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(54) **CONSTRUCTION METHOD FOR CONSTRUCTING TOWERS**

(57) The present invention relates to a construction method for constructing towers, posts, columns, or the like, which method comprises:

preparing foundations (1);
installing pillars (2) in the foundations (1);
fixing to the pillars (2) profiles (4) defining the tower (3);
such that
the foundations (1) are oversized and comprise respective additional pillars (2') located close to each pillar (2) and configured for receiving adjacent reinforcement profiles (4') fixed to the profiles (4). Embedded parts (5) can optionally be installed for the later arrangement of the additional pillars (2').

The profiles (4) preferably comprise coupling points (6) configured for fixing the adjacent profiles (4').

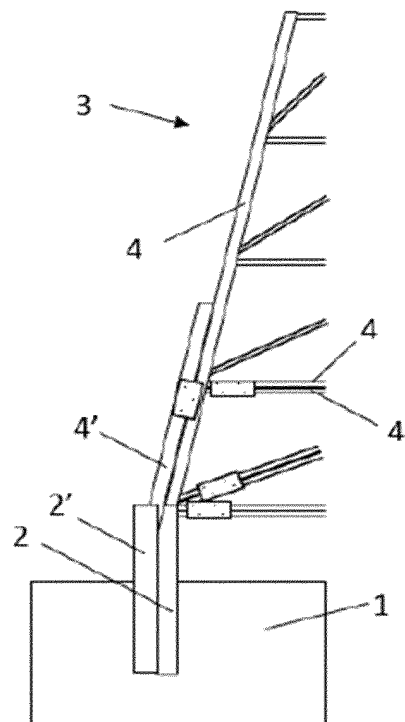


Fig. 1 **B**

Description

TECHNICAL FIELD

[0001] The present invention relates to a construction method for constructing towers, columns, and other vertical bearing devices. It is designed to facilitate refurbishing and updating the bearing capacity of towers, columns, and posts, particularly of lattice towers, columns, and posts.

[0002] It can be applied in the industry for building and installing communications equipment.

STATE OF THE ART

[0003] Over the years, high-rise infrastructures, such as towers, columns or posts (hereinafter simply "tower"), for example telecommunications towers, have been a basic necessity for raising system equipment up in height. The towers are designed under two possible criteria. The first criterion includes calculating the loads and conditions at that moment, and the second criterion includes oversizing the tower from the start.

[0004] In the first case, the initial cost is low, but the evolution of needs has meant that it may be necessary to modify the capacity. In that case, it costs time and resources to reinforce the tower, even more than the initial construction does. The tower may even be rendered useless for an extended time, which may exceed two weeks, according to tower dimensions. Furthermore, the operations for a new foundation work next to the old foundation can cause damage to same or cause unwanted movements of the tower.

[0005] For example, for the purpose of increasing the bearing capacity in a lattice tower the profiles are replaced or duplicated, resulting in a structure with a much larger area for absorbing stress, and therefore having a higher bearing capacity. To that end, the foundation must be enlarged, assuring that the behavior is consistent with the behavior of the previous foundation. Then reinforcement profiles are adhered, for example by means of riveting or screwing, to the already existing profiles. This work is done by hand, by drilling or arranging coupling points in the profiles one by one. Therefore, the work lasts for several weeks or months, during which time the equipment can be shut down (due to problems relating to operator exposure to radiation, for example).

[0006] In many cases there are situations in which the need for reinforcement means that the tower is oversized after being reinforced. In other words, need for reinforcement "compels" making an investment, but one, however, which allows a bearing capacity that may never be needed.

[0007] In the second case, the design that is provided is far superior to current needs. The fundamental problem lies in the need to make a high initial investment without being able to know the future need. The tower may require being enlarged, may be sufficient with the already

installed capacity, or may increase the capacity without needing to modify tower dimensions resulting from the breakthroughs made by technology. Therefore, this second case may comprise a completely unnecessary expenditure of resources and time.

[0008] The objective of the invention is to provide a tower construction method which allows for versatility (flexibility) in adapting the tower to current needs, such that neither huge investments nor service shutdowns are required.

BRIEF DESCRIPTION OF THE INVENTION

[0009] The invention consists of a construction method which facilitates modifying and refurbishing towers, posts, and the like. The claims show the preferred embodiments which solve the aforementioned problems.

[0010] The invention particularly relates to a construction method for constructing towers, posts, columns, or the like based on the known method of preparing foundations, installing pillars therein, and fixing a series of profiles to the pillars to define the tower. The novel aspect is that these foundations are oversized and comprise respective additional pillars which are arranged close to each pillar. These additional pillars are configured for receiving adjacent reinforcement profiles fixed to the profiles which, however, are not arranged until reinforcement of the structure is required. If desired, the additional pillars can be replaced with embedded parts, with or without a cover, in the foundations, which parts are indeed configured for fixing the additional pillars.

[0011] The profiles preferably comprise coupling points configured for fixing the adjacent profiles.

[0012] The additional pillars or the embedded parts can be arranged on the outer side of the tower, on the inner side, or on both.

[0013] Other variants will be described in other parts of the specification.

DESCRIPTION OF THE DRAWINGS

[0014] To better understand the invention, the following figures are included.

Figure 1: schematic depiction of a tower in its original state (A) and in it reinforced state (B), according to the state of the art.

Figure 2: schematic depiction of a tower in its recently constructed original state and prior to starting the reinforcement thereof in two embodiments.

EMBODIMENTS OF THE INVENTION

[0015] An embodiment of the invention is very briefly described below as an illustrative and non-limiting example of said invention.

[0016] The construction method for constructing the

tower, post, column, etc. begins as it often does with the preparation of the foundations (1), which will have the pillars (2) of the tower (3) embedded therein. The profiles (4) defining the tower (3) will be arranged on these pillars, and the features of such profiles (4) will depend on the type of tower, post, or column.

[0017] In the case of the drawing which corresponds to the most preferred example, the profiles (4) are arranged in a vertical, transverse, and oblique manner to form the structure. In one post, the (generally cylindrical) profile will only be vertical. Other tower, post, or column designs are likewise possible.

[0018] The entire tower (3) is designed and constructed for a fixed bearing capacity which will correspond to the original needs. If it were necessary, the upper part of the tower (3) will have a wide safety margin in order to reduce high above-ground operations during reinforcement. In that sense, for example, only the lower segment of the tower (3) may be reinforced when the increase in capacity is lower. In contrast, the lower part may have a smaller margin as it can be readily reinforced.

[0019] Once the tower (3) is constructed, the known method for reinforcing it comprises enlarging the foundation, embedding additional pillars (2') therein, and coupling to several or all of the profiles (4) an adjacent profile (4'), attached by a bar, clamp, or other fixing device.

[0020] However, according to the invention, the method is performed in a first step in which the foundations (1) are oversized and comprise from the start the additional pillars (2') which, in this case, remain free and are not directly connected to any original profile (4) of the tower (3). It is possible, though less advisable, to replace the additional pillars (2') with an embedded part (5) where the additional pillars (2') will later be fixed when the capacity of the tower (3) is going to be increased. This embedded part (5) may have an inner thread, a space where there will be fixed by means of resin, concrete, or another method the lower part of the corresponding additional pillar (2') or another similar solution having the suitable strength. The embedded part (5) may have a cover for preventing dirt from getting into it and affecting the use thereof.

[0021] This first modification therefore provides an advantage, in that there is a lower risk of the ground moving when enlarging the foundations (1). Moreover, if the additional pillars (2') are arranged from the start, it is possible to arrange them in the most effective position, without having to risk damaging the initial pillars (2) as they are arranged close-by (which may involve drilling the initial foundations (1) in a position close to the initial pillars (2)).

[0022] In a simple tower (3), such as a post, this solution allows obtaining a sufficient advantage because the adjacent profiles (4') can be arranged in a sufficiently quick manner. However, in more complex towers (3), such as in lattice towers, adjacent profiles (4') must be placed parallel to all or part of the original profiles (4). Since the number can be high, it would be appropriate

to make this task easier.

[0023] Therefore, the profiles (4) arranged during the construction of the tower (3) will have from the start coupling points (6) where the adjacent profiles could be fixed in a quick manner. The exact position of the coupling points (6) will mainly depend on the length of the profiles (4) and the maximum bearing capacity for which the tower (3) is to be reinforced.

[0024] A first example of coupling points (6) will be by means of through boreholes for fixing a bar. This bar can be placed at the time of the original construction (Figure 2B) or when the tower (3) is reinforced (Figure 2A), and it can be placed towards the inside or towards the outside of the tower (3) or on both sides.

[0025] Each additional pillar (2') can, however, be connected from the start to a first adjacent profile (4') in order to be correctly attached to the tower (3) and assure that all the adjacent profiles (4') will later be perfectly aligned with the coupling points (6).

[0026] Reinforcement of the tower (3) is thereby simplified by reducing the necessary operations to the simple assembly of the adjacent profiles (4') at the coupling points (6).

Claims

1. A construction method for constructing towers, posts, columns, or the like, said method comprising:

preparing foundations (1);
installing pillars (2) in the foundations (1);
fixing to the pillars (2) profiles (4) defining the tower (3);

characterized in that

the foundations (1) are oversized and comprise respective additional pillars (2') located close to each pillar (2) and configured for receiving adjacent reinforcement profiles (4') fixed to the profiles (4).

2. The method according to claim 1, the profiles (4) of which comprise coupling points (6) configured for fixing the adjacent profiles (4').
3. The method according to claim 1, wherein the additional pillars (2') are replaced with embedded parts (5) in the foundations (1) configured for fixing the additional pillars (2').
4. The method according to claim 3, the embedded parts (5) of which have respective covers.
5. The method according to claim 1 or 4, having additional pillars (2') or embedded parts (5) both on the outer side and on the inner side of the tower (3).
6. The method according to claim 2, the additional pil-

lars (2') of which are fixed to a first adjacent profile (4') attached to a profile (4) by its coupling points (6).

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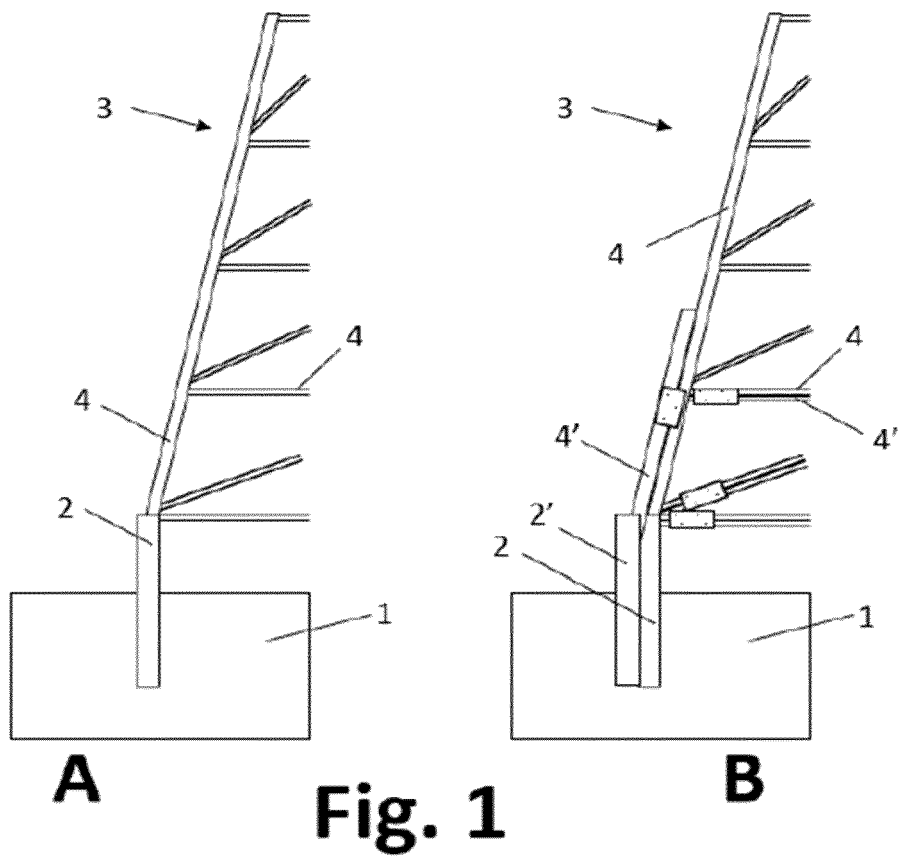
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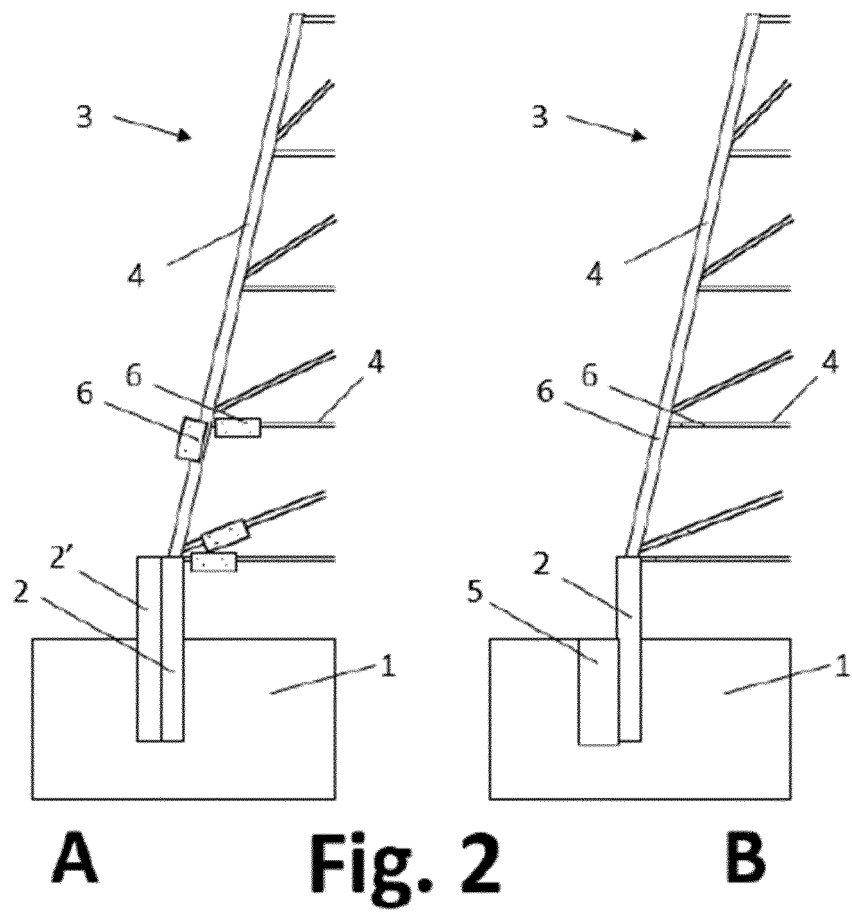
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Application Number
EP 19 38 2077

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 335 083 A1 (SAG ENERGIEVERSORGUNGSLOESUNG [DE]) 13 August 2003 (2003-08-13) * figures 1-5 * * paragraphs [0016] - [0018] *	1-6	INV. E04H12/10 E04H12/20 E04H12/22 E04G23/02
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A	WO 2009/156827 A1 (HEDINGER JOHAN [ZA]; NORTJE JOHANNES CORNELLUS [ZA]) 30 December 2009 (2009-12-30) * the whole document *	1-6	
			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 July 2019	Examiner Schnedler, Marlon
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 19 38 2077

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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