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DESCRIPTION

[0001] A corner connection, in particular for a wind turbine tower

[0002] The present invention relates to a corner connection, in particular for a wind turbine tower, connecting four adjacent tower segments by portions inwardly bent along a horizontal or vertical direction, whereby the lengths of the inwardly bent portions along the horizontal or vertical direction are alternated and two inwardly bent portions along the horizontal or vertical direction form a butt joint.

[0003] Wind turbine towers consisting of steel segments are well known. The segmentation may be horizontal and/or vertical relative to an erected tower. Common wind turbine towers comprise vertically segmented steel segments which are connected to adjacent steel segments. The connection of the segments to each other may be done in various ways, e. g. by bolted flange connections, bolted overlap connections and/or bolted splice plate connections.

[0004] Apart from the vertically segmented steel segments common wind turbine towers are further segmented by horizontally aligned connections substantially connecting a circular or polygonal shaped section on top of each other. The connection of the sections to each other may also be done in various ways, e. g. as bolted flange connections or bolted overlap connections.

[0005] A wind turbine tower according to the preamble of claim 1 is known from WO 2009/097858 A1. The wind turbine tower comprises several tower elements mounted on top of each other, each tower element has an outer surface and an inner surface, where the periphery of the tower element is made up of a number of segments preferably made of steel, the segments are provided with inwardly facing flanges at the longitudinal sides, where these flanges are connected to corresponding flanges on laterally arranged segments. The individual segments are made with an overlap on the outer surface at the transverse joints and with a butt joint at the inwardly facing flanges.

[0006] DE 10 2007 018 025 A1 discloses a wind turbine tower with tower sections being connected by splice plates.

[0007] Wind turbine towers of large wind turbines are influenced by huge forces occurring from the weight of the nacelle and rotor installed on the top of the tower and from the aerodynamic influence on the rotor which in turn is transferred to the tower. In a wind turbine tower constructed of steel segments which is divided into sections as previously discussed, large forces are transferred through the connections and especially at "corner" regions where adjacent segments and sections meet. A typical corner region comprises adjacent segments connected at vertical connections and adjacent sections connected at horizontal connections.

[0008] It is therefore an object of the present invention to provide a corner connection, in particular for a wind turbine tower, which ensures that forces are sufficiently transferred between connected tower segments.

[0009] According to the present invention this object is achieved in the above defined corner connection in that the portions are inwardly bent along the horizontal direction and the sections are overlapping vertically and at least one splice plate is connected to the butt joint.

[0010] The splice plate improves the load transfer at the corners of connected tower segments, which is a weak point in conventional wind turbine towers.

[0011] Due to the fact that the lengths of the inwardly bent portions along the horizontal or vertical direction are alternated a connection is achieved which is able to transfer the loads from one segment to an adjacent segment.

[0012] According to the invention the portions are inwardly bent along the horizontal direction and the sections are overlapping vertically.

[0013] In the inventive corner connection two inwardly bent portions along the horizontal or vertical direction form a butt joint. Preferably an inventive corner connection comprises two butt joints at displaced positions. The fact that the butt joints are spaced apart from each other reduces peak stresses.

[0014] In order to ensure a sufficient stiffness in the inventive corner connection it may be envisaged that bolted holes are provided near the butt joints. The bolted connections ensure a sufficient load transfer across the corner connection.

[0015] The inventive corner connection comprises at least one splice plate connected to the butt joint. The splice plate may be connected to the butt joint by bolted connections in order to improve the transfer of loads.

[0016] Even higher loads can be borne by the inventive corner connection when two splice plates are connected to the butt joint, one on each side.

[0017] Further the invention relates to a wind turbine tower.

[0018] In the inventive wind turbine tower the segments are connected by corner connections as described.

[0019] The invention and its underlying principle will be better understood when consideration is given to the following detailed description of preferred embodiments.

[0020] In the accompanying drawings:

Fig. 1

is a detail of a segmented wind turbine tower;

Fig. 2

is a detail of a non-inventive corner connection;

Fig. 3

shows the corner connection of fig. 2 during installation;

Fig. 4

shows the corner connection of fig. 2 during installation; and

Fig. 5

is a detail of a corner connection.

[0021] Fig. 1 shows a detail of the lower part of a wind turbine tower 1 comprising segmented steel segments 2 which are connected to adjacent steel segments 2. The wind turbine tower 1 is further segmented by horizontally aligned connections 3 connecting circular or polygonal shaped sections on top of each other.

[0022] Fig. 2 shows a detail of a corner connection 4 by which four single steel segments 5, 6, 7, 8 are connected together. Each steel segment 5, 6, 7, 8 comprises an inwardly bent portion 9, 10, 11, 12 which is bent along the vertical direction. In the installed state the sections 5, 8 and 6, 7 are overlapping horizontally. An overlap connection is realized by holes 13 which are provided at the lower ends of steel segments 5, 6 and at the upper ends of steel segments 7, 8. Overlap portions are provided with holes 13, into which bolted connections are inserted.

[0023] Arrows 14 in fig. 2 indicate how the steel segments 5, 6, 7, 8 are engaged. As can be seen in fig. 2 the vertical lengths of the bent portions 9, 10 of the steel segments 5, 6 are alternated to allow an overlap. Similarly the bent portions 11, 12 of steel segments 7, 8 have alternated vertical lengths. On the other hand the bent portions 10, 11 of steel segments 6, 7, which are arranged on top of each other form a butt joint. Similarly the bent portions 9, 12 of steel segments 5, 8 form a butt joint. The two butt joints are at displaced positions.

[0024] Fig. 3 shows the corner connection 4 during installation. Steel segment 5 overlaps steel segment 8, steel segment 6 overlaps steel segment 7, the overlap connection is secured by bolts which are inserted through holes 13. Bent portions 9 to 12 are bent approximately 90 degrees with regard to the steel segments 5, 6, 7, 8. Bent portions 9, 12 form a first butt joint, bent portions 10, 11 form a second butt joint, both butt joints are vertically displaced from each other. In order to ensure that loads can be sufficiently transferred through the corner connection 4 through holes 20 are provided in the area of the butt joints. In fig. 3 only one through hole 20 is depicted, whereas plural through holes may be present.

[0025] In the schematic drawing of fig. 4 one can see that the butt joint consisting of bent portions 9, 12 and the butt joint consisting of bent portions 10, 11 are further connected by a bolted connection 15 across the butt joints.

[0026] Fig. 5 shows another embodiment of a corner connection 16 which is a further development of the corner connection 4 as depicted in fig. 2 to fig. 4. Corner connection 16 connects steel segments 5, 6, 7, 8 with bent portions 9, 10, 11, 12, whereby bent portions 9, 12 and 10, 11 each form butt joints which are displaced from each other in vertical direction. In order to further increase the stability of the corner connection 16 splice plates 17, 18 are used, which are positioned on either side of the butt

joints. Connection of the splice plates 17, 18 to the butt joints is realized by bolted connections 19, comprising bolts, washers and nuts. The increased stability of the corner connection 16 is effected by "diagonal" bent portions of steel segments, e. g. bent portions 9 and 11.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WC2009097858A1 [0005]
- DE102007018025A1 [0006]

P a t e n t k r a v

5 1. Hjørneforbindelse (4, 16), især til et vindmølletårn (1), hvilken hjørneforbindelse forbinder fire tilstødende tårnsegmenter (5, 6, 7, 8) ved hjælp af dele (9, 10, 11, 12), som er indadbøjet langs en horisontal eller vertikal retning, hvor længderne af de indadbøjede dele (9, 10, 11, 12) langs den horisontale eller vertikale retning er vekslende, og to indadbøjede dele (9, 10, 11, 12) langs den horisontale eller vertikale retning danner en stødforbindelse, **kendetegnet ved, at** delene (9, 10, 11, 12) er indadbøjet langs den horisontale retning, og sektionerne er vertikalt overlappende, og mindst en laskeplade (17, 18) er forbundet med stødforbindelsen.

15 2. Hjørneforbindelse ifølge et af de foregående krav, **kendetegnet ved, at** den omfatter to stødforbindelser i forskudte positioner.

3. Hjørneforbindelse ifølge krav 2, **kendetegnet ved, at** der er tilvejebragt bolthuller i nærheden af stødforbindelserne.

20 4. Hjørneforbindelse ifølge et af de foregående krav, **kendetegnet ved, at** der er forbundet to laskeplader (17, 18) med stødforbindelsen.

25 5. Hjørneforbindelse ifølge et af de foregående krav, **kendetegnet ved, at** den i det mindste ene laskeplade (17, 18) er forbundet med stødforbindelsen ved hjælp af boltforbindelser (19).

6. Hjørneforbindelse ifølge et af de foregående krav, **kendetegnet ved, at** segmenterne (5, 6, 7, 8) er fremstillet af stål.

30 7. Vindmølletårn, som består af en flerhed af forbundne segmenter (5, 6, 7, 8), **kendetegnet ved, at** segmenterne (5, 6, 7, 8) er forbundet ved hjælp af hjørneforbindelser (4, 16) ifølge et af kravene 1 til 6.

DRAWINGS

FIG 1

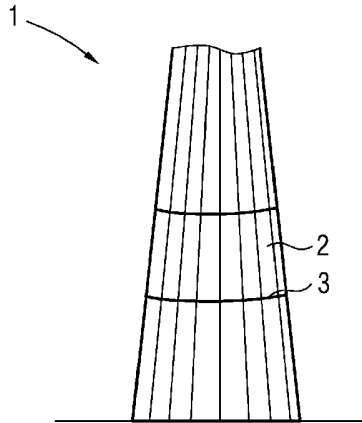


FIG 2

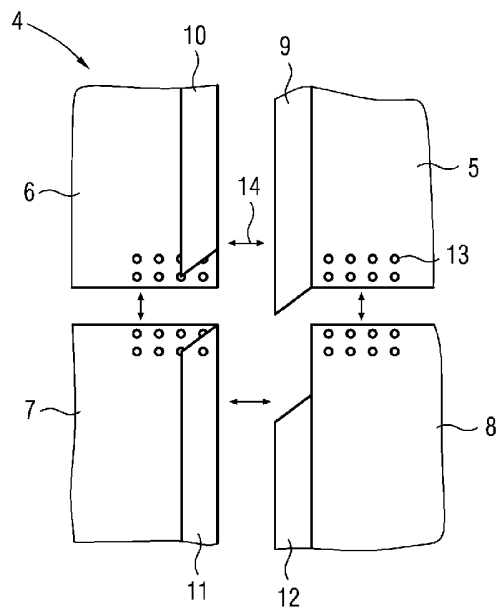


FIG 3

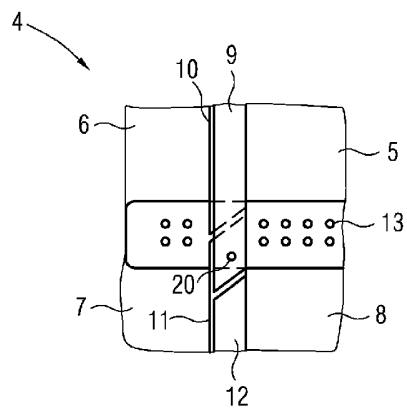


FIG 4

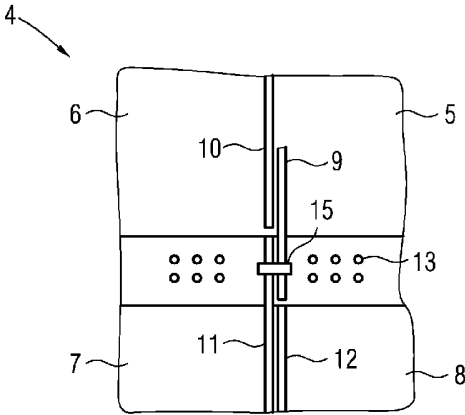


FIG 5

