated to pre-fabrication of level units (5) comprising five floors each, which are lifted to intermediate or final position by monkey-climbers. The construction process can co-exist with normal activity of already-lifted floors, or can be interrupted if needed, and be resumed later, e.g. after the end of an economic slump. Access to the building and floors is made through the basement (13,24) and the supports (3).

**Fig. 14****EP 0 550 780 A1**

The present invention relates to a high-rise building according to the preamble of claim 1 and the method of its construction.

Methods for constructing high-rise buildings have been developed to improve the process and particularly to avoid costly and dangerous scaffolding as in traditional construction methods.

Using the technology known for building telecommunication towers, some of these methods take advantage of the mechanical characteristics of a central, vertical support secured to ground-level, horizontal foundation parts.

These foundation parts are broad and massive enough to give the building its stability vis-à-vis geoclimatic hazards. They are used during the building process to construct the floors one at a time on the ground level, taking advantage of a safe, one-level, more efficient environment as opposed to using other methods involving the more dangerous and costly scaffolding.

When a floor is finished, sometimes to the point of being ready for utilization, it is lifted along the vertical support with an appropriate known elevating system to its final level, where it is permanently secured to the central support. Such building and erecting methods are described e.g. in Soviet Inventor's Certificate No. 853031, in European Patent No. 0 244 158, in DE 27 43 390, or in GB 1 476 417.

The above methods, however, find their limits in the mechanical strength that one vertical support can provide, especially when the building is still under construction. This is also the case, to a lesser degree, when the building is finished, with all the floors in place.

During construction, specific problems may temporarily arise: due to the sequential character of the construction

of the floors, in order to reduce the cost and duration of the floor-elevating process, the builder will have the tendency to limit the number of elevating operations to a minimum, which results in an initial, temporary accumulation of highest-level floors at the top of the vertical support. This can lead to hazards in cases where geoclimatic conditions are quickly changing or tend to be extreme: a building that is in the middle of its construction process is particularly vulnerable to e.g. an unexpected storm because it is temporarily top-heavy.

The floors once in place also have a stabilizing function in the general case where their peripheric faces, made by their outer walls, are in contact, thus forming the external envelope of a pillar of a larger diameter than the original vertical support. The above is true only when the building is finished. During the construction steps where only upper-level floors are in place, the building's resistance to winds and other hazards is dependent

principally on the vertical support's mechanical strength.

This can also be an additional source of risk during the construction process because such a half-constructed building presents weak points in the part of the vertical support not reinforced by attached floors.

Even if appropriate solutions are chosen to protect the building from the above hazards during the construction process, the stability and the long-term security of the building's users will be largely determined by the strength of the vertical support and, to an extent, of the floors' faces.

The present invention eliminates the above disadvantages by the means described in claim 1.

A major advantage of the invention is that, by using two or more support elements, the enlargement of the horizontal dimensions of the building is possible. This also increases its solidity and resistance. It also allows to construct higher buildings, with a larger number of floors that can also be of bigger height, and more generally allows to use more efficiently the available space and surface while preserving the aesthetic environment more easily.

In a particular embodiment of the invention, the vertical supports will be made of cells, giving the vertical support a vertebra-like structure. The dimensions of the cells can be chosen in such a way that each floor corresponds to a cell in each vertical support.

In a particular embodiment of the invention, the proper positioning of the vertical supports on the foundation parts can contribute to increase the aerodynamic stability of the building in the direction of the steadiest or strongest winds blowing in the given area.

If a plurality of vertical supports are used, they do not have to be in the interior of the floor surface, but can provide support at the floor periphery. This can be a major advantage from the point of view of design flexibility, distribution of functions, static and dynamic properties of the building, particularly in the construction phase.

The stability of the building can also be improved by an appropriate lifting sequence of the floors as they are constructed: lifting a floor or a group of floors to an intermediate position allows to maintain some adequate distribution of weights and prevents the building to be top-heavy.

The vertical supports can be built in a known manner, e.g. by a classical slip forming method and can conveniently contain stairs, elevators, fluids supply and evacuation means like air-conditioning, water, gases, energy sources or communication means adapted to the uses of the building and floors. More generally, they can implement different kinds of logistic functions between the

floors and the outside of the building that cannot be performed through the faces of the floors. These functions can be shared between the vertical supports. The choice of functions will be influenced by various considerations, e.g. security or economical considerations: water separated from electricity, gas separated from everything else, air-conditioning separated from hot water.

The cells can have a distribution function from the vertical support to the corresponding floors, with regard to the above-mentioned logistic means.

In a particular embodiment of the invention, the ground level is dedicated to an assembly line used for pre-fabricating and assembling of the floors to be lifted, while the access to the floors already assembled, lifted and in use is made through access ways in the basement even while the construction of further floors goes on. The ground level installations can comprise various known means of optimizing logistics of the assembling and mounting operations, including a railway ring for adequate transportation of materials or semi-finished products on the ground floor, and more generally the elements of an assembly line.

A major advantage of this particular embodiment of the invention resides in the extensive cost savings allowed; this is particularly true for costs incurred in traditional construction of sky-scrapers, where the workers have to be transported to the floors to perform their work: this leads to tight safety requirements and related costs, as well as time lost in transportation. It also allows the workers to operate in a more attractive environment and eliminates the problem of dwindling-related hazards.

A further advantage of this embodiment is to allow a high degree of flexibility in the construction process: as the ground floor is dedicated to pre-fabrication and assembling operations, while the people and goods enter and leave the already-lifted floors through the support elements and access ways on the basement level, no interference exists between normal use of the already-lifted floors and the on-going construction process. This allows not only to finance part of the construction by the profits of the activity of the floors already in use, but even, if the economic situation gets bad, to stop the construction for an adapted time period, without any harm to the existing activities. This advantage has a very important and positive impact on the financial data within which the construction activity has to take place.

In a particular embodiment of the invention, the active areas of the ground level are protected, during the assembling and pre-fabricating operations, by a temporary structure that is designed to protect the workers of the assembly line from climatic hazards, particularly if construction takes

place in extreme climatic conditions. This structure can also be useful to protect some semi-finished products or chemicals used in the assembling and pre-fabricating process, and that can be spoiled by excessive humidity or temperatures.

A major advantage of this protecting structure is that the assembling and pre-fabricating process can benefit, as needed, of all the advantages of a workshop or plant environment, as opposed to a traditional open-air construction process that is dependent on weather conditions.

In a particular embodiment of the invention, the floors are grouped in level units. These units are assembled and lifted along the vertical structure jointly. The size of one unit can be chosen taking into account the optimal size of the commercially available logistic means, for instance: water pumps or reservoirs, garbage disposal equipment, centralized vacuum cleaner engines, elevators systems, phone switchboards or Value-Added Network type of equipment, supporting modern features of intelligent buildings but primarily as a compromise between ease of assembly and ease of lifting.

In a particular embodiment of the invention, the mentioned pre-fabrication and assembling process, taking place on the ground floor while, optionally, some other floors are already assembled, lifted and in use, can be adapted to construct several floors at a time into one level unit, which is then ready to be lifted and put in use.

In a particular embodiment of the invention, the top floor of one level unit will be the broadest floor of the unit and the bottom floor the narrowest, giving to the level unit the shape of a cup. This will allow to use the top level of a unit as a platform with specific uses.

Other advantages of the invention will become apparent with reference to the accompanying drawings, in which:

- figure 1 represents an elevation of a known tower with one support;
- figure 2 represents a top view of a cell as part of a round-shaped support as depicted in the building of figure 1.
- figure 3 is a schematic elevation of a building comprising four support elements, according to the present invention.
- figure 4 is a plane view of another embodiment of the invention.
- figure 5 represents a schematic, perspective view of a building under construction according to the invention, with two support elements;
- figure 6 represents a schematic, perspective view of an alternate embodiment of a building under construction according to the invention, with two support elements;

- figure 7 represents a schematic, perspective view of an alternate embodiment of a building under construction according to the invention, with three round-shaped support elements;
- figure 8 represents a schematic, perspective view of a building under construction according to the invention, with four support elements;
- figure 9 represents a schematic, perspective view of an alternate embodiment of a building under construction according to the invention, with four support elements;
- figure 10 represents a schematic, perspective view of a building under construction according to the invention, with five support elements;
- figure 11 represents a schematic, perspective view of a building under construction according to the invention, with six support elements;
- figure 12 represents a schematic, perspective view of a building under construction according to the invention, with seven support elements;
- figure 13 is a detailed view of a part of another embodiment of a cell, different from figure 2, showing steel rods around the vertical support.
- figure 14 represents an elevated cross-section of the foundation parts of a building in an intermediate step of its construction.

Figure 1 shows a known structure comprising one support 3, with floors 1 grouped in four units 2, of different sizes, around this single support 3, in a finished and functioning state.

Figure 2 is a plane view of an example of a call of a round support of figure 9, accommodating various logistic functions in a known manner for the corresponding floor.

Figure 3 is an elevation of a building, comprising four support elements, and constructed on a ground that is firm enough, so that piles are unnecessary. Figure 4 is a plane view of another embodiment of the invention with six support elements, one being central and the others being peripheric, supporting floors in a flower-like pattern, the petals of the flower being of various size. Each petal is supported not only by the central support, but also by distributed support elements 3.

In figures 5 through 12, buildings according to the invention are represented at an intermediate step of the construction, where only a top level unit 4 of six floors is put in its definitive place in the structure. A group 5 of floors is represented in an intermediate, non-definitive position with the aim to serve as a spacer between the support elements 6, 7, 8, 9, 10, 11, 12.

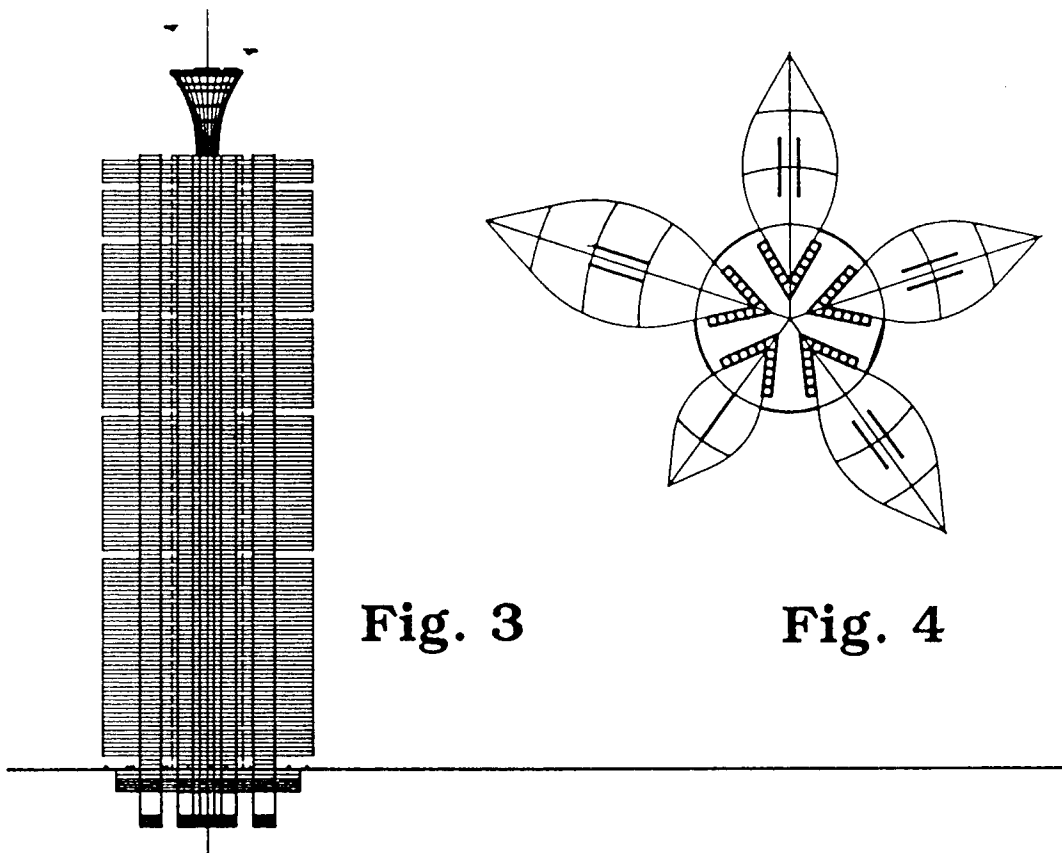
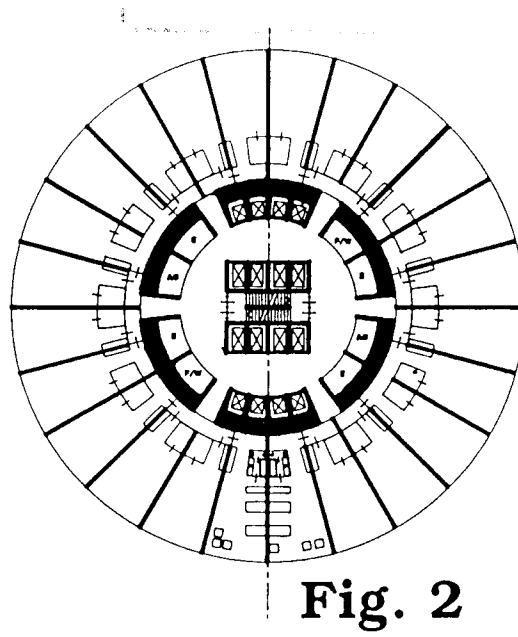
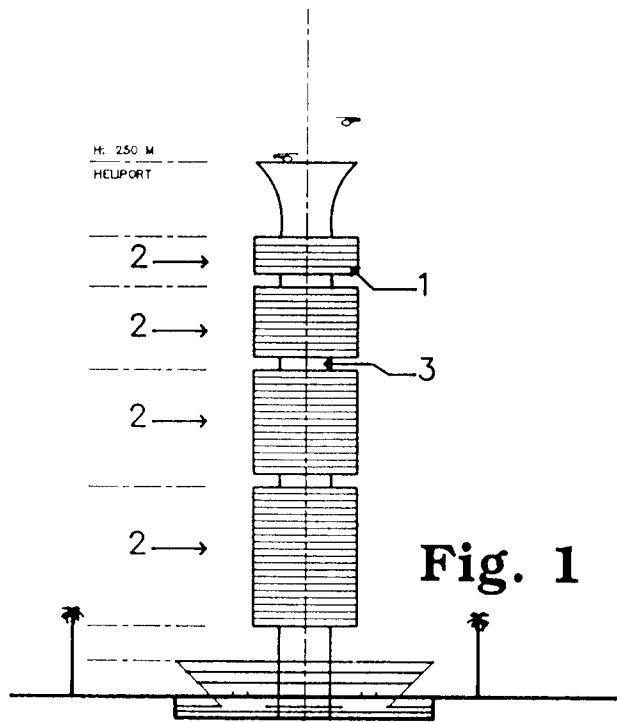
Figure 13 is a detailed view of figure 10, showing a round support with steel rods 19 on its periphery, designed to operate monkey climbers.

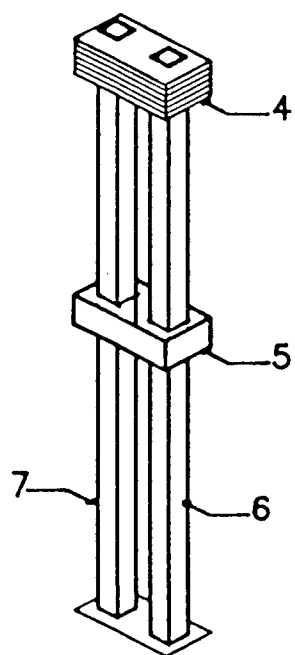
Figure 14 is an elevated cross-section of the foundation parts of a building partially constructed, with a unit 5 of five active floors that have previously been pre-fabricated, assembled, lifted and secured to the support 3. The ground level is kept free, with some decorative plants or shrubs 20 on the lawn, available for later re-installment of the assembly line to allow construction of additional floors as needed. The entrances 13 of the building are situated under the ground level on an entrance level, communicating with the ground level by a slope 14 opening to the outside ways of communication like streets, etc. situated on the ground floor, but away from the support and the surrounding ground floor that is dedicated to the assembly line. The purpose is to leave a good part of the ground floor area free for assembly of additional floors by the assembly line. Other underground floors comprise parking levels 15 and a concrete mat 16. A water tank 17 is accommodated in the support, which is prolonged by stabilizing piles 18 if the ground is not firm enough to support the height of the building.

## Claims

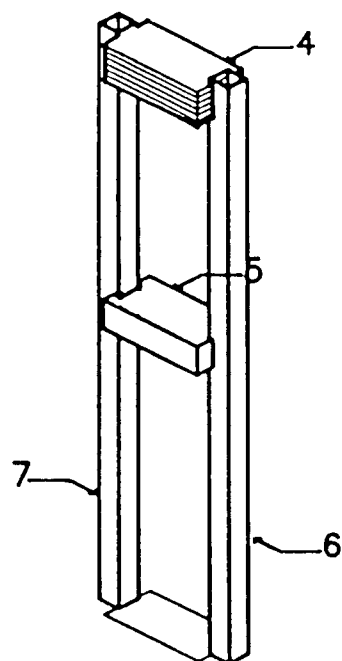
1. A building comprising foundation parts, a vertical structure and a plurality of floors movable along and securable to the vertical structure, characterized in that the vertical structure comprises a plurality of spaced-apart vertical supports (3, 6, 7, 8, 9, 10, 11, 12) secured to the foundation parts.
2. A building according to claim 1, characterized in that the vertical supports (3, 6, 7, 8, 9, 10, 11, 12) are made of cells which correspond to one or more floors.
3. A building according to claim 1, characterized in that some of the vertical supports are located at the periphery of the building.
4. A method for construction of a building according to claim 1, comprising the steps of building foundation parts, a vertical structure comprising a plurality of vertical supports secured to the foundation parts, and a plurality of floors, characterized in that the floors are first pre-fabricated and assembled in an assembly line on the ground level immediately above the foundation parts, and then lifted along the vertical structure.

5. A method for construction of a building according to claim 4, characterized in that at least one floor is first lifted and secured to an intermediate position during construction before being lifted and secured to its final position. 5
  6. A method for construction of a building according to claim 4, characterized in that a plurality of floors are constructed and lifted simultaneously in the form of level units. 10
  7. A method for construction of a building according to claim 5, characterized in that the level units comprise five floors. 15
  8. A method for construction of a building according to claim 4, characterized in that logistic functions are shared between the vertical supports. 20
  9. A method for construction of a building according to claim 4, characterized in that a temporary structure is set up to protect the assembly line from climatic hazards. 25
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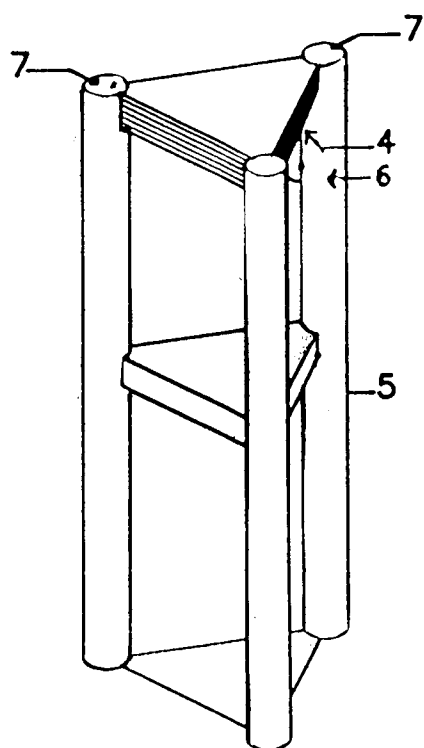




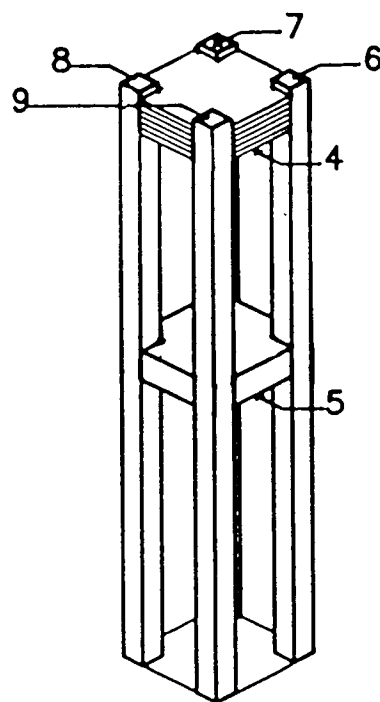
**Fig. 5**



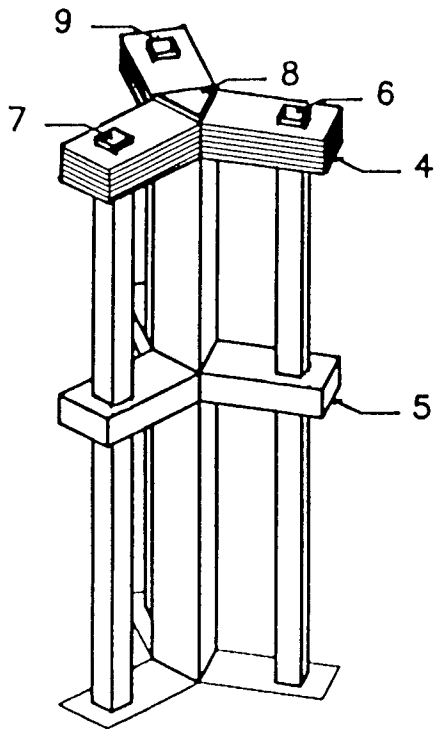
**Fig. 6**



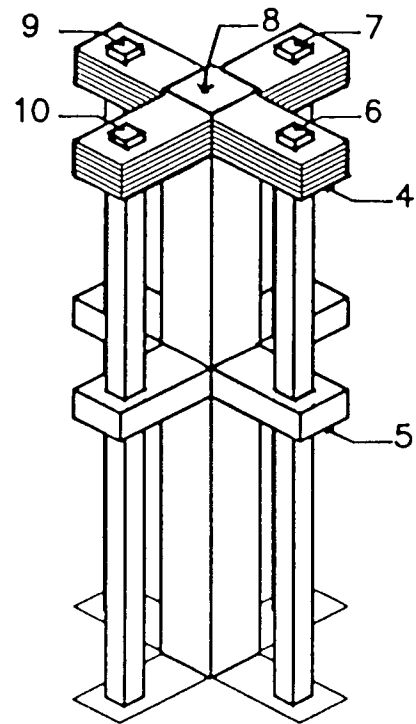
**Fig. 7**



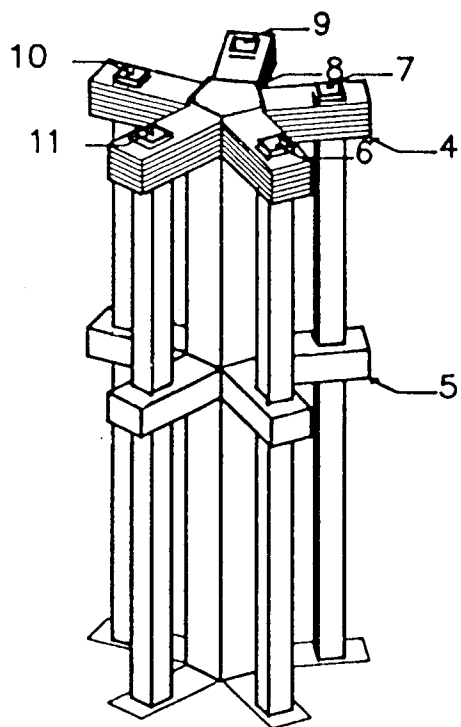
**Fig. 8**



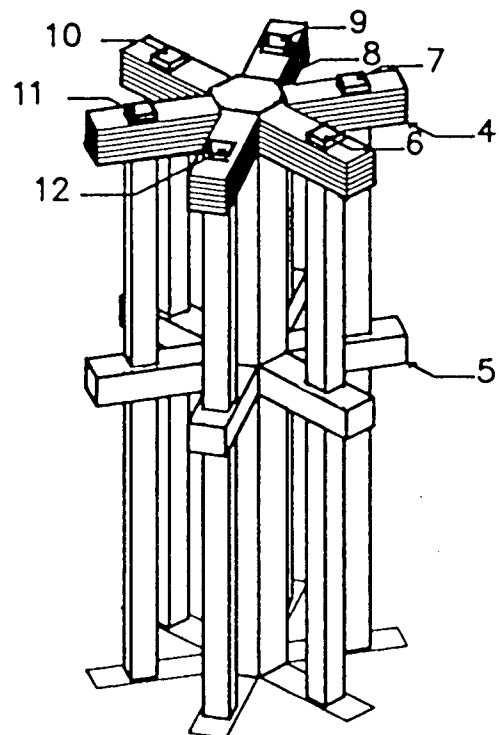
**Fig. 9**



**Fig. 10**



**Fig. 11**



**Fig. 12**

Fig. 13

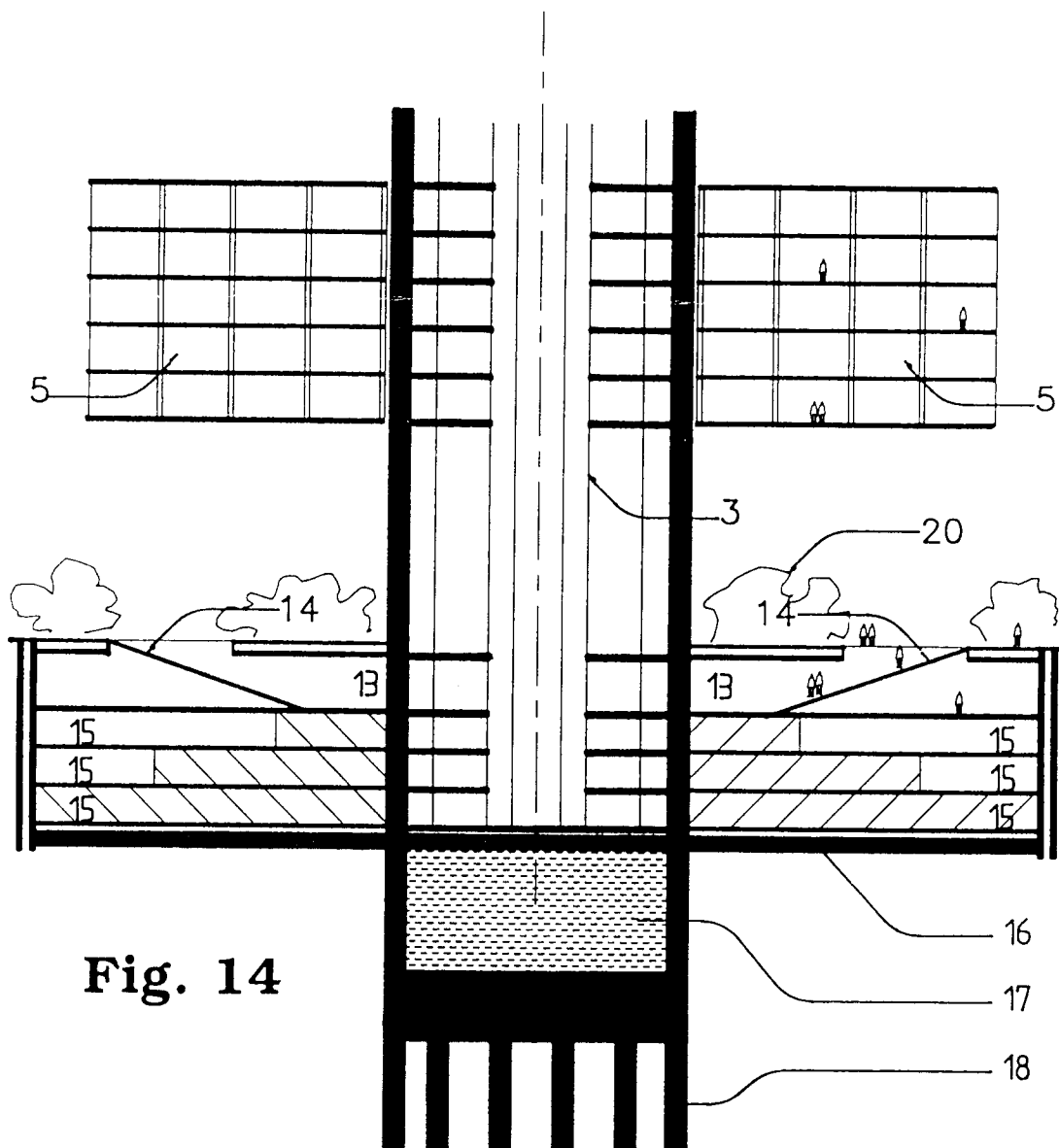
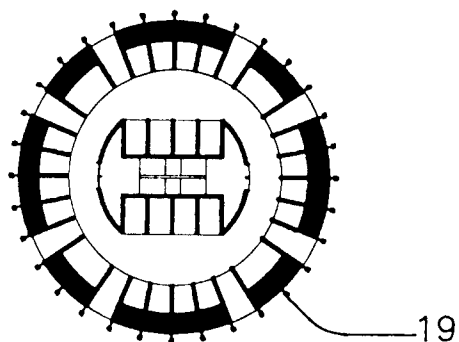


Fig. 14



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## EUROPEAN SEARCH REPORT

Application Number

EP 92 10 0217

### DOCUMENTS CONSIDERED TO BE RELEVANT

| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate,<br>of relevant passages | Relevant<br>to claim                                  | CLASSIFICATION OF THE<br>APPLICATION (Int. Cl.5) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------|
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FR-A-2 219 282 (DZIEWOLSKI)<br>* the whole document *<br>---                     | 1-4, 8                                                | E04B 1/35                                        |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CH-A-519 635 (LJUNG)<br>* claims 1-3; figures 1,2 *<br>---                       | 1, 3, 4                                               |                                                  |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FR-E-74 311 (DUBOIS)<br>* the whole document *<br>-----                          | 1, 4, 8                                               |                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                  |                                                       | TECHNICAL FIELDS<br>SEARCHED (Int. Cl.5)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                  |                                                       | E04B                                             |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                  |                                                       |                                                  |
| Place of search<br>BERLIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                  | Date of completion of the search<br>17 SEPTEMBER 1992 | Examiner<br>PIEPER C.                            |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                                                                  |                                                       |                                                  |