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(54) TELESCOPIC ARM

(57) A telescopic arm (2) for a crane (4) with a winch device (6) provided with a wire (8), the telescopic arm (2) comprising a telescopic boom assembly (10) arranged to hold a pulley device (12) for the wire (8) at a tip of the telescopic boom assembly (10), an adaptor (14) comprising a first end (16) pivotally connected to the telescopic boom assembly (10) at a boom assembly pivot axle (18) and a second end (20) structured to be mounted to a crane boom (22) of the crane, and a wire guide arranged between the winch device (6) and the pulley device (12). The wire being guided by the wire guide in the region of the boom assembly pivot axle (18). The wire guide further comprises a first wire guiding pulley (24) with a first wire guiding wheel (26) arranged to rotate around a first pulley axle (28). The first end (16) of the adaptor (14) comprises a first part (30) and a second part (32) pivotally connected to the boom assembly pivot axle (18), wherein the first part (30) and second part (32) being symmetrically arranged on either side of a common plane, with a gap in between the first part (30) and the second part (32) forming a cavity (34) in the adaptor (14) arranged to be intersected by the common plane.

The first wire guiding wheel (26) is arranged in the gap between the first part (30) and the second part (32) and the boom assembly pivot axle (18) is arranged as the first pulley axle (28) around which the first wire guiding wheel (26) is arranged to rotate. The wire guide further comprises a second wire guiding pulley (36) with a second wire guiding wheel (38) arranged to rotate around a second pulley axle (40) in the common plane. The first pulley axle (28) and the second pulley axle (40) are positioned in relation to each other such that the wire (8) routed by the wire guide passes outside said cavity(34) and between said first and second wire guiding wheels (26, 38).

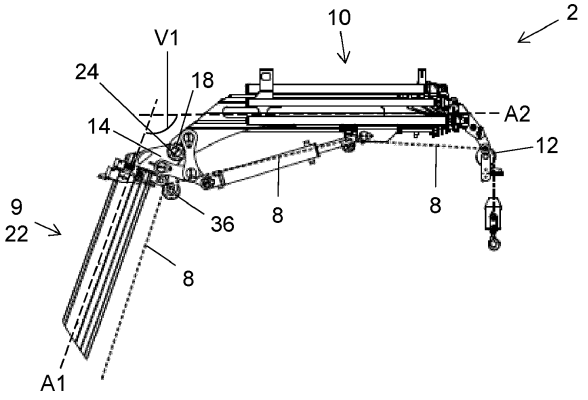

FIG. 4

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Description

Technical field

[0001] The present disclosure relates to a telescopic arm, a crane provided with the telescopic arm and a vehicle with a crane. More specifically, this invention addresses a telescopic boom, a so-called jib, for a hoisting application, and relates in particular to the wire guiding pulleys of the joint to the jib.

Background

[0002] This disclosure relates to cranes arranged to be mounted to a vehicle such as a truck. These cranes comprise a crane base arranged to be mounted to the vehicle, a column which is rotatably mounted to the crane base so as to be rotatable in relation to the crane base about an essentially vertical axis of rotation and an actuator for rotating the column in relation to the crane base. Stabilizers are further included in the crane assembly and attached to an outrigger beam connected to the crane base. Crane booms are attached to the column to achieve a desired reach of the crane. Often some of those booms are telescopic booms. In the present application is a crane provided with three booms discussed, where a first boom is attached to the column, a second boom is attached to the first boom, and a third boom is attached to the second boom. In the crane discussed herein, the second boom may optionally be a telescopic boom and the third boom is a telescopic booms. However, the present invention is equally applicable for cranes having none or only one telescopic boom, and having more or less booms than three. For hoisting purposes, a wire is routed along the crane booms to a hoisting pulley at the tip of the outermost boom.

[0003] There are two general types for routing wires along telescopic crane arms, either at one of the left or right sides of the crane arms (left or right side referring to the sides of the crane when mounted to a vehicle for operation), or along the longitudinal symmetry axis of the crane arms at the lower side of the crane booms. A drawback to route the wire asymmetrically along one of the sides is that bending forces may affect the crane arms. The present application relates to cranes where the wire is routed along the symmetry axis of the crane booms.

[0004] Below, some patent documents in the technical field of cranes provided with a hoisting wire will be identified, and briefly discussed.

[0005] JP6627235B2 discloses a jib mounted adaptor. The adapter body is interposed between the distal end of the boom and the proximal end of the jib. The structure includes an auxiliary sheave for guiding a wire rope of an auxiliary winding device and an auxiliary sheave support member having a base end connected to the adapter body and an auxiliary sheave rotatably supported at the distal end. It also has a jib mounting adapter. KR20180100858A discloses a refractory crane. The crane includes a first boom rotationally mounted on a post and a second boom rotationally connected to the first boom by a hinge that rotates with respect to the first boom. It is disclosed that the wire is supported with one guide roller to secure safety by preventing jamming of the wire caused by a complicated structure and ease of manufacturing the crane.

[0006] CN110626964A discloses a foldable crane with adjustable height. The crane includes an upright post with a cylinder hinge seat and a height adjusting driving device capable of changing the height of the upright post.

[0007] EP1477450 relates to a crane, comprising a first arm and a second arm that are interconnected with each other. The second arm is pivotally arranged in relation to the first arm, and wherein a longitudinal axis of the first arm and a longitudinal axis of the second arm extend in a common plane which is also the pivot plane of the second arm. A winch device is provided, arranged on the first arm and provided with a wire, and a pulley device arranged on the second arm, and a wire guide that is arranged between the winch device and the pulley device. The wire extends from the winch via the wire guide to the pulley device, and the wire is redirected by the wire guide in the region of the pivot centre between the first and second arm.

[0008] Many of the prior systems have problems with ease of use. For example, there are often obstacles when routing the wire to pass the joint to the jib boom due to narrow space. It often requires a lot of time and effort to mount and dismount wire guiding wheels from the crane assembly and is also dependent on the configuration of the crane. Loader crane operators require solutions, which allow them a quick and safe start-up of the machine, for any crane configuration.

[0009] In prior systems, the wire is often routed by guiding pulleys resulting in many bends of the wire, particularly in some crane positions such as routing the wire to pass the joint to the jib boom, resulting in an increase wear of the wire.

[0010] The object of the present invention is to remove, or at least mitigate, the above drawbacks with the presently applied solutions.

Summary

[0011] The above-mentioned object is achieved by the present invention according to the independent claims.

[0012] Preferred embodiments are set forth in the dependent claims.

[0013] The adapter of the telescopic arm according to the present invention has a structure where the wire guide includes a first pulley that is positioned such that the pivot axle connecting the telescopic boom assembly (the jib) to the crane arm is used as its pulley axle. A second pulley is arranged in relation to the first pulley such that the wire routed by the wire guide passes between the guiding wheels of the first and second pulleys.

[0014] The wire guide according to the invention allows

for a compact and space efficient placement of the pulleys, enabling the pulleys to have a relatively large diameter while also allowing space in between the pulleys. The compact and space efficient placement also enables more room for the boom sections of the telescopic boom assembly in the region of the j oint, which allows for a longer reach for the telescopic arm. Another advantage obtained by the telescopic arm according to the invention is that the wire end can be passed through the wire guiding pulleys arranged in relation to the joint connecting the crane to the telescopic boom assembly (the jib) without any tool and/or dismounting any pulley or any other component. This also, in practice, allows that wire ends of wires having a relatively large diameter to easily be routed through the guiding pulleys.

[0015] A still further advantage is that the telescopic arm according to the invention, allows folding the crane (including the jib) without dismounting or removing any pulley or part, and, if wanted, with the wire routed through the jib joint guiding pulleys.

[0016] The solution according to the present invention is particularly advantageous when the crane works as illustrated in figure 4, in that there is less wear on the wire as only one bend of the wire is required when passing the jib joint, in comparison to the solutions disclosed in the prior art.

[0017] The adapter according to the invention is structured such that the first and second wire guiding wheels with a large diameter may be applied. This is advantageous in that the diameter of a guiding wheel affects the wear of the wire such that a larger wheel results in less wear in comparison to if a wheel having a smaller diameter is used.

[0018] Generally, the lifetime of the wire will increase by avoiding bending of the wire as the wear of the wire then decreases.

Brief description of the drawings

[0019]

Figure 1 is a schematic illustration of a vehicle provided with a crane according to the present invention.

Figure 2 is a side view of a column, a first and a second boom of a crane that may be applied in relation to the present invention.

Figures 3 and 4 illustrate side views of a telescopic arm according to the present invention in two different working positions.

Figure 5 is a side view of an adapter according to the present invention.

Figures 6 and 7 are perspective views of the adapter according to the present invention.

Figure 8 is a view from above of the first end of the adapter according to the present invention.

Figure 9 is a view from below of the adapter according to the present invention.

Detailed description

[0020] The telescopic arm will now be described in detail with references to the appended figures. Throughout the figures, the same, or similar, items have the same reference signs.

[0021] Moreover, the items and the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0022] Figure 1 schematically illustrates a vehicle 42 provided with a crane 4.

[0023] Figure 2 illustrates a part of the basic structure of a crane 4 to which the invention can be applied to, with a first and a second boom; a third boom according to the invention may be mounted to the second boom.

[0024] With reference to the illustration in figure 2, a first boom 3 is arranged to the column 5 and an actuator is arranged to be able to move the first boom around a first axle 7 with reference to the column 5. A second boom 9 is arranged to the first boom 3 and another actuator is arranged to be able move the second boom around a second axle 11 with reference to the first boom 3.

[0025] Cranes like this may further have a third boom, herein also denoted telescopic boom assembly 10 that is mounted to the second boom 9. See the illustrations in figures 3 and 4 where the second and the third booms are illustrated. A further actuator is then arranged to be able move the third boom around a third axle, herein also denoted telescopic boom assembly pivot axle 18, with reference to the second boom. This third boom may also be referred to as a "jib".

[0026] The first axle 7 is the pin around which the first boom pivots, so its angle with respect to the column changes.

[0027] The second axle 11 is the pin around which the second boom pivots, so its angle with respect to the first boom changes.

[0028] The third axle, i.e. the telescopic boom assembly pivot axle 18, is the pin around which the jib (third boom) pivots, so its angle with respect to the second boom changes.

[0029] The present disclosure relates to a crane provided with a third boom and in particular when using the crane for hoisting applications where a winch device with a wire is attached and the wire is guided along a telescopic arm 2. The third boom is a detachable telescopic arm for a crane. In the context of this disclosure, the telescopic arm further has a winch device provided with a wire.

[0030] The third boom is typically a telescopic boom assembly with one or more boom extensions being arranged to extend in the longitudinal axis of the boom and hence extending the reach of the boom. The telescopic boom assembly is further arranged to hold a pulley device for the wire at a tip of the boom assembly, in order to enable a hoisting application of the crane.

[0031] The present invention will now be described in detail with references to figures 3-9. Figures 3 and 4 are

side views illustrating the second and third booms 9, 10 in two different positions in relation to each other. The crane position shown in figure 4 where the crane boom and the telescopic boom assembly, having the longitudinal axes A1 and A2, respectively, are angled in relation to each other, is the position most commonly applied.

[0032] The present invention relates to a telescopic arm 2 for a crane 4 with a winch device 6 provided with a wire 8.

[0033] The telescopic arm 2 comprises a telescopic boom assembly 10 arranged to hold a pulley device 12 for the wire 8 at a tip of the telescopic boom assembly 10. The telescopic arm further comprises an adaptor 14 comprising a first end 16 (see figures 5-9) pivotally connected to the telescopic boom assembly 10 at a boom assembly pivot axle 18 and a second end 20 structured to be mounted to a crane boom 22 of the crane. More in detail, the second end 20 is structured to be inserted into an open end of the crane boom and fastened in that position. The adaptor enables that the telescopic boom assembly to be detachably mounted to the crane boom.

[0034] In the variation discussed above, the second end of the adapter is inserted into an open end of the crane boom.

[0035] A longitudinal axis A1 of the crane boom 22 (second boom 9) and a longitudinal axis A2 of the telescopic boom assembly 10 (the third boom) extend in a common plane, being the plane of the sheet illustrating figures 3 and 4.

[0036] The telescopic arm also comprises a wire guide arranged between the winch device 6 and the pulley device 12, the wire 8 extending from the winch device 6 via the wire guide to the pulley device 12, and the wire being guided by the wire guide in the region of the boom assembly pivot axle 18. The wire guide further comprises a first wire guiding pulley 24 with a first wire guiding wheel 26 (see figures 5 and 6) arranged to rotate around a first pulley axle 28. Often further guiding pulleys are arranged, provided with wire guiding wheels, e.g. at the mid part of the telescopic boom assembly as shown in figures 3 and 4.

[0037] With references in particular to figures 6-9, the first end 16 of the adaptor 14 comprises a first part 30 and a second part 32 pivotally connected to, or pivotally connectable to, the boom assembly pivot axle 18.

[0038] The first part 30 and second part 32 being symmetrically arranged on either side of the common plane, with a gap in between the first part 30 and the second part 32 forming a cavity 34 in the adaptor 14 arranged to be intersected by the common plane, when the telescopic boom assembly 10 is mounted to the crane boom 22. The gap between the first and second parts is dimensioned to receive the first wire guiding wheel 26. Each of the first part and second part comprises openings for bearings configured to receive the boom assembly pivot axle 18. The widths of each of the first and second parts are the same along the boom assembly pivot axle 18, and the total width of the adapter where the first and second parts are provided corresponds essentially to the width of the adapter at the second end of the adapter. As described earlier the telescopic boom assembly 10 is pivotally connected to the first end 16 of the adaptor 14 at the pivot axle 18. The telescopic boom assembly 10 may hence comprise connection parts with openings configured to receive the boom assembly pivot axle 18, in a similar manner as the first 30 and second part 32 of the first end 16 of the adaptor 14. The connection parts of the telescopic boom assembly 10 may be arranged to fit with the placements of parts 30, 32 along the pivot axle 18 while still allowing for a cavity 34 with a gap to receive the first wire guiding wheel 26.

[0039] The first wire guiding wheel 26 is arranged in the gap between the first part 30 and the second part 32 and the boom assembly pivot axle 18 is arranged as the first pulley axle 28 around which the first wire guiding wheel 26 is arranged to rotate. The cavity 34 is clearly indicated in figures 7-9. Thus, the boom assembly pivot axle 18 and the first pulley axle 28 coincide.

[0040] The wire guide further comprises a second wire guiding pulley 36 with a second wire guiding wheel 38 arranged to rotate around a second pulley axle 40 in the common plane. This is particularly illustrated in figures 5 and 6.

[0041] The first pulley axle 28 and the second pulley axle 40 are positioned in relation to each other such that the wire 8 routed by the wire guide passes outside the cavity 34 and between the first and second wire guiding wheels 26, 38. Thus, the wire 8 is to be routed outside the cavity 34, and not in a space between the first guiding wheel 26 and an inner bottom part of the cavity 34.

[0042] As shown in figures 3 and 4, the adapter 14 is structured to provide the wire guide to route the wire 8 at a lower side of the telescopic boom assembly 10 during hoisting work performed by the crane 4. This is shown in figures 3 and 4 where the wire 8 is routed from the winch device 6 to the pulley device 12 at the tip of the telescopic boom assembly 10.

[0043] According to one embodiment, the first pulley axle 28 and the second pulley axle 40 are positioned in relation to each other such that in a crane position where the longitudinal axes A1, A2 of the crane boom 22 and the telescopic boom assembly 10 being essentially parallel (an angle between A1 and A2 is essentially 180 degrees), the wire 8 is routed by both the first and second guiding wheels 26, 38. This is illustrated in figure 3.

[0044] In a crane position illustrated in figure 4, where an angle V1 between the longitudinal axes A1, A2 of the crane boom 22 and the telescopic boom assembly 10 is less than a predetermined angle, the wire 8 is routed only by the second guiding wheel 38. Thereby the wear of the wire is reduced because the wire is only routed by one guiding wheel when passing the boom assembly pivot axle 18.

[0045] The predetermined angle is preferably in the range of 160-170 degrees.

[0046] With regard to the wear of the wire it is referred

to a standard EN 13001-3-2:2014, where, in "table A.1-bending counts", on page 30, in Annex A, it is explained that sheaves with reverse sensed bending increase the number of bending counts by double compared to sheaves with the same sensed bending, so, it reduces the fatigue life of the wire.

[0047] According to a further embodiment, illustrated in figures 5 and 6, the adapter 14 comprises a second guiding wheel supporting structure 44 configured for mounting of the second guiding wheel 38 at the second pulley axle 40. The supporting structure 44 comprises two mounting plates 46 extending downwards and backwards in relation to the longitudinal axis A3 of the adapter 14 when the adapter 14 is mounted to the crane boom 22. The mounting plates 46 are structured to hold the second pulley axle 40 between outer parts of the mounting plates 46.

[0048] The backward direction is preferably defined by an angle V2 between the longitudinal axis A4 of the second end 20 of the adapter 4 and the longitudinal extension A5 of the supporting structure 44 and is in the range of 10-30 degrees, and more preferably 10-20 degrees. With the angle V2 in the preferred range, the relative placement of the pulleys will also enable a space efficient solution in a folded configuration of the crane. This is advantageous as the placements of the pulleys may affect the available space for the retracted telescopic sections in the folded configuration. More available space allows for longer telescopic sections which increases the maximum reach of the telescopic arm. This is illustrated in figure 5.

[0049] In still a further embodiment, a wire routing space is defined between the mounting plates 46 and between the first and second guiding wheels 26, 38, where the wire 8 is to be routed. This routing space is easily accessible which is advantageous when a wire should be mounted or dismounted as the wire end can be passed through the routing space without having to dismount any guiding wheel.

[0050] The present invention also relates to a crane provided with a telescopic arm 2 as described herein, and also to a vehicle provided with a crane as described herein.

[0051] The present invention is not limited to the above-described preferred embodiments. Various alternatives, modifications and equivalents may be used. Therefore, the above embodiments should not be taken as limiting the scope of the invention, which is defined by the appending claims.

Claims

1. A telescopic arm (2) for a crane (4) with a winch device (6) provided with a wire (8), the telescopic arm (2) comprising:

- a telescopic boom assembly (10) arranged to hold a pulley device (12) for the wire (8) at a tip of the telescopic boom assembly (10),
- an adaptor (14) comprising a first end (16) pivotally connected to the telescopic boom assembly (10) at a boom assembly pivot axle (18) and a second end (20) structured to be mounted to a crane boom (22) of the crane, wherein a longitudinal axis A1 of the crane boom (22) and a longitudinal axis A2 of the telescopic boom assembly (10) extend in a common plane, and
- a wire guide arranged between the winch device (6) and the pulley device (12), the wire (8) extending from the winch device (6) via the wire guide to the pulley device (12), and the wire being guided by the wire guide in the region of the boom assembly pivot axle (18), wherein the wire guide further comprises a first wire guiding pulley (24) with a first wire guiding wheel (26) arranged to rotate around a first pulley axle (28), **characterized in that** the first end (16) of the adaptor (14) comprises a first part (30) and a second part (32) pivotally connected to the boom assembly pivot axle (18), wherein the first part (30) and second part (32) being symmetrically arranged on either side of the common plane, with a gap in between the first part (30) and the second part (32) forming a cavity (34) in the adaptor (14) arranged to be intersected by the common plane, when the telescopic boom assembly (10) is mounted to the crane boom (22),
- wherein the first wire guiding wheel (26) is arranged in the gap between the first part (30) and the second part (32) and the boom assembly pivot axle (18) is arranged as the first pulley axle (28) around which the first wire guiding wheel (26) is arranged to rotate;
- wherein the wire guide further comprises a second wire guiding pulley (36) with a second wire guiding wheel (38) arranged to rotate around a second pulley axle (40) in the common plane, and
- wherein the first pulley axle (28) and the second pulley axle (40) are positioned in relation to each other such that the wire (8) routed by the wire guide passes outside said cavity(34) and between said first and second wire guiding wheels (26, 38).

2. The telescopic arm (2) according to claim 1, wherein the adapter (14) is structured to provide the wire guide to route the wire (8) at a lower side of the telescopic boom assembly (10) during hoisting work performed by the crane (4).

3. The telescopic arm (2) according to claim 1 or 2, wherein the first pulley axle (28) and the second pulley axle (40) are positioned in relation to each other such that in a crane position where the longitudinal

axes A1, A2 of the crane boom (22) and the telescopic boom assembly (10) being essentially parallel, the wire (8) is routed by both the first and second guiding wheels (26, 38), and in a crane position where the angle V1 between the longitudinal axes A1, A2 of the crane boom (22) and the telescopic boom assembly (10) is less than a predetermined angle, the wire (8) is routed only by the second guiding wheel (38).

4. The telescopic arm (2) according to claim 3, wherein said predetermined angle is in the range of 160-170 degrees.

5. The telescopic arm (2) according to any of claims 1-4, wherein the wire (8) is to be routed outside said cavity (34), and not in a space between said first guiding wheel (26) and an inner bottom part of the cavity (34).

6. The telescopic arm (2) according to any of claims 1-5, wherein the adapter (14) comprises a second guiding wheel supporting structure (44) configured for mounting of the second guiding wheel (38) at said second pulley axle (40), and wherein the supporting structure (44) comprises two mounting plates (46) extending downwards and backwards in relation to the longitudinal axis A3 of the adapter (14) when the adapter (14) is mounted to the crane boom (22), and that said mounting plates (46) are structured to hold said second pulley axle (40) between outer parts of said mounting plates (46).

7. The telescopic arm (2) according to claim 6, wherein the backward direction is defined by an angle V2 between the longitudinal axis A4 of the second end (20) of the adapter (14) and the longitudinal extension A5 of the supporting structure (44) and is in the range of 10-30 degrees, and more preferably 10-20 degrees.

8. The telescopic arm (2) according to claim 6 or 7, wherein a wire routing space is defined between the mounting plates (46) and between the first and second guiding wheels (26, 38), where the wire (8) is to be routed.

9. A crane (4) comprising a telescopic arm (2) according to any of claim 1-8.

10. A vehicle (42) comprising a crane (4) according to claim 9.

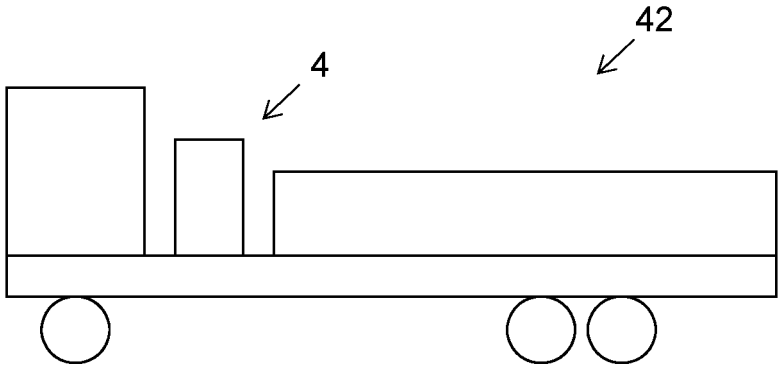


FIG. 1

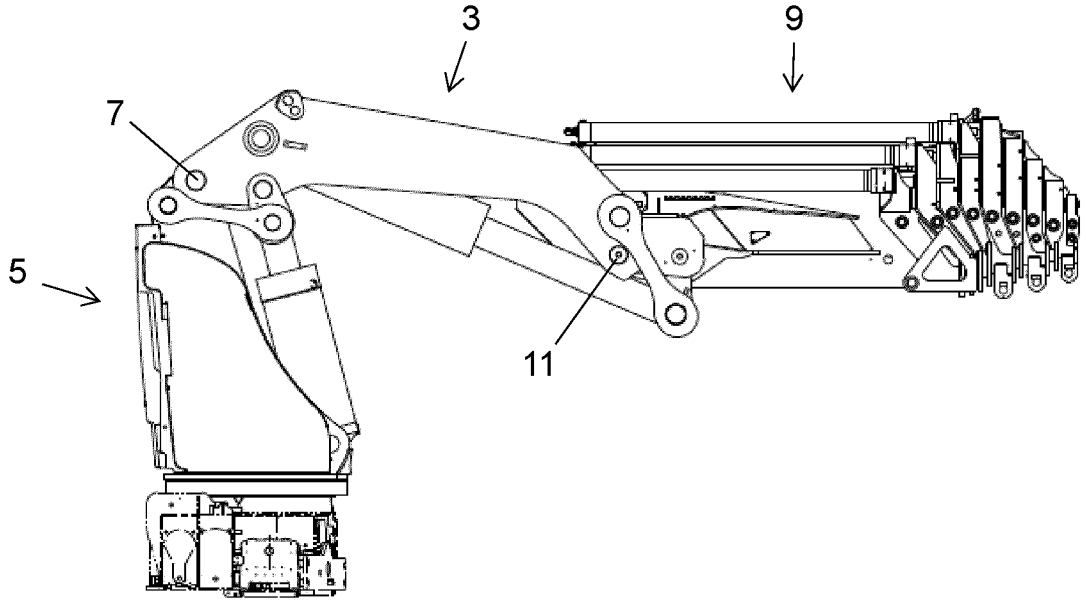
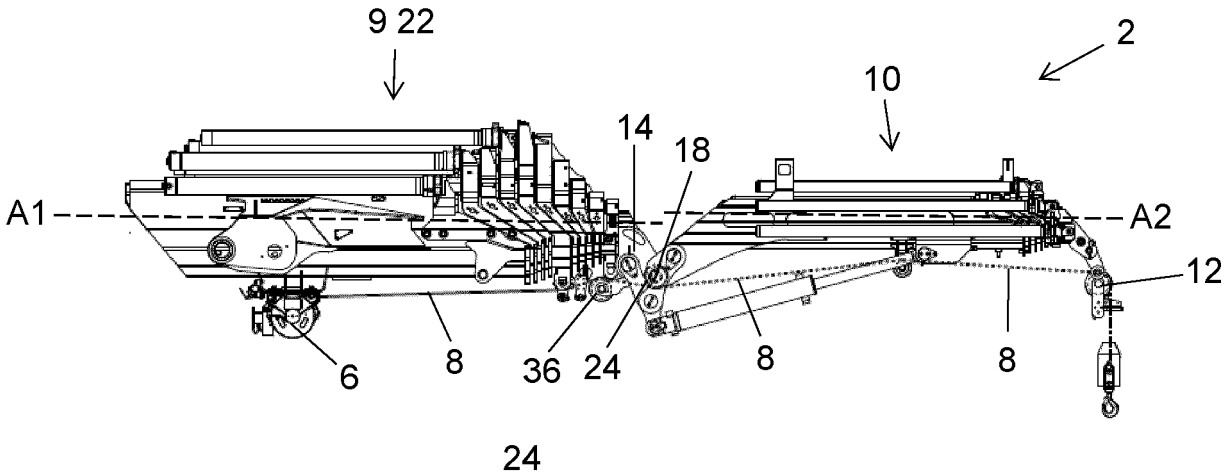


FIG. 2


9 22
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A1
A2
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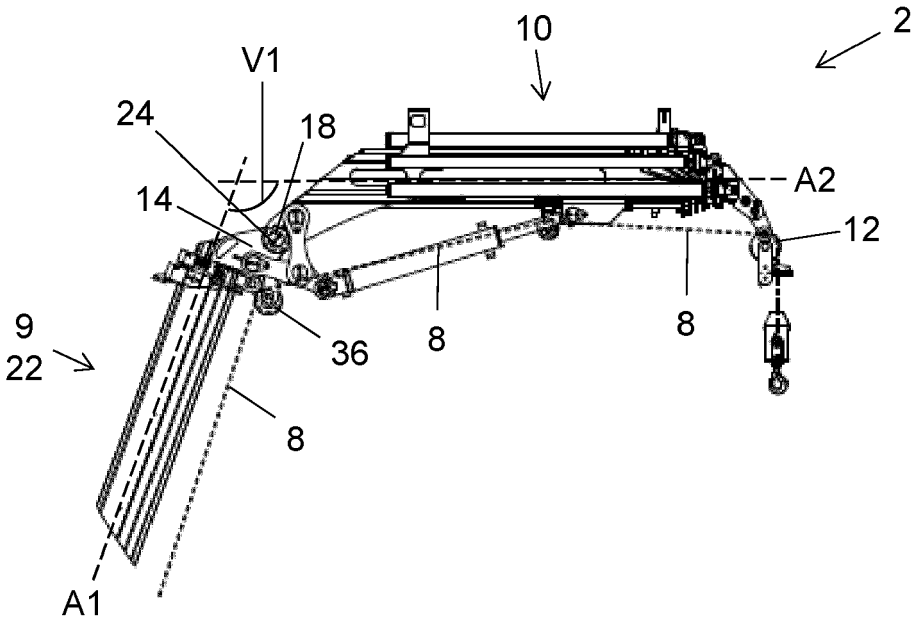
FIG. 3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V1
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18
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A2
12
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A1

FIG. 4

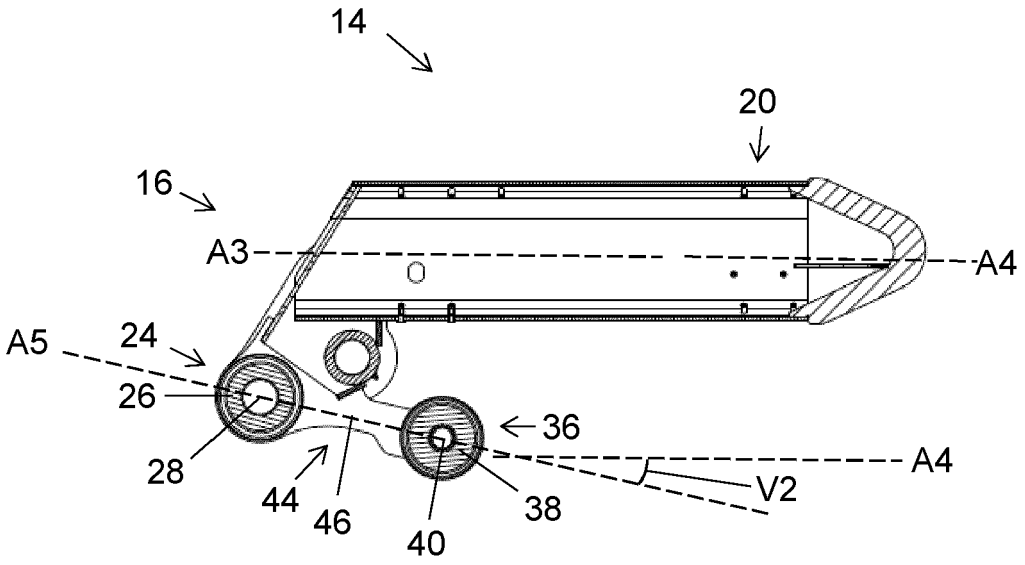

FIG. 5

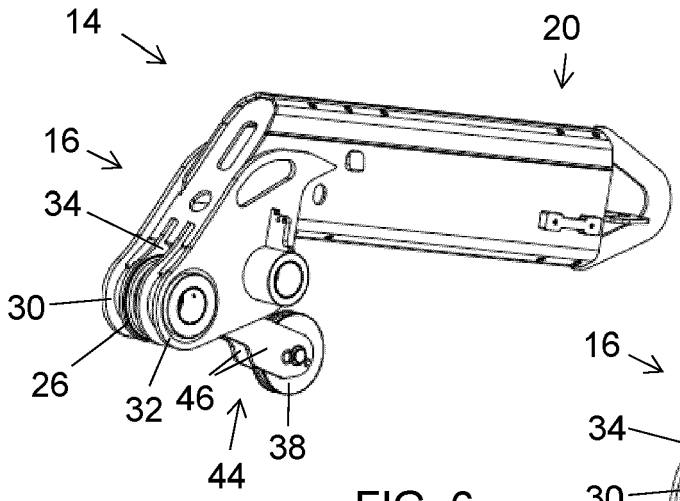

FIG. 6

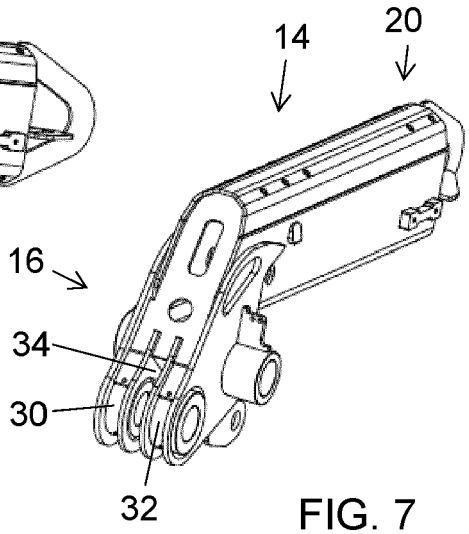

FIG. 7

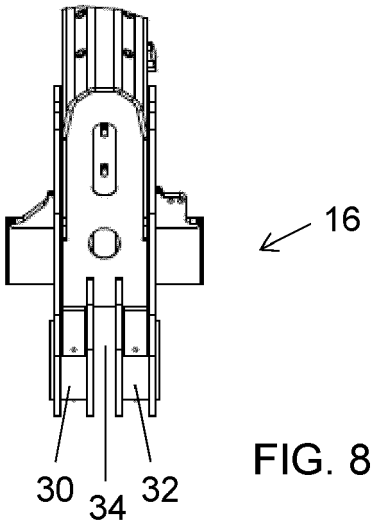

FIG. 8

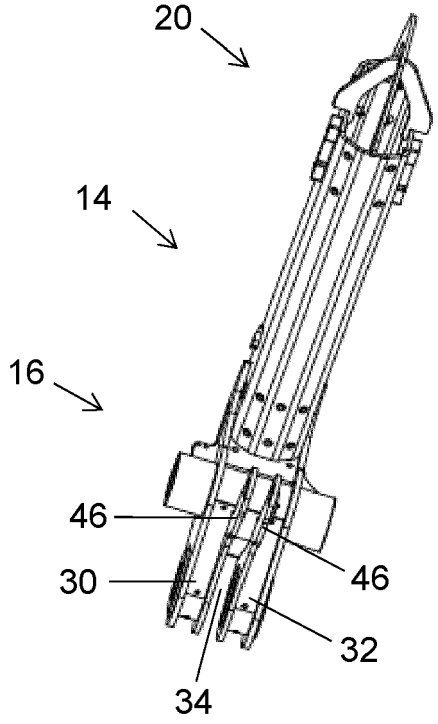

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 21 21 0093

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 1 477 450 A1 (HIAB AB [SE]) 17 November 2004 (2004-11-17) * paragraph [0022] - paragraph [0033]; figures *	1-10	INV. B66C23/70 B66C23/00
A	FR 2 138 086 A1 (FMC CORP) 29 December 1972 (1972-12-29) * page 2 - page 8; figures *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 May 2022	Popescu, Alexandru

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