(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 194 017 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.06.2010 Bulletin 2010/23

(51) Int Cl.:
B66C 23/18 *(2006.01)* ***B66C 23/52*** *(2006.01)*
B66C 23/64 *(2006.01)*

(21) Application number: **09177868.8**

(22) Date of filing: **03.12.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **03.12.2008 NO 20085058**

(71) Applicant: **Engineering-Support AS**
2380 Brumunddal (NO)

(72) Inventor: **Eikrem, Oddvar**
NO-2316, Hamar (NO)

(74) Representative: **Bergheim, Olav**
Zacco Norway AS
Haakon VII's gt. 2
P.O. Box 2003 Vika
0125 Oslo (NO)

(54) An offshore crane

(57) Offshore crane (1) comprising a base (2), a lifting boom (3) of which a first, proximal end is pivotally connected (5) with the base (2) and a second, distant end of which is pivotally connected (6) with a traverser carriage boom (4), said pivotal connections (5,6) providing angular movement of the lifting boom (3) and the traverser carriage boom (4) in a substantially vertical direction, said traverser carriage boom (4) further comprising a traverser carriage (7) for suspension and lifting or lowering of a load and running back and forth along a length (8) of said traverser carriage boom (4), said pivotal connection (6) between the traverser carriage boom (4) and the lifting boom (3) also providing angular movement of the traverser carriage boom (4) in a lateral direction.

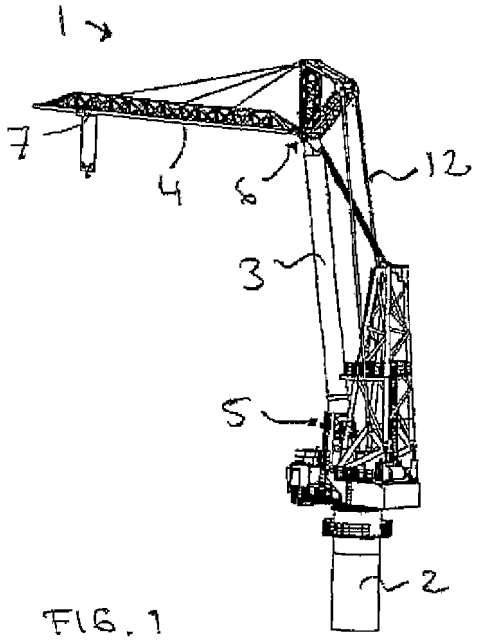


FIG. 1

EP 2 194 017 A1

Description

[0001] The present invention relates to a crane, and more specifically to an offshore crane and a method of operating an offshore crane in accordance with the preamble of claim 1 and 8, respectively.

[0002] Prior art offshore crane constructions are made as 360° rotating cranes having a winch operated boom lift for altering the range of the crane. When operating supply vessels offshore, an adequate movement of the hook suspension (the crane arm top) in order to follow the movements of the supply vessel is required. The construction standard for offshore cranes requires 1°/s when altering the boom angle at $H_{1/3} \geq 3{,}0$ m, which yields approx. 0,7 m/s at a favourable boom angle, and a high fastening for the load results in a long pendulum and necessitates a large movement in order to move suspended load. A shorter pendulum results in a safer positioning of the load (cf. knuckle boom cranes).

[0003] As to prior art, DE 2734960 A1 discloses a crane arrangement comprising a lifting boom and a traverser carriage boom or traverser boom, without any lateral movement of the traverser carriage boom in relation to the lifting boom to which it is connected.

[0004] Further, GB 2234728 A discloses an offshore crane equipped with measuring and control means in order to maintain the crane within acceptable limits related to the problems of side lead and off lead, but however in a quite different way than provided by the present invention.

[0005] The present invention aims at solving or at least mitigating the above or other drawbacks or deficiencies by providing an offshore crane and a method of operating an offshore crane in accordance with the characterizing clause of claim 1 and 8, respectively.

[0006] Favourable embodiments of the invention are stated in the dependent claims.

- An object of the present invention is thus to render possible a supply to or from an offshore rig at larger maximum wave height than what is normal today.

- A further object of the invention is automatic following of off-lift and landing site on supply vessels (horizontal plane).

[0007] In order to position the lifting point as a result of the movements of the supply vessel and the rig a large speed is required, which is provided by the use of a traverser carriage having a large capacity of movement.

[0008] In order to compensate for the movement of the supply vessel in the rotation direction of the crane, the mass of the crane has to be accelerated and retarded in order to follow the movement requirement. In order to obtain a higher acceleration and a better control the crane according to the invention is provided with a joint or connection for horizontal pivoting between the lifting boom (the main boom) and the traverser carriage boom (the horizontal boom). With this solution the required horizontal movement, in order to compensate for the collective horizontal movements, can be reached at a faster speed than by rotating the crane.

- Compensation for vertical movements of the rig (crane angle).
  For some rigs or vessels the movements of the cranes, through the movements of the vessel or the rig, result in a big need for compensation. For the crane according to the present invention the compensation for the movement in the direction of the crane is achieved by applying a correction movement to the tower through a hydraulic cylinder which tilts said tower in a corresponding counter direction of the movements of the rig/ the vessel. A smaller vertical movement of the hook attachment point is thus achieved, and the traverser carriage path maintains its horizontal position.
- Compensation for the vertical movements of the movements of the supply vessel (hook); i.e. run the hook up and down to follow a moveable landing level. Compensation for relative movement between crane and supply vessel is made by controlling the velocity and the position of the winch. This is prior art technology when using hydraulic cylinders for extra hoisting/lowering movement (linear compensator), for hydraulically operated winches which are controlled both as to heave compensation and hoisting/lowering movement, as to electrically operated winches with frequency controlled asynchronous motors or permanent magnet motors.
- Controlling the hook position instead of crane movement. (Change of principle).
  The herein disclosed crane arrangement may, with its controlling options and dynamics, provide a new dimension as to possibilities for automating the lifting operations, and introduce a change of the user interface. It is feasible that the load is moved in a 3-dimensional virtual coordinate system and that the movements of the cranes are made in accordance with this.

[0009] In order to move a suspended load in the horizontal plane, a force has to be applied to the load in order to achieve acceleration and thus an increasing velocity. The force is achieved through the horizontal component of force of the inclined position of the hoist wire (the pendulum). The larger distance from the centre of gravity of the load and to the point of suspension on of crane, the more the point of suspension has to be moved in order to achieve a sufficient acceleration. A short pendulum is thus crucial for a fast movement of the load, and thus to fulfil the requirements of a safer load handling (cf. knuckle boom cranes).

[0010] In case of a large movement of the foundation (the rig or the vessel) of the crane, this will result in large vertical movements of the end of a long crane boom.

When the movements of the supply vessel are to be compensated , this has to be done by spooling in and out of the hoist winch. By compensating for the movements of the rig by introducing a counter movement of the tower of the crane, the crane boom will maintain its relative position as to the supply vessel, and thus reduce the required power of the hoist winch.

[0011] For a prior art offshore crane arrangement the load is generally lifted using single part in order to achieve a sufficient hoist velocity. When the working radius of the cranes is reduced, the load is also lifted if this is not compensated by spooling out of the hoist winch. This reduces net velocity and complicates combining of reduced range and at the same time a put down on deck. A similar problem arises when the working radius is to be increased during a lift. The result is that the load is often pulled across the surface of deck before it is finally lifted from the surface.

[0012] By introducing a substantially horizontal carriageway or path with a traverser carriage for suspension of the lifting wire, the hoisting velocity at horizontal movement of the hoisting point is maintained and the load can be lifted from the deck. The horizontal carriageway may, in accordance with the present invention, preferably also have a lateral movement in order to increase the reaction force during a pivotal movement. This may be required depending on the total rotary inertia of the crane.

When using a traverser carriage, as in accordance with the present invention, a double part is used above a spreader to which the hook is attached. Use of a spreader render possible a forced rotation of the load as the hook can be rotated by energy from the crane before landing on deck, which leads to safer working conditions. The crane arrangement of the applicant with its horizontal carriageway which can be lowered to a desired low position above the deck of a supply vessel, results in a relatively large force for rotating the load.

[0013] A non-limiting embodiment of the offshore crane according to the present invention is described in more detail in the following, with reference to the enclosed drawings in which

Fig. 1 is a perspective view of an offshore crane according to the invention,

Fig. 2 is an elevation view of the offshore crane of fig. 1, with the lifting boom arranged in an angle of 80°, and the traverser carriage boom horizontally arranged.,

Fig. 3 is an elevation view similar to Fig. 2, with the lifting boom arranged in an angle of 45°,

Fig. 4 is an elevation view similar to Figs. 2 and 3, with the lifting boom arranged in an angle of -10°, and

Fig. 5 is a top view of an offshore crane according to the invention, with the traverser carriage boom in a neutral or mid position indicated by solid lines and in two opposite lateral positions indicated by broken lines.

[0014] By referring to Figs. 1 - 5, there is shown an offshore crane 1 according to the invention comprising a base 2, a lifting boom 3 of which a first, proximal end is pivotally connected 5 to the base 2 and a second, distant end of which is pivotally connected 6 to a traverser carriage boom 4, said pivotal connections 5, 6 providing angular adjustment of the lifting boom 3 and the traverser carriage boom 4 in a substantially vertical direction. For the angular movement of the traverser carriage boom 4 and thus to make possible a substantial horizontal position of the traverser carriage boom 4, there is provided a first system of stays, struts and cables comprising a first stay 12 extending parallel to the lifting boom 3 along the length of the lifting boom 3 and which at its distal end is connected to a second stay 13. The second stay 13 is extending between the distal ends of a first strut 14 extending upwards in a variable angle from the distal end af the lifting boom 3 and a second strut 15 extending upwards in a second variable angle from a proximal end of the traverser carriage boom 4 at the pivotal connection 6. As shown in the figures, the struts 14, 15 preferably have a framework design. In the embodiment shown in the figures three cables 16 are arranged between three separate points along the length of the traverser carriage boom 4 and a single point at the distal end of the second strut 15, and which are tensioned by the weight of the traverser carriage boom 4 and any load to be lifted by means of the traverser carriage boom 4. An angular movement of an actuator 17 extending upwardly at the first pivotal connection 5 and which is connected to a proximal end of the first stay 12 thus results in an angular movement of the traverser carriage boom 4. In the embodiment shown in the figures, and by referring to Figs. 1 and 5, the stays 12, 13 are preferably arranged in respective parallel pairs. The angular movement of the lifting boom 3 is made by movement of a second system comprising a third stay 18 arranged between a top of a tower 19 of the crane 1 and a distal end of the lifting boom 3, and the operations of the first and second systems are coordinated, either manually or preferably by a common control system, in order to make sure that the traverser carriage boom is substantially horizontally arranged independently of the actual angle of the lifting boom 3, as shown in Figs. 2 - 4. As mentioned below, such a control system may also include heave compensation.

[0015] The traverser carriage boom 4 further comprises a traverser carriage 7 for suspension and lifting or lowering of a load and running back and forth along a length 8 of said traverser carriage boom 4, and thus providing off lead compensation.

The pivotal connection 6 between the traverser carriage boom 4 and the lifting boom 3 also provides angular adjustment in a lateral direction, preferably in an angle of 15° in both directions from a neutral or mid position, thus

providing side lead compensation. The present invention thus provides an area of movement instead of just a line of movement as for prior art offshore cranes.

[0016] As to the above paragraph, the terms "side lead" and "off lead" are well known in the art, and are used for describing deviations in the longitudinal and the lateral direction of a crane, respectively.

[0017] As shown in the figures, the lifting boom 3 preferably has a tubular design but could also have a framework design.

[0018] As also shown in the figures, the traverser carriage boom 4 has a framework design, which is preferably made of aluminium in order to achieve a lightweight construction, und thus lower mass forces and a faster movement.

[0019] As shown in Figs. 1 - 4 a double part 9 is preferably provided above a spreader 10 to which a hook 11 is attached. Even though not shown in the figures, a heave compensation system comprising a software controlled hydraulic system with on or several hydraulic cylinders is preferably provided in order to control the position of the traverser carriage boom 4 to be substantially horizontal.

[0020] There may also be provided a further or alternative compensation system for relative movement between crane and supply vessel by controlling the velocity and the position of a winch in order to run the hook up and down to follow a moveable landing level caused by said relative movements.

[0021] According to the invention there is also provided a method of operating an offshore crane as described above, comprising the step of pivoting the traverser carriage boom 4 in a lateral direction.

[0022] In the embodiment of the invention shown in the drawings the winch of the traverser carriage 7 is the only load hoisting means. However, in another feasible embodiment a separate winch may be provided at the distal end of the lifting boom 3 for heavy lifts, while the traverser carriage winch is mainly for fast execution of lighter lifts.

Claims

1. An offshore crane (1) comprising a base (2), a lifting boom (3) of which a first, proximal end is pivotally connected (5) with the base (2) and a second, distant end of which is pivotally connected (6) with a traverser carriage boom (4), said pivotal connections (5, 6) providing angular movement of the lifting boom (3) and the traverser carriage boom (4) in a substantially vertical direction, said traverser carriage boom (4) further comprising a traverser carriage (7) for suspension and lifting or lowering of a load and running back and forth along a length (8) of said traverser carriage boom (4), **characterized in that** the pivotal connection (6) between the traverser carriage boom (4) and the lifting boom (3) also provides angular movement of the traverser carriage boom (4) in a lateral direction.

2. An offshore crane according to claim 1, **characterized in that** the lifting boom (3) has a tubular design.

3. An offshore crane according to claim 1, **characterized in that** the lifting boom (3) has framework design.

4. An offshore crane according to any of the preceding claims, **characterized in that** traverser carriage boom (4) has a framework design, and preferably is made of aluminium.

5. An offshore crane according to any of the preceding claims, **characterized in that** a double part 9 is provided above a spreader (10) to which a hook (11) is attached.

6. An offshore crane according to any of the preceding claims, **characterized by** a heave compensation system to control the position of the traverser carriage boom (4) to be substantially horizontal.

7. An offshore crane according to claim 5 or 6, **characterized by** a compensation system for relative movement between the crane (1) and a supply vessel by controlling the velocity and the position of a winch in order to run the hook (11) up and down to follow a moveable landing level caused by said relative movements.

8. A method of operating an offshore crane (1) according to any of the preceding claims, **characterized by** the step of pivoting the traverser carriage boom (4) in a lateral direction.

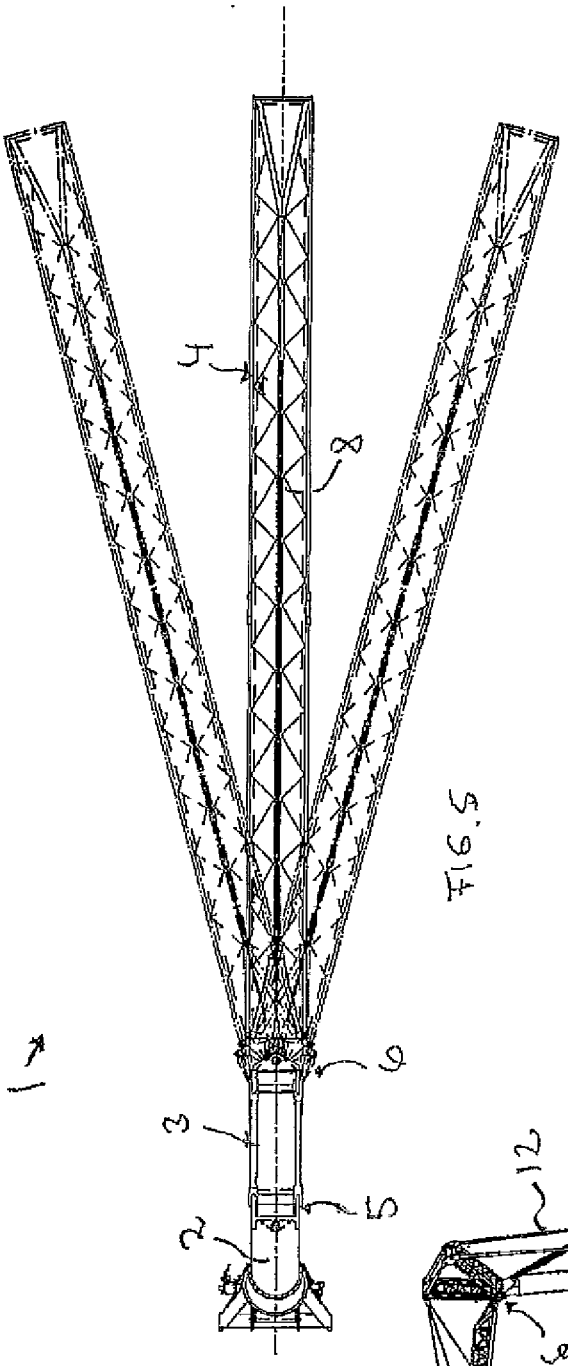


FIG. 5

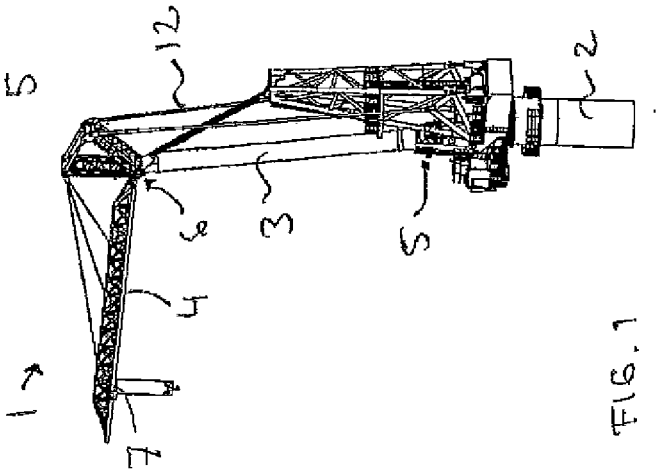


FIG. 1

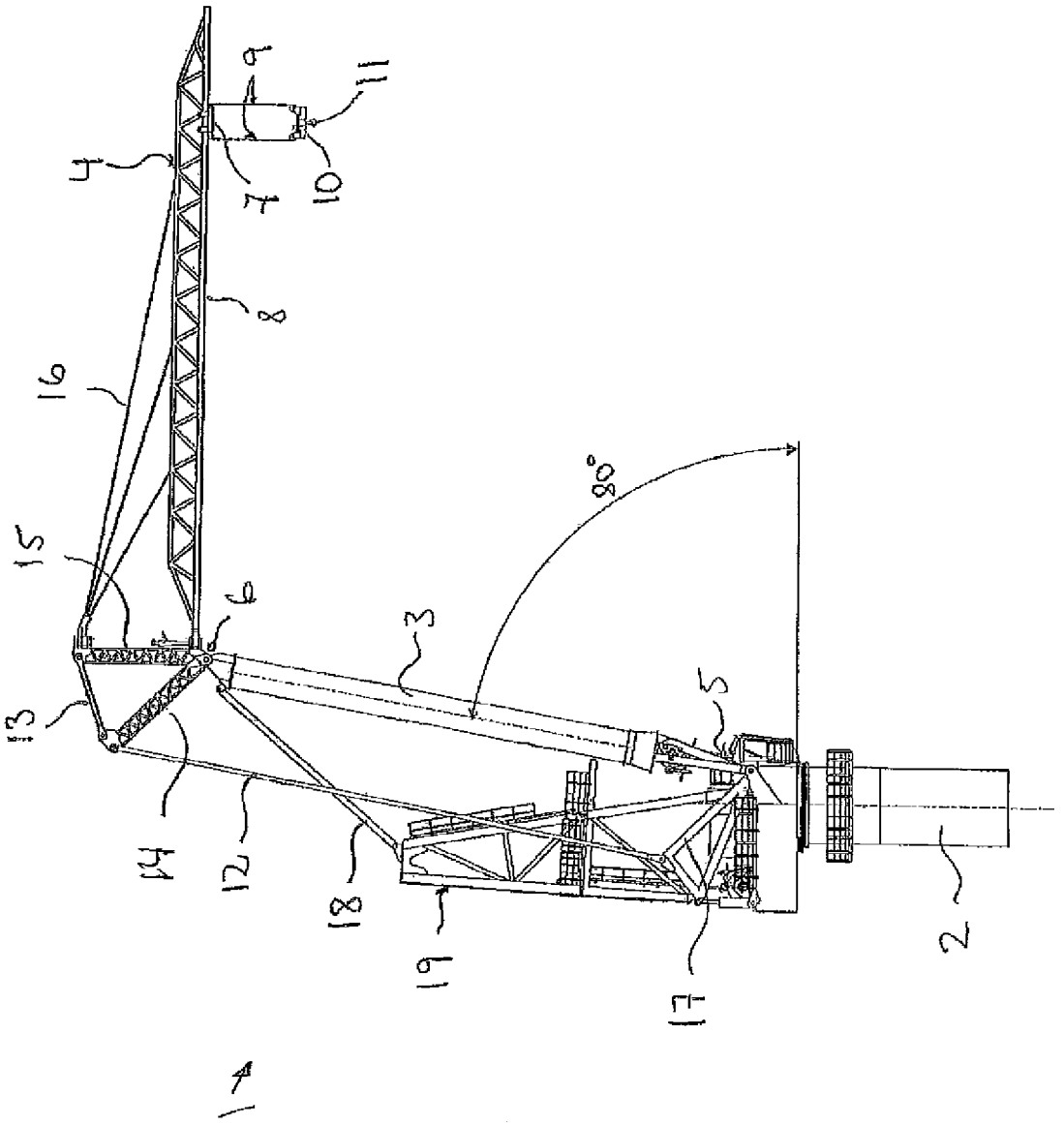


FIG. 2

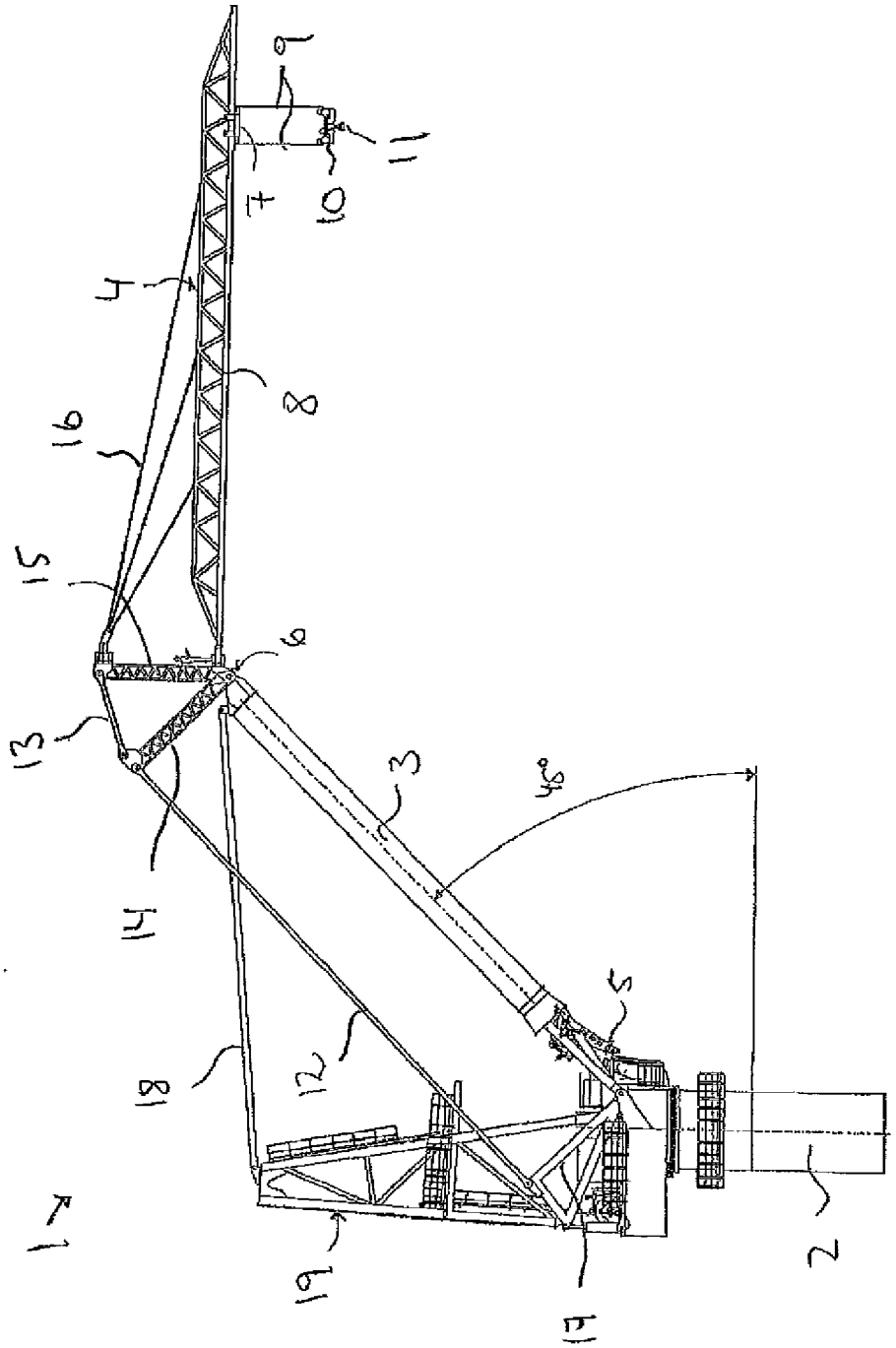


FIG. 3

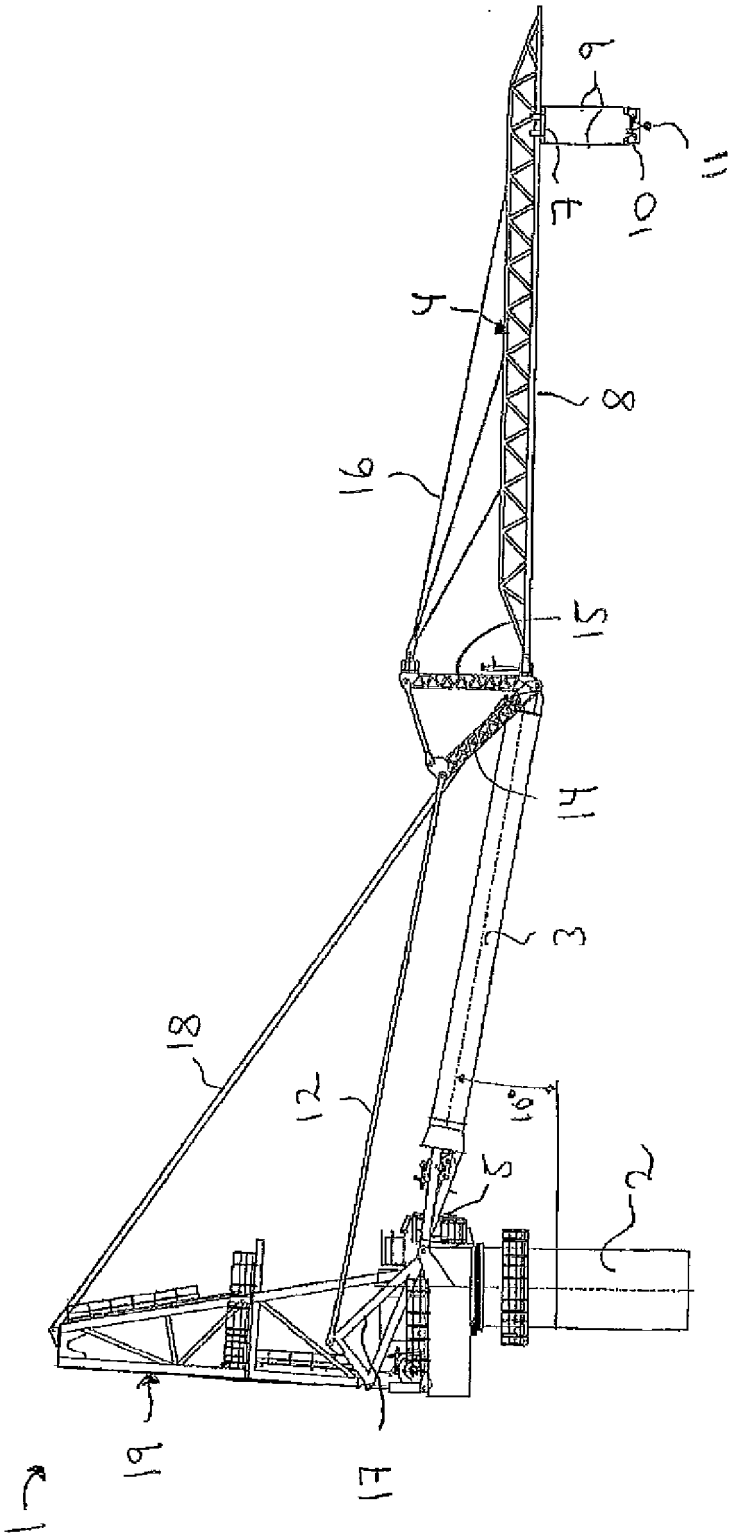


Fig. 4

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 09 17 7868

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	DE 27 34 960 A1 (HOCHTIEF AG HOCH TIEFBAUTEN) 15 February 1979 (1979-02-15) * figures *	1-8	INV. B66C23/18 B66C23/52 B66C23/64
A	NL 7 509 722 A (FERRANTI LTD) 19 February 1976 (1976-02-19) * figures 8,9 *	1-8	
A	DE 26 23 151 A1 (SAUTHOF HEINRICH DIPL ING) 1 December 1977 (1977-12-01) * figures *	1	
A	EP 0 838 562 A1 (PUTZMEISTER AG [DE]) 29 April 1998 (1998-04-29) * abstract; figure 1 *	1	
A	DE 32 36 510 A1 (ELBA WERK MASCHINEN GMBH & CO [DE]) 5 April 1984 (1984-04-05) * abstract; figures * * page 5 - page 9 *	1	

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	29 March 2010	Verheul, Omiros

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 09 17 7868

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-03-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2734960 A1	15-02-1979	NONE	
NL 7509722 A	19-02-1976	AR 210863 A1	30-09-1977
		AU 8395175 A	03-03-1977
		BR 7505280 A	03-08-1976
		DE 2536694 A1	04-03-1976
		DK 371375 A	18-02-1976
		ES 440298 A1	16-06-1977
		FI 752323 A	18-02-1976
		FR 2282398 A1	19-03-1976
		IT 1044417 B	20-03-1980
		JP 51076758 A	02-07-1976
		NO 752850 A	18-02-1976
		SE 7509208 A	19-02-1976
DE 2623151 A1	01-12-1977	NONE	
EP 0838562 A1	29-04-1998	DE 19644412 A1	30-04-1998
DE 3236510 A1	05-04-1984	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- DE 2734960 A1 **[0003]**
- GB 2234728 A **[0004]**