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(54) TELESCOPIC CRANE BOOM SECTION, TELESCOPICALLY EXTENSIBLE CRANE BOOM AND HYDRAULIC CRANE

(57) A telescopic crane boom section having an elongated main body in the form of a straight tubular beam (30), which is formed by one single bent metal sheet and consists of wall portions (W1-W12) connected to each other via bending corners (33), wherein:
- a neutral layer (37) of the tubular beam extends across lateral wall portions (W1, W2) on either side of a vertical plane of symmetry (36) of the tubular beam;
- the tubular beam has planar upper and lower wall portions (W3, W8), which are perpendicular to the vertical plane of symmetry and connected to each one of said lateral wall portions via intermediate wall portions; and
- opposite longitudinal edges of the metal sheet are joined to each other by a welding joint (35) located at an upper or lower edge of one of said lateral wall portions.

The invention also relates to a crane boom and a crane comprising such a crane boom section.

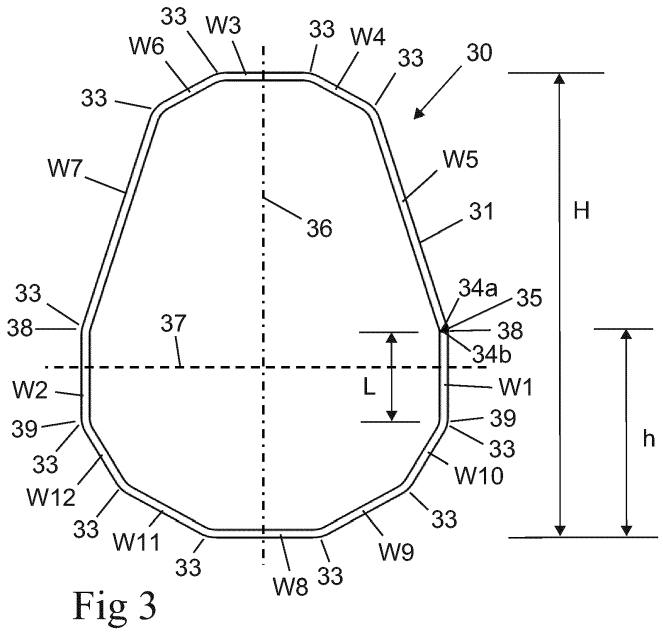

Fig 3

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Description

FIELD OF THE INVENTION AND PRIOR ART

[0001] The present invention relates to a telescopic crane boom section. The invention also relates to a telescopically extensible crane boom and a hydraulic crane.

[0002] An ordinary loader crane is provided with a crane boom system which normally comprises a first crane boom in the form of a so-called inner boom, which is articulately connected to a rotatable column of the crane, and a second crane boom in the form of a so-called outer boom, which is telescopically extensible and articulately connected to the inner boom. The outer boom comprises a hollow base section, through which the outer boom is articulately connected to the inner boom, and telescopic crane boom sections, which are hollow and carried by the base section. The telescopic crane boom sections are telescopically mounted to each other and displaceable in the longitudinal direction of the base section by means of hydraulic cylinders for adjustment of the extension length of the outer boom. In order to extend the reach of the crane, i.e. the possible range for the lifting operations, an additional crane boom, in the following referred to as a jib, may be detachably mounted to the outer end of the outer boom. Also the jib may be telescopically extensible and may comprise one or more telescopic crane boom sections of the above-mentioned type.

[0003] It is previously known to produce a telescopic crane boom section of the above-mentioned type from one single metal sheet, wherein the metal sheet is shaped by bending and opposite longitudinal edges of the metal sheet are joined to each other by a longitudinal welding joint in order to form a tubular beam. CA 2 697 304 A1 discloses a telescopic crane boom section produced in this manner, wherein CA 2 697 304 A1 teaches that a suitable location of the longitudinal welding joint is at the top or at the bottom of the crane boom section along the plane of symmetry.

SUMMARY OF THE INVENTION

[0004] The object of the present invention is to provide a telescopic crane boom section of a new and favourable design.

[0005] According to the invention, this object is achieved by means of a telescopic crane boom section having the features defined in claim 1.

[0006] The telescopic crane boom section of the present invention has an elongated main body in the form of a straight tubular beam that is formed by one single bent metal sheet and consists of several wall portions which are distributed about a longitudinal centre axis of the tubular beam and connected to each other via bending corners formed in the metal sheet, wherein:

- opposite longitudinal edges of the metal sheet are joined to each other by a welding joint extending in the longitudinal direction of the tubular beam;
- the tubular beam has a vertical plane of symmetry as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam;
- a neutral layer of the tubular beam extends across a first lateral wall portion on a first side of the vertical plane of symmetry and across an opposite second lateral wall portion on an opposite side of the vertical plane of symmetry;
- the tubular beam has a planar upper wall portion at its top, wherein this upper wall portion is perpendicular to the vertical plane of symmetry and is connected to each one of said first and second lateral wall portions via one or more intermediate wall portions;
- the tubular beam has a planar lower wall portion at its bottom, wherein this lower wall portion is perpendicular to the vertical plane of symmetry and is connected to each one of said first and second lateral wall portions via one or more intermediate wall portions; and
- the welding joint is located at an upper edge or lower edge of one of said first and second lateral wall portions.

[0007] The above-mentioned configuration of the telescopic crane boom section will not only result in a telescopic crane boom section of high strength, it also improves the reliability of the welding joint. The conventional location of the welding joint is at the lower or upper end of the crane boom section for manufacturing reasons. Such a location of the welding joint implies that the welding joint will be positioned on the plane of symmetry, where the welding joint is affected by high stresses. At the upper end of the crane boom section the tensile stresses are high and at the lower end the compressive stresses are high. With such a conventional location of the welding joint, the requirements on the quality of the welding joint are therefore very high in order to achieve a reliable welding joint that can endure the stresses. By having the welding joint located at a lateral wall portion that is intersected by the neutral layer, it will be possible to locate the welding joint rather close to the neutral layer, which implies reduced stresses on the welding joint as compared to the conventional location of the welding joint at the lower or upper end of the crane boom section. For manufacturing reasons, it is favourable to have the welding joint of the crane boom section located at a corner between two wall portions, and by moving the welding joint from the lower or upper end of the crane boom section to an edge of a lateral wall portion, it will be possible to have planar upper and lower wall portions with an extension perpendicular to the vertical plane of symmetry. The inclusion of planar upper and lower wall portions with an extension perpendicular to the vertical plane of symmetry will make it possible to arrange planar and horizontally extending sliding elements at the top and bottom of the crane boom section, wherein vertical loads on the

crane boom section may be taken up by these horizontal sliding elements is an efficient and reliable manner, which in its turn creates opportunities for a high stiffness of a telescopic crane boom that is provided with crane boom sections according to the invention. The horizontal sliding elements may co-operate with other planar sliding elements at inclined wall portions on either side of the upper and lower wall portions in order to distribute the local loads on the crane boom section in a suitable manner and thereby achieve a favourable stress distribution in the upper and lower parts of the crane boom section at the areas where the tubular beam makes contact with the sliding elements. Furthermore, the telescopic crane boom section of the present invention may be produced in an efficient and cost-effective manner.

[0008] According to an embodiment of the invention, each one of said first and second lateral wall portions has a length that is 5-45% of the height of the tubular beam, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam. By such a restriction of the length of the lateral wall portions that are intersected by the neutral layer, it is ensured that the welding joint located at the upper or lower edge of one of these wall portions will be positioned rather close to the neutral layer. The above-mentioned range of 5-45% has been found to be advantageous as it provides a good trade-off between a desired closeness of the upper or lower edge of the lateral wall portions to the neutral layer and a desire to make the manufacturing process less demanding when it comes to the bending of the metal sheet.

[0009] The welding joint is preferably located at a height above the lower wall portion that is 30-60% of the height of the tubular beam, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam.

[0010] Further advantageous features of the telescopic crane boom section according to the present invention will appear from the description following below and the dependent claims.

[0011] The invention also relates to a telescopically extensible crane boom having the features defined in claim 11 and a hydraulic crane comprising such a crane boom.

[0012] Further advantageous features of the crane boom according to the present invention will appear from the description following below and the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] With reference to the appended drawings, a specific description of embodiments of the invention cited as examples follows below. In the drawings:

Fig 1 is a perspective view of a hydraulic loader crane comprising telescopically extensible crane booms provided with telescopic crane boom sections according to the present invention,

Fig 2 is a perspective view of a telescopic crane boom section according to an embodiment of the invention,

Fig 3 is a cross-sectional view of the crane boom section of Fig 2,

Fig 4 is a cross-sectional view of the crane boom section of Figs 2 and 3, as seen when telescopically mounted to another such crane boom section, and

Fig 5 is a cross-sectional view of a telescopic crane boom section according to another embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0014] A hydraulic loader crane 1 according to an embodiment of the present invention is illustrated in Fig 1. The illustrated crane 1 comprises a crane base 2, which for instance may be connected to the chassis of a lorry. Adjustable support legs 3 for supporting the crane 1 are fixed to the crane base 2. The crane 1 further comprises:

- a column 5, which is rotatably mounted to the crane base 2 so as to be rotatable in relation to the crane base about an essentially vertical axis of rotation by means of an actuating unit;
- a liftable and lowerable first crane boom 6, in the following denominated inner boom, which is articulately connected to the column 5 in such a manner that it is pivotable in relation to the column about an essentially horizontal axis of rotation;
- a first hydraulic cylinder 7 for lifting and lowering the inner boom 6 in relation to the column 5;
- a liftable and lowerable second crane boom 8, in the following denominated outer boom, which is articulately connected to the inner boom 6 in such a manner that it is pivotable in relation to the inner boom about an essentially horizontal axis of rotation; and
- a second hydraulic cylinder 9 for lifting and lowering of the outer boom 8 in relation to the inner boom 6.

[0015] The expression "liftable and lowerable crane boom" here refers to a crane boom which can be pivoted in a vertical plane so as to thereby perform liftings and lowerings of a load carried by the crane. The expression "hydraulic cylinder for lifting and lowering the crane boom" here refers to the hydraulic cylinder which is associated with the liftable and lowerable crane boom and which carries out the pivoting thereof in a vertical plane.

[0016] The outer boom 8 is telescopically extensible to enable an adjustment of the extension length thereof. The outer boom 8 comprises a hollow base section 10, through which the outer boom 8 is articulately connected to the inner boom 6, and several hollow telescopic crane

boom sections 11 which are carried by the base section 10 and displaceable in the longitudinal direction of the base section by means of hydraulic cylinders 12 for adjustment of the extension length of the outer boom 8.

[0017] In the illustrated example, an additional telescopically extensible crane boom in the form of a jib 15 is detachably and articulately connected to the outer boom 8 in such a manner that it is pivotable in relation to it about an essentially horizontal axis of rotation. The hydraulic crane 1 further comprises a hydraulic cylinder 16 for lifting and lowering of the jib 15 in relation to the outer boom 8.

[0018] The jib 15 is telescopically extensible to enable an adjustment of the extension length thereof. The jib 15 comprises a hollow base section 20, through which the jib 15 is articulately connected to the outer boom 8, and a hollow telescopic crane boom section 21 which is carried by the base section 20 and displaceable in the longitudinal direction of the base section by means of a hydraulic cylinder 22 for adjustment of the extension length of the jib 15.

[0019] One of the telescopic crane boom sections 11 of the outer boom 8 shown in Fig 1 is illustrated in closer detail in Figs 2-3.

[0020] The crane boom section 11 has an elongated main body in the form of a straight tubular beam 30 formed by one single metal sheet 31, preferably of steel, which is shaped by bending. A collar 32 is mounted to the tubular beam 30 at a front end thereof, wherein the piston rod of the hydraulic cylinder 12 that is connected to the crane boom section 11 in order to effect an axial displacement thereof is fixed to the tubular beam 30 via the collar 32. The tubular beam 30 consists of several wall portions W1-W12, which are distributed about a longitudinal centre axis of the tubular beam 30 and connected to each other via bending corners 33 (see Fig 3) formed in the metal sheet 31. Opposite longitudinal edges 34a, 34b of the metal sheet 31 are joined to each other by a welding joint 35, which extends in the longitudinal direction of the tubular beam 30.

[0021] The tubular beam 30 has a vertical plane of symmetry 36 (see Fig 3) as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam. A neutral layer 37 of the tubular beam 30 extends across a first lateral wall portion W1 on a first side of the vertical plane of symmetry 36 and across an opposite second lateral wall portion W2 on the opposite side of the vertical plane of symmetry 36.

[0022] Each one of said first and second lateral wall portions W1, W2 preferably has a length L that is in the range of 5-45% of the height H of the tubular beam 30, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam. The first and second lateral wall portions W1, W2 are preferably parallel to each other and parallel to the vertical plane of symmetry 36, which implies that these wall portions W1, W2 are vertically arranged in the boom system.

[0023] In the illustrated example, the welding joint 35 is located at an upper edge 38 of the first lateral wall portion W1. As an alternative, the welding joint 35 could be located at a lower edge 39 of the first lateral wall portion W1 or at the upper or lower edge 38, 39 of the second lateral wall portion W2.

[0024] The welding joint 35 is preferably located at a height h above the lower end of the tubular beam 30 that is in the range of 30-60%, preferably 35-50%, of the height H of the tubular beam, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam.

[0025] The welding joint 35 may be produced by any suitable type of welding technique, such as for instance laser welding or arc welding.

[0026] The tubular beam 30 has a planar upper wall portion W3 at its top, wherein this upper wall portion W3 is perpendicular to the vertical plane of symmetry 36. Thus, the upper wall portion W3 is horizontally arranged. The upper wall portion W3 is connected to each one of said first and second lateral wall portions W1, W2 via one or more intermediate wall portions W4-W7, each of which being planar and inclined in relation to the vertical plane of symmetry 36. In the illustrated example, the upper wall portion W3 is connected to the first lateral wall portion W1 via two intermediate wall portions W4, W5 and to the second lateral wall portion W2 via two opposite intermediate wall portions W6, W7. Having two or more intermediate wall portions between the upper wall portion W3 and each lateral wall portion W1, W2 adds flexibility in the shaping of the crane boom section 11 to provide room for the hydraulic cylinders 12. Furthermore, it may also improve the resistance to buckling, owing to the fact that an increase of the number of intermediate wall portions will make it possible to reduce the length of each individual intermediate wall portion, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam.

[0027] The tubular beam 30 also has a planar lower wall portion W8 at its bottom, wherein this lower wall portion W8 is perpendicular to the vertical plane of symmetry 36. Thus, the lower wall portion W8 is horizontally arranged. The lower wall portion W8 is connected to each one of said first and second lateral wall portions W1, W2 via one or more intermediate wall portions W9-W12, each of which being planar and inclined in relation to the vertical plane of symmetry 36. In the illustrated example, the lower wall portion W8 is connected to the first lateral wall portion W1 via two intermediate wall portions W9, W10 and to the second lateral wall portion W2 via two opposite intermediate wall portions W11, W12.

[0028] The tubular beam 30 has a polygonal cross-sectional shape and it is preferably designed as a drop-shaped polygon, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam, wherein a lower end of the drop-shaped polygon is wider than an upper end thereof. In the illustrated examples, the essentially drop-shaped cross-sectional shape of the tubular beam 30 is mainly achieved in that the inclined

wall portions W5, W7 connected to the upper edges 38 of the first and second lateral wall portions W1, W2 are considerably longer than the inclined wall portions connected to the lower edges 39 of the first and second lateral wall portions W1, W2 and in that the inclined wall portions W4, W6 connected to the upper wall portion W3 are shorter than the inclined wall portions W9, W11 connected to the lower wall portion W8, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam. The tubular beam 30 preferably has ten or more sides. In the embodiment illustrated in Figs 2 and 3, the tubular beam 30 is twelve-sided. In the embodiment illustrated in Fig 5, the tubular beam 30 is ten-sided. In the latter case, the lower wall portion W8 is connected to the first lateral wall portion W1 via one single intermediate wall portion W9 and to the second lateral wall portion W2 via an opposite intermediate wall portion W11.

[0029] Fig 4 illustrates how the tubular beam 30 of the crane boom section 11 illustrated in Figs 2 and 3 is telescopically mounted within a tubular beam 30' of another crane boom section 11 of corresponding design, wherein:

- a first planar sliding element S1 is arranged in contact with an outer surface of the upper wall portion W3 of the inner tubular beam 30;
- a second planar sliding element S2 is arranged in contact with an outer surface of a first inclined wall portion W4 that is connected to the upper wall portion W3 of the inner tubular beam 30 on a first side of the upper wall portion W3;
- a third planar sliding element S3 is arranged in contact with an outer surface of a second inclined wall portion W6 that is connected to the upper wall portion W3 of the inner tubular beam 30 on an opposite second side of the upper wall portion W3;
- a fourth planar sliding element S4 is arranged in contact with an outer surface of the lower wall portion W8 of the inner tubular beam 30;
- a fifth planar sliding element S5 is arranged in contact with an outer surface of a third inclined wall portion W9 that is connected to the lower wall portion W8 of the inner tubular beam 30 on a first side of the lower wall portion W8;
- a sixth planar sliding element S6 is arranged in contact with an outer surface of a fourth inclined wall portion W11 that is connected to the lower wall portion W8 of the inner tubular beam 30 on an opposite second side of the lower wall portion W8;
- a seventh planar sliding element S7 is arranged in contact with an outer surface of a fifth inclined wall portion W10 that is arranged between said third inclined wall portion W9 and the first lateral wall portion W1 of the inner tubular beam 30; and
- an eight planar sliding element S8 is arranged in contact with an outer surface of a sixth inclined wall portion W12 that is arranged between said fourth inclined wall portion W11 and the second lateral wall portion W2 of the inner tubular beam 30.

[0030] The above-mentioned first, second and third sliding elements S1-S3 are fixed to the outer side of the inner tubular beam 30 at the rear end thereof and the other sliding elements S4-S8 are fixed to the inner side of the outer tubular beam 30' at the front end thereof.

[0031] The telescopic crane boom section 21 of the jib 15 shown in Fig 1 is designed in the same manner as the telescopic crane boom section 11 that has been described above with reference to Figs 2-5.

[0032] The invention is of course not in any way restricted to the embodiments described above. On the contrary, many possibilities to modifications thereof will be apparent to a person with ordinary skill in the art without departing from the basic idea of the invention such as defined in the appended claims.

Claims

1. A telescopic crane boom section intended to form part of a telescopically extensible crane boom, the crane boom section (11) having an elongated main body in the form of a straight tubular beam (30) formed by one single bent metal sheet (31) and consisting of several wall portions (W1-W12) which are distributed about a longitudinal centre axis of the tubular beam (30) and connected to each other via bending corners (33) formed in the metal sheet, wherein:

- opposite longitudinal edges (34a, 34b) of the metal sheet (31) are joined to each other by a welding joint (35) extending in the longitudinal direction of the tubular beam (30);
- the tubular beam (30) has a vertical plane of symmetry (36) as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam;
- a neutral layer (37) of the tubular beam (30) extends across a first lateral wall portion (W1) on a first side of the vertical plane of symmetry (36) and across an opposite second lateral wall portion (W2) on an opposite side of the vertical plane of symmetry (36);
- the tubular beam (30) has a planar upper wall portion (W3) at its top, wherein this upper wall portion (W3) is perpendicular to the vertical plane of symmetry (36) and is connected to each one of said first and second lateral wall portions (W1, W2) via one or more intermediate wall portions (W4-W7);
- the tubular beam (30) has a planar lower wall portion (W8) at its bottom, wherein this lower wall portion (W8) is perpendicular to the vertical plane of symmetry (36) and is connected to each one of said first and second lateral wall portions (W1, W2) via one or more intermediate wall portions (W9-W12); and

- the welding joint (35) is located at an upper edge (38) or lower edge (39) of one of said first and second lateral wall portions (W1, W2).

2. A telescopic crane boom section according to claim 1, **characterized in that** each one of said first and second lateral wall portions (W1, W2) has a length (L) that is 5-45% of the height (H) of the tubular beam (30), as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam (30).

3. A telescopic crane boom section according to claim 1 or 2, **characterized in that** the welding joint (35) is located at a height (h) above the lower wall portion (W8) that is 30-60%, preferably 35-50%, of the height (H) of the tubular beam (30), as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam (30).

4. A telescopic crane boom section according to any of claims 1-3, **characterized in that** said first and second lateral wall portions (W1, W2) are parallel to each other and parallel to the vertical plane of symmetry (36).

5. A telescopic crane boom section according to any of claims 1-4, **characterized in that** said upper wall portion (W3) is connected to each one of said first and second lateral wall portions (W1, W2) via two or more intermediate wall portions (W4-W7), each of which being planar and inclined in relation to the vertical plane of symmetry (36).

6. A telescopic crane boom section according to any of claims 1-5, **characterized in that** said lower wall portion (W8) is connected to each one of said first and second lateral wall portions (W1, W2) via two or more intermediate wall portions (W9-W12), each of which being planar and inclined in relation to the vertical plane of symmetry (36).

7. A telescopic crane boom section according to any of claims 1-6, **characterized in that** the tubular beam (30) has a polygonal cross-sectional shape.

8. A telescopic crane boom section according to claim 7, **characterized in that** the tubular beam (30) is designed as a drop-shaped polygon, as seen in a cross-section perpendicular to the longitudinal centre axis of the tubular beam, wherein a lower end of the drop-shaped polygon is wider than an upper end thereof.

9. A telescopic crane boom section according to claim 7 or 8, **characterized in that** the tubular beam (30) has ten or more sides.

10. A telescopic crane boom section according to claim 9, **characterized in that** the tubular beam (30) is twelve-sided.

11. A telescopically extensible crane boom comprising a hollow base section (10; 20), a telescopic crane boom section (11; 21) telescopically mounted to the base section (10; 20), and a hydraulic cylinder (12; 22) configured to act between the base section (10; 20) and the telescopic crane boom section (11; 21), wherein the telescopic crane boom section (11; 21) is displaceable in the longitudinal direction of the base section (10; 20) by means of the hydraulic cylinder (12; 22), **characterized in that** said telescopic crane boom section (11; 21) is a telescopic crane boom section according to any of claims 1-10.

12. A telescopically extensible crane boom according to claim 11, **characterized in that** the crane boom (8; 15) comprises several telescopic crane boom sections (11; 21) according to any of claims 1-10, which are carried by the base section (10; 20) and telescopically connected to each other so as to be displaceable in the longitudinal direction of the base section (10; 20).

13. A telescopically extensible crane boom according to claim 11 or 12, **characterized in:**

- **that** a first planar sliding element (S1) is arranged in contact with an outer surface of the upper wall portion (W3) of the tubular beam (30) of each telescopic crane boom section (11; 21);
- **that** a second planar sliding element (S2) is arranged in contact with an outer surface of a first inclined wall portion (W4) that is connected to the upper wall portion (W3) of the tubular beam (30) of each telescopic crane boom section (11; 21) on a first side of the upper wall portion (W3);
- **that** a third planar sliding element (S3) is arranged in contact with an outer surface of a second inclined wall portion (W6) that is connected to the upper wall portion (W3) of the tubular beam (30) of each telescopic crane boom section (11; 21) on an opposite second side of the upper wall portion (W3);
- **that** a fourth planar sliding element (S4) is arranged in contact with an outer surface of the lower wall portion (W8) of the tubular beam (30) of each telescopic crane boom section (11; 21);
- **that** a fifth planar sliding element (S5) is arranged in contact with an outer surface of a third inclined wall portion (W9) that is connected to the lower wall portion (W8) of the tubular beam (30) of each telescopic crane boom section (11; 21) on a first side of the lower wall portion (W8); and
- **that** a sixth planar sliding element (S6) is ar-

ranged in contact with an outer surface of a fourth inclined wall portion (W11) that is connected to the lower wall portion (W8) of the tubular beam (30) of each telescopic crane boom section (11; 21) on an opposite second side of the lower wall portion (W8).

14. A hydraulic crane, **characterized in that** the hydraulic crane (1) comprises a telescopically extensible crane boom (8, 15) according to any of claims 11-13.

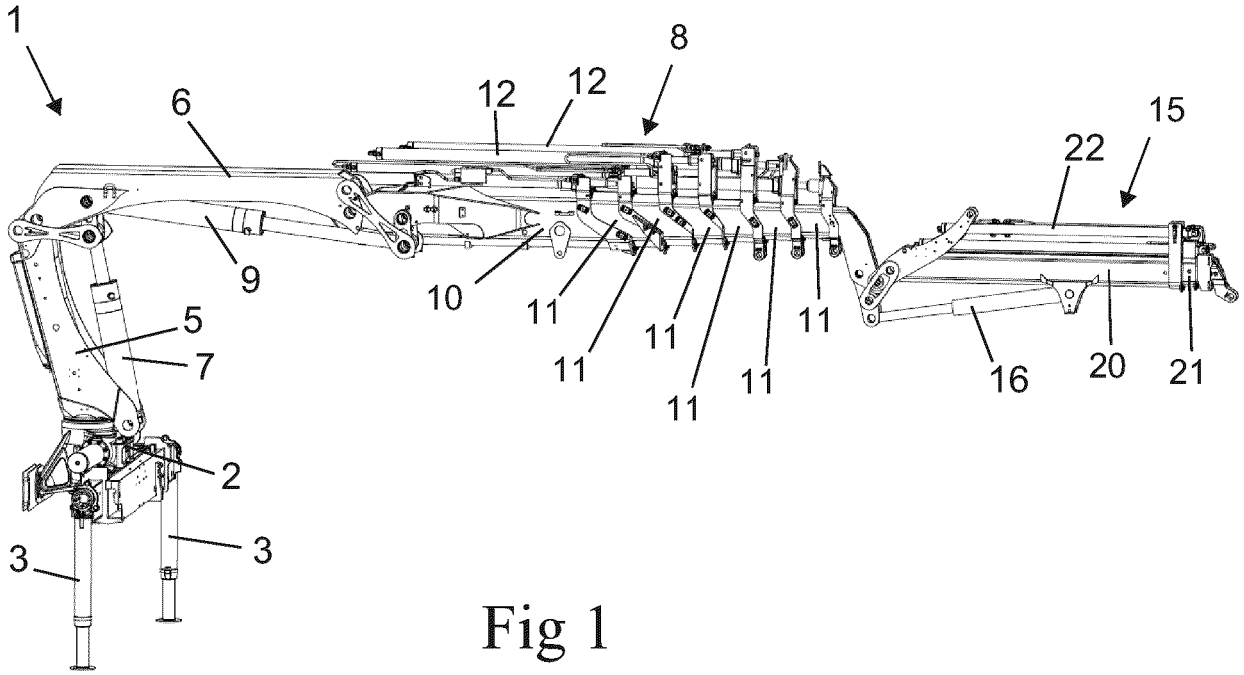
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Fig 1

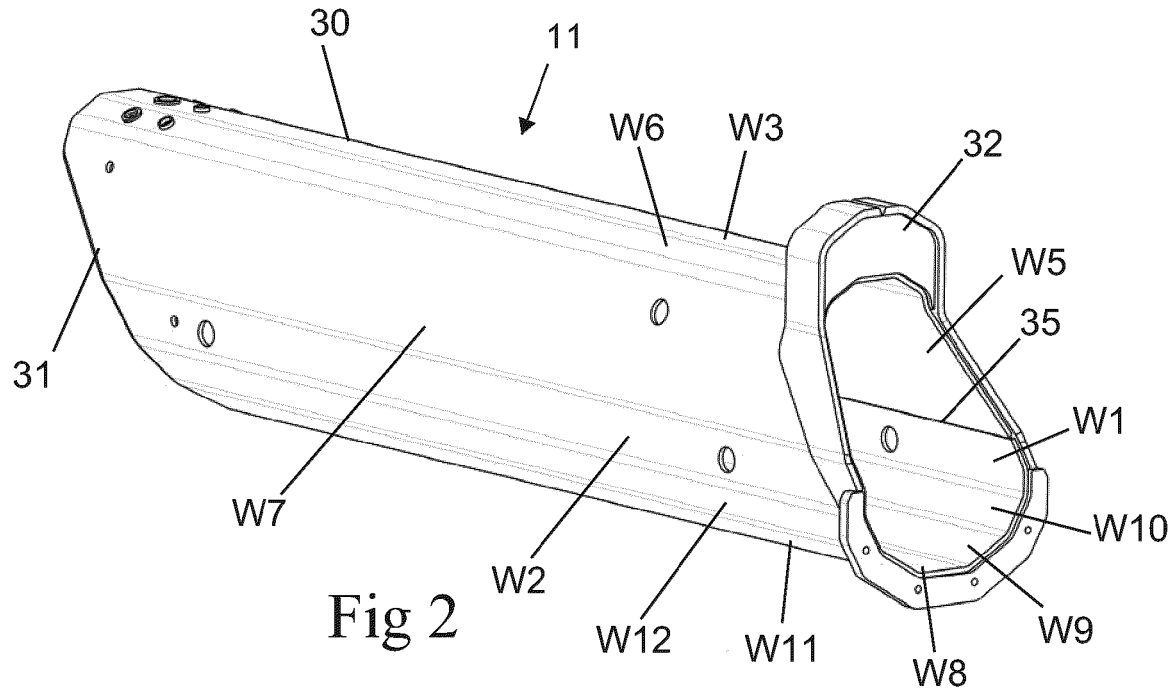
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Fig 2

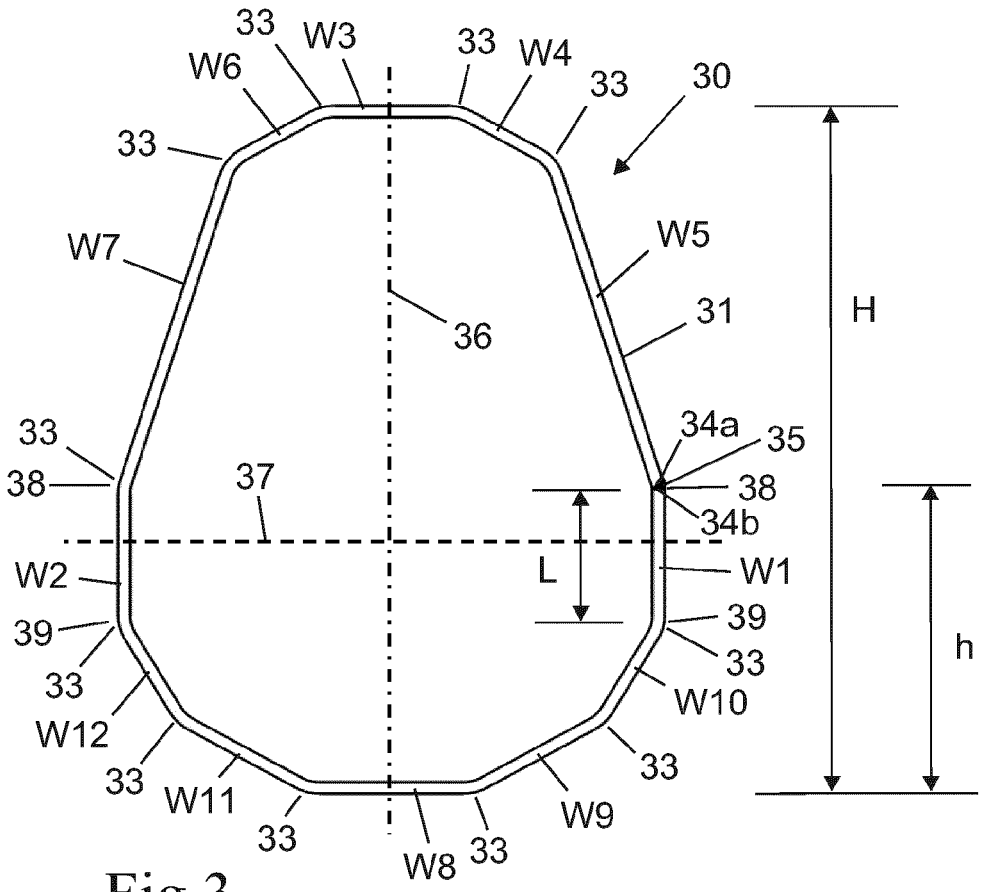
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Fig 3

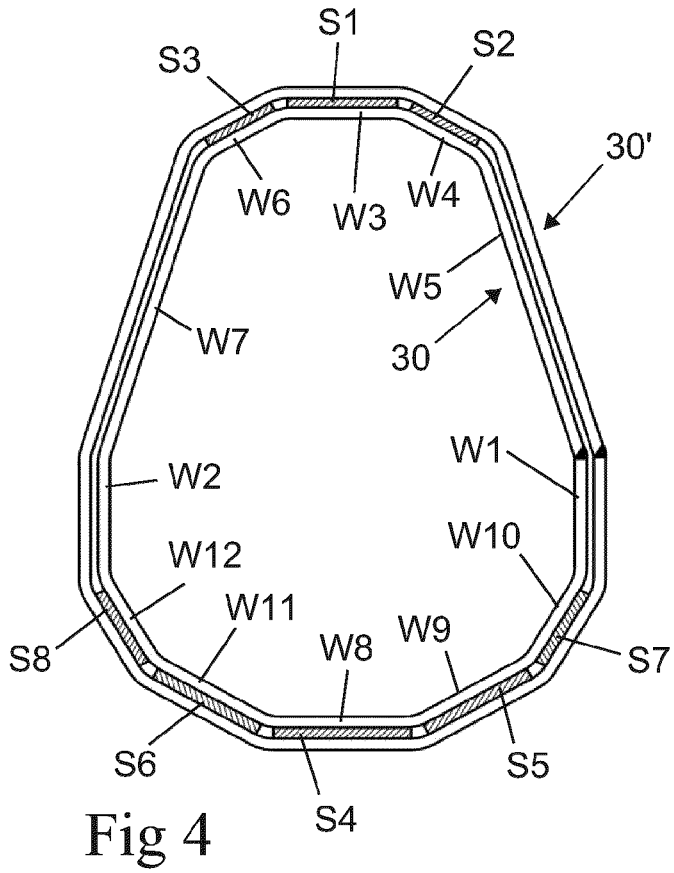
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Fig 4

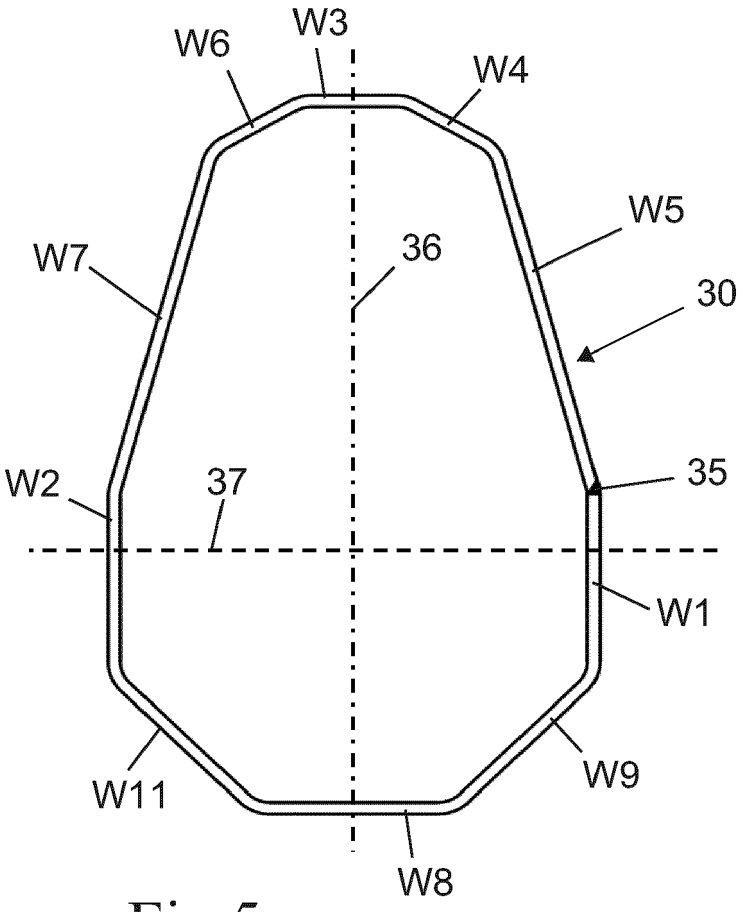

Fig 5

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 3786

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 302 435 A1 (EFFER S P A [IT]) 16 April 2003 (2003-04-16) * paragraphs [0021], [0033] * * abstract * * figures *	1-14	INV. B66C23/68 B66C23/70
Y	CN 108 033 369 A (TAIYUAN HEAVY IND CO LTD) 15 May 2018 (2018-05-15) * paragraph [0005] * * abstract * * figures *	1-14	
A	EP 2 363 214 A1 (FERRO UMFORMTECHNIK GMBH & CO KG [DE]) 7 September 2011 (2011-09-07) * abstract * * figures *	1-14	
A,D	CA 2 697 304 A1 (PALFINGER AG [AT]) 12 March 2009 (2009-03-12) * abstract * * figures *	1-14	TECHNICAL FIELDS SEARCHED (IPC)
A	US 6 098 824 A (KREBS THOMAS [DE] ET AL) 8 August 2000 (2000-08-08) * abstract * * figures *	1-14	B66C B23K B21C E02F E04C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 August 2020	Colletti, Roberta

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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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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21-08-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1302435 A1	16-04-2003	DK 1302435 T3	14-06-2018
		EP 1302435 A1	16-04-2003
		ES 2670924 T3	04-06-2018
		TR 201807546 T4	21-06-2018
CN 108033369 A	15-05-2018	NONE	
EP 2363214 A1	07-09-2011	DE 102010010008 A1	08-09-2011
		EP 2363214 A1	07-09-2011
CA 2697304 A1	12-03-2009	BR PI0816409 A2	03-03-2015
		CA 2697304 A1	12-03-2009
		CN 101827776 A	08-09-2010
		EP 2185463 A1	19-05-2010
		RU 2010112842 A	10-10-2011
		WO 2009029968 A1	12-03-2009
US 6098824 A	08-08-2000	DE 19711975 A1	17-09-1998
		US 6098824 A	08-08-2000

EPO FORM P0459

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Patent documents cited in the description

- CA 2697304 A1 **[0003]**