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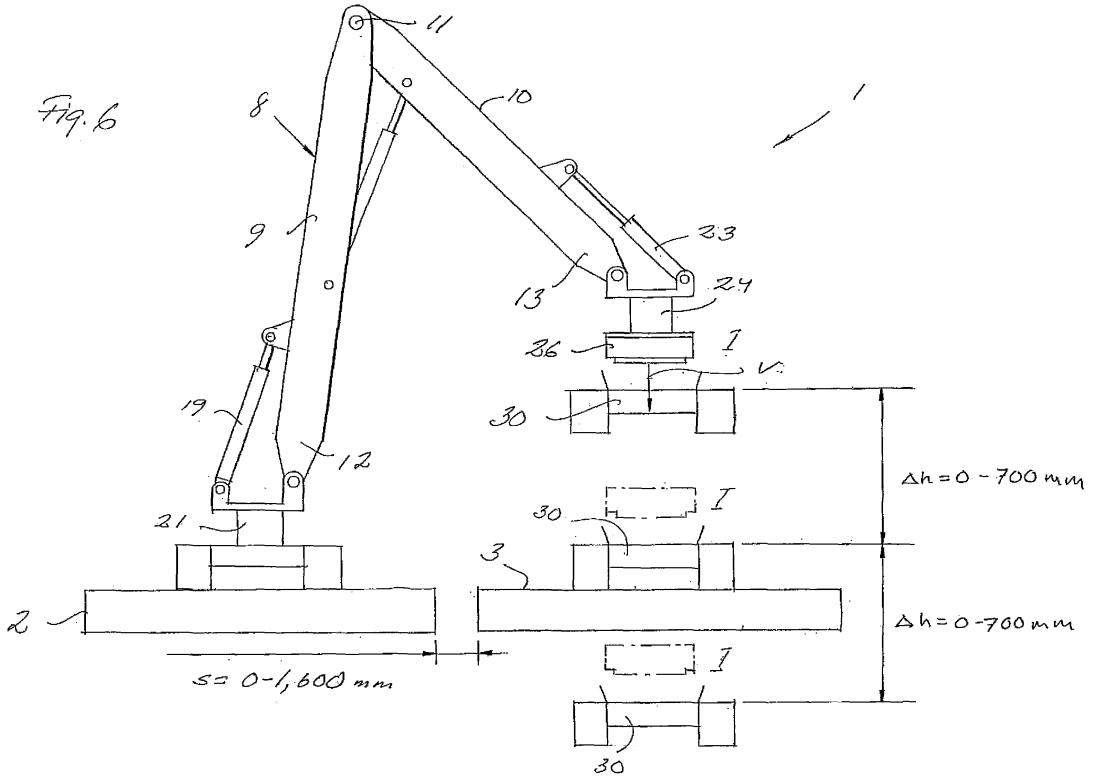
(54) **Spreader assembly and positioning means**

(57) The invention refers to a positioning means in a spreader assembly, the positioning means comprising an articulated arm (8), a first end (12) of which is connected to a primary spreader frame (2) and a second end (13) of which is selectively connectable to a secondary spreader frame (3), wherein the first and second arm ends connect pivotally in horizontal planes of the associated spreader frames as well as in vertical planes intersecting a longitudinal axis of each primary and secondary spreader frames. According to the invention, the second arm end (13) is selectively connectable and non-connectable, respectively, to a seat (30) mounted on the secondary spreader frame (2), the seat having an insert or connecting end facing upwards from the spreader frame, and the second arm end carrying means mating with the seat in result of a driven and remotely controlled, vertical or substantially vertical downward movement of the second arm end upon connection.



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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a spreader assembly, and more specifically to a spreader assembly comprising a positioning means by which the relative position between two spreaders are controllable in tandem lift operations.

BACKGROUND AND PRIOR ART

[0002] The spreaders referred to are commonly used in ports and freight yards for shifting containers to and from transport vehicles, such as between ships and shore. The spreader typically comprises a frame work carrying in its lower side locking means arranged in pairs, and by which the spreader is detachably connectable to the top side of the container. The spreader is controlled in lifting/lowering operations through crane cables that run through idling sheaves supported on the upper side of the spreader. The spreader frames may be telescopically extendable/retractable and this way adapted for optionally handling one 20-45 feet container in single lift operations, or two 20-feet containers concurrently in end facing relation during a twin lift operation.

[0003] In tandem lift operations, two containers (or 2 plus 2 containers, if applicable) are handled simultaneously in side by side relation. For this purpose spreaders are known to be convertible from a single lift mode to a tandem lift mode. Another approach to tandem lift operations comprises dual spreader frames separately supported from a crane and individually controlled through separate cable-drives in lifting/lowering movements. When the two spreader frames are concurrently operated in tandem lift, positioning means are activated and operative to control the relative position between the spreaders in order to avoid collision caused by swinging and in order to allow the simultaneous lowering of the two spreaders into the load space of a container ship, e.g. A positioning means which is previously known comprises an arm, one end of which is supported on a first spreader frame, and extendable telescopically for docking with its other end in a seat supported on a second spreader frame. In connected position, the arm spans the lateral distance from side to side of the horizontally spaced and interconnected spreader frames. The structure allows a small misalignment in the spreader relation due to some degree of pivoting in the arm-to-spreader connections, but the structure is vulnerable in cases of greater displacements in space which may cause damage to the arm-to-spreader connections. The structure also suffers from a cumbersome connecting of the positioning arm, requiring for example a rather accurate horizontal leveling of the spreader frames upon connection which typically involves ground personnel to guide the crane operator in the connecting procedure.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to provide a positioning means in a spreader assembly that avoids the drawbacks recited above, and by which interconnection of spreader frames in tandem lift operations is simplified and practicable without assistance from ground personnel and wherein an accurate leveling of the spreader frames is not critical for activation of the positioning means.

[0005] Another object is to provide a positioning means structured to allow greater displacements in space between the dual spreader frames in interconnected relation.

[0006] Still another object is to provide a positioning means that is less vulnerable to displacements powered by cable-drives and gravity acting on the payload.

[0007] Yet another object is to provide a positioning means that is operable selectively for controlling a relative position between interconnected spreader frames in a horizontal plane, while disregarding displacements in the vertical planes.

[0008] Some or several of these and other objects are met in a positioning means as specified in accompanying claims, the subordinated ones of which define advantageous realizations of the invention.

[0009] Briefly, the present invention provides a positioning means in a spreader assembly, the positioning means comprising an articulated arm, a first end of which is connected to a primary spreader frame and a second end of which is selectively connectable to a secondary spreader frame, wherein the first and second arm ends connect pivotally in horizontal planes of the associated spreader frames as well as in vertical planes intersecting a longitudinal axis of each primary and secondary spreader frames. The positioning means is characterized in that the second arm end is selectively connectable and non-connectable, respectively, to a seat mounted on the secondary spreader frame, the seat having an insert or connecting end facing upwards from the spreader frame, and the second arm end carrying means mating with the seat in result of a driven and remotely controlled, vertical or substantially vertical downward movement of the second arm end upon connection.

[0010] Advantageous embodiments of the invention include, e.g.:

a connecting means carried in the second arm end and comprising a latch mechanism which is driven and remotely controlled for engagement and disengagement, respectively, with the seat;

the first arm end is connected to a top side of the primary spreader frame, and the second arm end is selectively connectable to a seat mounted on a top side of the secondary spreader frame, wherein specifically, the first and second arm ends both connect to a longitudinal center of the associated spreader

frame;

at least one of said first and second arm ends is pivotally connected about mutually perpendicular horizontal axes and in transversely intersecting vertical planes of the associated spreader frame;

the first arm end is connected to the seaside spreader frame in the spreader assembly, as viewed from a crane operator;

drive means for articulation of the arm, drive means for pivoting the arm and drive means for connection/disconnection of the second arm end, are all powered and controlled from the primary spreader frame;

position detecting means mounted on the spreader frames, and a control unit controlling drive means effective for activating the articulated arm in response to a detected relative position between the spreader frames;

position detecting means mounted on the articulated arm, the control unit controlling the articulated arm to move the second arm end to a start position (I) above the seat which is determined from the detected relative position between the articulated arm and the secondary spreader frame, and to move the second arm end downwards from the start position to the seat upon connection;

the articulated arm comprises inner and outer arm sections (9,10) pivotally connected and articulated through the operation of linear drive units to the extent that a start position above the seat is attainable at a maximum detected difference in height between the spreader frames of at least +/- 300 mm, preferably at a detected height difference of at least +/- 500 mm, and most preferred at a detected height difference of at least +/- 700 mm between the primary and secondary spreader frames, in result of chosen lengths of the arm sections and stroke lengths of the linear drive units.

[0011] Even further details and advantages will appear from the following description.

BRIEF DESCRIPTION OT THE DRAWINGS

[0012] The invention will now be further explained below in relation to the drawings, diagrammatically illustrating an embodiment of the invention. In the drawings,

Fig. 1 is a perspective view of a spreader assembly comprising a positioning means according to the invention in a tandem lift operation;

Fig. 2 is a partial detail view showing primary and secondary spreader frames in non-connected position for single lift operation;

Fig. 3 is a partial detail view of the area of connecting between the positioning means and a primary spreader frame included in the spreader assembly of fig. 1;

Fig. 4 is a corresponding partial detail view of the area of connecting between the positioning means and a secondary spreader frame included in the spreader assembly of fig. 1;

Fig. 5 is a view from below of the connecting area shown in fig. 4;

Fig. 6 is a simplified diagram illustrating possible relative positions and connecting procedure upon interconnecting of the primary and secondary spreader frames through the positioning means of the present invention;

Figs. 7a-7d are end views showing the spreader assembly in tilted relation in a plane transversely to the longitudinal;

Fig. 8 is an elevation view showing the spreader assembly in tilted relation in a longitudinal plane;

Figs. 9a-9d are end views showing the spreader assembly in non-leveled relation;

Fig. 10 is a view from above showing the spreader assembly in a horizontally skewed relation, and

Fig. 11 is a perspective showing the spreader assembly in a longitudinally shifted relation.

DETAILED DESCRIPTION OF THE INVENTION

[0013] As used herein, any reference made to the horizontal and vertical shall be understood in relation to a spreader frame that is balanced and parallel to the flat and leveled ground. Also, any reference to the longitudinal and transversal shall be understood as referring to the longitudinal and transverse axes of the spreader frames included in the assembly.

[0014] With reference to fig. 1 a spreader assembly 1 is shown, comprising a primary spreader frame 2 and a secondary spreader frame 3. Each primary and secondary spreader frames 2 and 3 typically carries a superstructure or head-block 4 and 5, respectively. In the following, the expression "spreader frame" shall be understood as referring to the subject spreader structure with or without such superstructure or head-blocks. Cable sheaves 6 attach each spreader frame individually to separate cable drives in a crane, via cables 7. Through the cable drives, controlled by a crane operator, the pri-

mary and secondary spreader frames are controllable in lifting and lowering movements, separately in single lift operations or in pairs in tandem operations as desired. The spreader frames 2,3 may be conventionally equipped and controllable for connecting/disconnecting to different sized containers in a manner well known to the person skilled in the art, and will therefore not be further explained in these well known aspects.

[0015] In tandem lift operations as illustrated in fig. 1, at least one articulated arm 8 is selectively operable for controlling the relative position between primary and secondary spreader frames 2 and 3. In the following, reference is made to a singular arm 8 even though, and appreciated by the person skilled in the art from the teachings learned from this disclosure, two similarly structured arms 8 may equally serve as positioning means in the spreader assembly.

[0016] With reference made also to fig. 2, showing the spreader frames in non-connected relation, the articulated arm 8 comprises an inner arm section 9 pivotally connected to an outer arm section 10 via a hinged joint 11. A first end 12 of the arm 8 is connected to the primary spreader frame 2, or to the superstructure 4 thereof as the case may be. A second end 13 of the arm 8 is selectively connectable and non-connectable, respectively, to the secondary spreader frame 3, or to the superstructure 5 thereof if appropriate. In connected position, illustrated in fig. 1, both first and second arm ends 12, 13 connect pivotally in horizontal planes of the associated spreader frames as well as in vertical planes intersecting a longitudinal axis of the associated primary and second spreader frames.

[0017] With reference made to fig. 3, the first end 12 of the articulated arm 8, which may be permanently connected or detachably connectable to the primary spreader frame 2, pivots in a horizontal plane about a vertical axis 14 and in a vertical plane about a horizontal axis 15. Likewise, with reference made to fig. 4, the second arm end 13 in connected position pivots in a horizontal plane about a vertical axis 16 and in a vertical plane about a horizontal axis 17.

[0018] Articulations of the arm 8, as well as pivoting of the arm in the horizontal and vertical planes, are driven and controlled through linear drive means such as the hydraulic piston/cylinder-units shown in the illustrated embodiment, or by equivalent linear drives.

[0019] Thus, a first cylinder 18 visible in figs. 1-2 operates between the inner and outer arm sections for extension/retraction of the articulated arm 8. Wt reference made to fig. 3, a second cylinder 19 is effective for lifting/lowering the articulated arm 8 in a vertical plane about the horizontal pivot axis 15, said second cylinder 19 operating between the inner arm section 9 and an arm connection 20 attaching the first arm end 12 to a pivot bearing 21 supported on the primary spreader frame 2. A third cylinder 22 operates between the arm connection 20 and the primary spreader frame for pivoting the arm in the horizontal plane, about the vertical pivot axis 14 of the pivot bearing 21. Pivoting movements at the second arm end 13 are correspondingly powered and controlled as will be explained by reference made to fig. 4: a fourth cylinder 23 operates between the outer arm section 10 and an arm connection 24 attaching the second arm end 13 to a pivot bearing 25 supported on a connecting means 26 which is carried in the second arm end and connectable, as will be further described below, to the secondary spreader frame 3. The fourth cylinder 23 is effective for pivoting the articulated arm in a vertical plane about the horizontal pivot axis 17. A fifth cylinder 27 operates between the arm connection 24 and the connecting means 26 for pivoting the articulated arm in a horizontal plane, about the vertical pivot axis 16 of the pivot bearing 25.

[0020] In addition, at least one tilt cylinder such as a sixth cylinder 28 visible in fig. 3, is arranged and operative for tilting the articulated arm 8 in a vertical tilt plane transversally intersecting the vertical pivot plane, about a horizontal tilt axis 29 perpendicular to the horizontal pivot axis 15. In the illustrated embodiment, the tilt axis 29 constitutes a hinged connection between pivotally connected upper and lower members of the arm connection 20 for the first arm end 12. A tilt function may additionally, or alternatively, be correspondingly arranged through a hinged arm end connection 24 for the second arm end 13.

[0021] As previously mentioned the second arm end 13 carries a connecting means 26 by which the primary and secondary spreader frames can be interconnected in tandem lift operations. The connecting means 26 is operative for connection/disconnection of the second arm end to a seat 30 mounted on the secondary spreader frame, or when appropriate onto its superstructure 5, in fig. 2 illustrated in a disconnected mode and in figs. 4 and 5 illustrated in connected modes, respectively.

[0022] The seat 30 is formed with an upwards facing insert or/and connecting end, by which the connecting means 26 is receivable upon connection in a downwards movement of the second end 13 of the articulated arm, as illustrated in fig. 6. In the seated position thus attained through a substantially vertical interconnecting movement of the second arm end 13, a latch mechanism 31 of the connecting means is operable to arrest the connecting means in a lower end of the seat as illustrated in fig. 5, remote from seat's insert end.

[0023] "Substantially vertical" as used herein should be understood as referring to a movement, the major component of direction of which is vertical and not horizontal, and which at least partially includes a true vertical movement downwards to the seat of a spreader frame which is balanced and leveled with the ground.

[0024] In the shown embodiment, the latch mechanism 31 comprises first and second latches 32 and 33 which are driven through a lock cylinder 34 to slide in opposite directions in guides 35 arranged on the connecting means 26. In locked position, the latches 32, 33 engage a lower side of the seat remote from the insert end, while a flange formation 36 on the connecting means abuts a shoulder 37 formed at the insert end of the seat.

[0025] Preferably, the first and second ends of the articulated arm attaches in connected position to the top sides of the two spreader frames or to the top sides of the superstructures 4 and 5 thereof, respectively, and in a singular arm embodiment preferably at the longitudinal centers of the primary and secondary spreader frames, or the superstructures thereof.

[0026] In any case, regardless of point of attachment with the subject spreader frame, the seat 30 is mounted thereto with its insert or/and connecting end facing upwards, thereby able to receive the second end of the articulated arm through the vertical or substantially vertical connection movement of the second arm end as recited above. The arrangement of a seat 30 which is connectable through the downwards movement of the arm end ensures a stable and accurate mating between seat and arm end, while the weight of the spreader hanging in the crane cables provides a favorable counter support which is lacking in a structure relying on a horizontal connecting movement.

[0027] Also preferred, the primary spreader attaching the first end 12 of the articulated arm is chosen to be the seaside spreader, that is the remote spreader as viewed from the crane operator. This way, the operator will have full visibility in the connecting operation.

[0028] Especially advantageous, the drive means for articulation and pivoting of the arm, as well as the lock cylinder that connects/disconnects the second arm end to the secondary spreader, are all driven and controlled via the primary spreader in a preferred embodiment. In other words, hydraulic power is supplied via the primary spreader to all drives controlling the movements and connection of the articulated arm 8, and operator control is remotely performed via control logic and hydraulic medium valves carried on the primary spreader. However, though less preferred, the teachings provided herein would also be applicable in embodiments where at least one of power, control logic, drive means and connecting structures, such as the pivot bearing 25 and latch mechanism 31, e.g., are located on the secondary spreader in the alternative.

[0029] The articulated arm 8 is operable via the control logic for controlling the relative position of the primary and secondary spreader frames in a horizontal plane, while disregarding displacements in vertical planes powered by cable-drives and gravity acting on the payload. Thus, the arm is operative through the activation of corresponding drive means mentioned above to control the horizontal spacing between the spreader frames notwithstanding a transverse tilt as illustrated in figs. 7a-7d, or a longitudinal tilt as illustrated in fig. 8 (by pivoting about the at least one tilt axis 29). Likewise, the arm is operable under non-leveled conditions wherein a height difference prevails between the spreader frames, as illustrated in figs. 9a-9d, as well as under conditions of longitudinal shift as illustrated in fig. 11. Also in conditions of skewing, illustrated in fig. 10, the articulated arm is controllable for positioning the spreader frames with respect to the horizontal distance between the spreader frames.

[0030] In a practicable realization of the invention, the positioning means is designed with respect to freedom of pivoting and arm length to accommodate a lateral separation s between spreader frames of at least 1,600 mm, in leveled as well as tilted or shifted conditions. Also, the illustrated embodiment is operable at height differences Ah of at least +/- 700 mm at zero spacing and of at least +/- 300 mm at 1,600 mm spacing.

[0031] The versatile operability of the positioning means of the present invention, i.e. the articulated arm, its pivots and drives, is achievable and provided through a corresponding power control of the drives. More precisely, the positioning means is controlled by the control logic to a non-powered condition in displacements governed by the cable-drives and gravity, setting the articulated arm and subject drive means into a free-floating condition in which the arm freely pivots about the corresponding pivot axes. Simultaneously, the drive means operable for extension/retraction and for corresponding pivoting of the articulated arm are selectively powered, effecting control and adjustment of the horizontal spacing between spreader frames. Load detection and overload protection may be provided through load and pressure sensors arranged on cylinders, as known per se, and readings of the sensors are processed through the control logic for shifting corresponding drives between powered and non-powered modes. This way, the positioning means structured as disclosed is made durable and less vulnerable to displacements caused by loads that are too high to be counteracted by available power of drive means and structural design of the articulated arm.

[0032] Upon interconnecting the primary and secondary spreader frames, the articulated arm 8 is controlled and powered to move the second arm end 13 to a start position above the seat 30, from which position the connecting means 26 carried in the arm end is descended to match with the seat. In order to secure a successful mating with the seat, guides 38 may be arranged at the insert end of the seat as illustrated in figs. 2 and 4, e.g. The start position I is illustrated in fig. 6 which is a simplified diagram wherein details are omitted for clarity. The start position I is determined from a detected relative position between the spreader frames, indicative for the relative position between the seat 30 and the articulated arm 8. To this purpose, optical or sound operated position detection means are arranged on the spreader frames. Position detectors are notoriously applied in purpose of spreader control and well known to persons skilled in the art of spreader design, and for this reason need no further explanation herein. Based on the readings of the position detectors, the control logic governs the arm through activation of corresponding drive units for extension/retraction and for pivoting about the horizontal and vertical axes, in result of which the second arm end 13 and connecting means 26 supported therein are moved to the start position I above the seat 30. Primarily, the horizontal distance s and longitudinal shift is required to determine

the start position, essentially vertically above the seat. It will be understood, that the start position I is not necessarily a fixed position but rather an elevated position above the seat, as indicated by broken lines in fig. 6. The subject posture of the arm may be continuously monitored through linear detectors arranged on the cylinders, e.g., continuously detecting the length of extension of cylinder pistons as is a well known technology applied to hydraulic cylinders. By the appropriate choice of arm geometry, i.e. lengths of arm sections 9 and 10, stroke lengths of linear drives and freedom of pivoting about horizontal and vertical axes, a start position I above the seat 30 is attainable at detected maximum differences Δh in height between the spreader frames of at least +/- 300 mm at a lateral spacing s of 1,600 mm, preferably at a detected height dif ference of at least +/- 500 mm at lesser lateral spacing, and most preferred at a detected height difference of at least +/- 700 mm between the primary and secondary spreader frames at zero lateral spacing, as has proven available in the illustrated embodiment. From that start position, the connecting means is lowered for mating with the seat in a vertical or substantially vertical descending motion V which is terminated upon mating contact, detectable through electrical switches, optic/sound sensors, or load sensing detectors on the subject drive means, e.g.

[0033] In result of a perfect leveling of the spreader frames not being critical upon connection, interconnecting is simplified and practicable without assistance from ground personnel and possible through an approximate leveling controlled by the crane operator alone.

[0034] Though illustrated by example, the person skilled in the art will appreciate that the details and features disclosed applied separately or in other combinations will still add to the solution defined in independent claims.

Claims

1. A positioning means in a spreader assembly, the positioning means comprising an articulated arm (8), a first end (12) of which is connected to a primary spreader frame (2) and a second end (13) of which is selectively connectable to a secondary spreader frame (3), wherein the first and second arm ends connect pivotally in horizontal planes of the associated spreader frames as well as in vertical planes intersecting a longitudinal axis of each associated primary and secondary spreader frames, **characterized in that**

   - the second arm end is selectively connectable and non-connectable, respectively, to a seat (30) mounted on the secondary spreader frame;
   - the seat having an insert or connecting end facing upwards from the spreader frame, and
   - the second arm end carrying means mating with the seat in result of a driven and remotely controlled, vertical or substantially vertical downward movement of the second arm end upon connection.

2. The positioning means of claim 1, wherein connecting means (26) carried in the second arm end comprises a latch mechanism (31) which is driven and remotely controlled for engagement and disengagement, respectively, with the seat (30).

3. The positioning means of claim 1 or 2, wherein the first arm end (12) is connected to a top side of the primary spreader frame (2), and the second arm end (13) is selectively connectable to a seat (30) mounted on a top side of the secondary spreader frame (3).

4. The positioning means of any of claims 1 to 3, wherein the first and second arm ends (12; 13) both connect to a longitudinal center of the associated spreader frame (2; 3).

5. The positioning means of claim 1, wherein at least one of said first and second arm ends (12; 13) is pivotally connected about mutually perpendicular horizontal axes (15; 29) and in transversely intersecting vertical planes of the associated spreader frame.

6. The positioning means of any of claims 1 to 5, wherein the first arm end (12) is connected to the seaside spreader frame (2) in the spreader assembly, as viewed from a crane operator.

7. The positioning means of any of claims 1 to 6, wherein drive means (18; 19; 23) for articulation of the arm, drive means (22; 27; 28) for pivoting the arm and drive means (34) for connection/disconnection of the second arm end, are all powered and controlled via the primary spreader frame (2).

8. The positioning means of any of claims 1 to 7, comprising position detecting means mounted on the spreader frames, and a control unit controlling drive means effective for activating the articulated arm in response to a detected relative position between the spreader frames.

9. The positioning means of claim 8, wherein position detecting means are mounted on the articulated arm, the control unit controlling the articulated arm to move the second arm end with connecting means to a start position (I) above the seat which is determined from the detected relative position between the articulated arm and the secondary spreader frame, and to move the second arm end downwards from the start position to mate with the seat upon connection.

10. The positioning means of claim 9, wherein the articulated arm comprises inner and outer arm sections (9,10) pivotally connected and articulated through the operation of linear drive units (18; 19; 23) to the extent that a start position above the seat is attainable at a maximum detected difference in height (h) between the spreader frames of at least +/- 300 mm, preferably at a detected height difference of at least +/- 500 mm, and most preferred at a detected height difference of at least +/- 700 mm between the primary and secondary spreader frames, in result of chosen lengths of the arm sections and stroke lengths of the linear drive units.

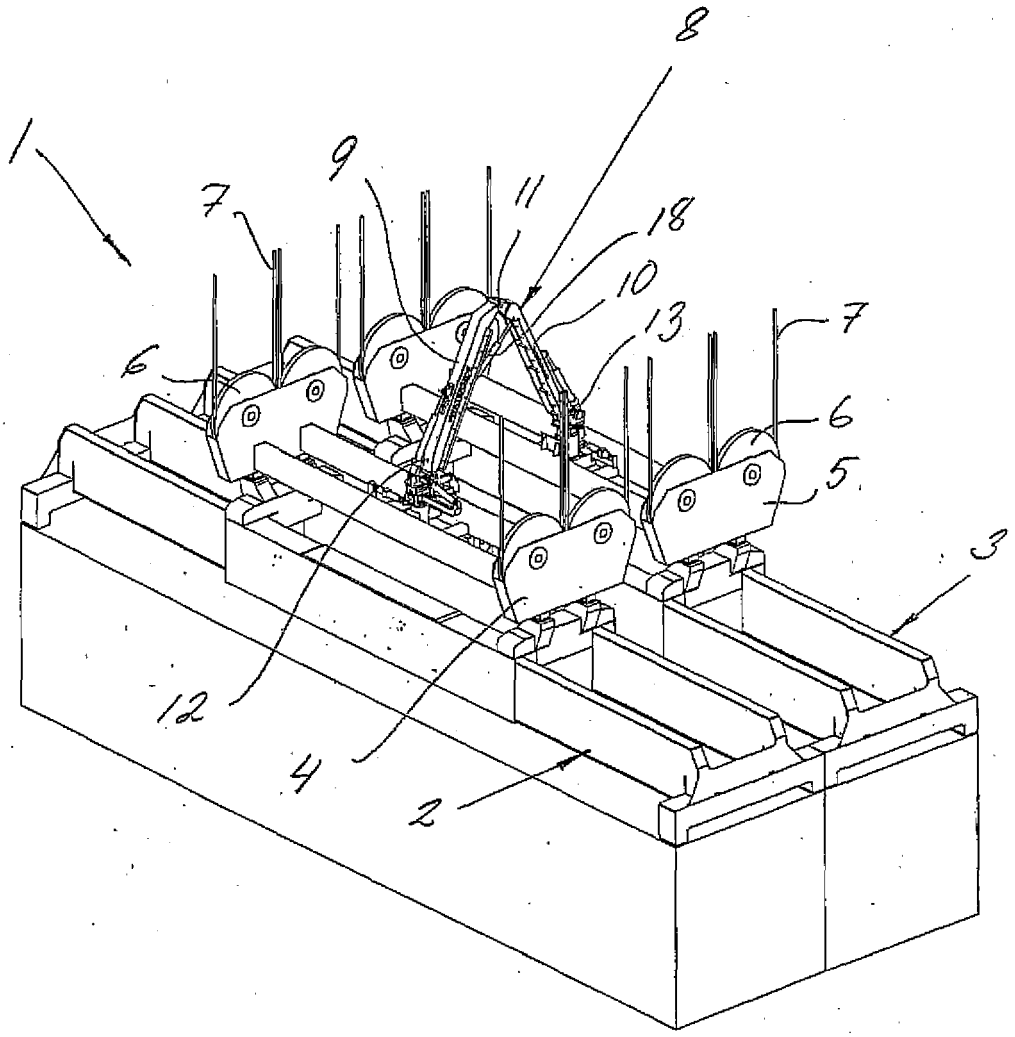

Fig. 1

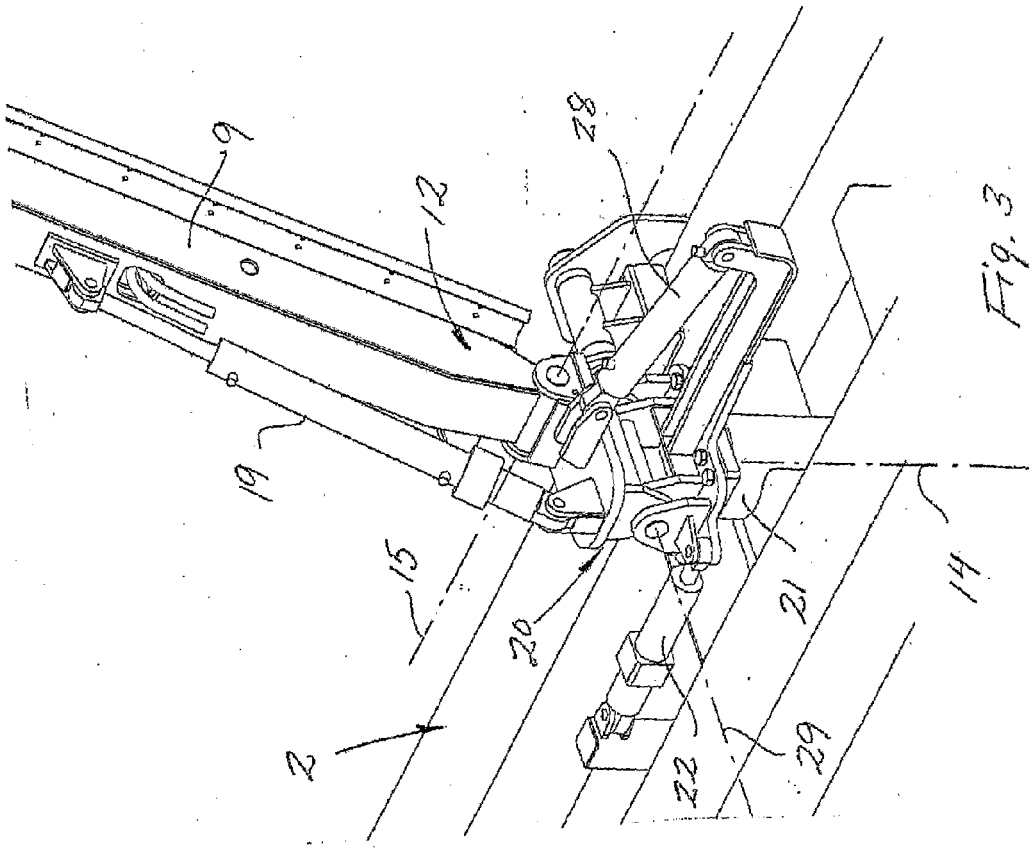

Fig. 3

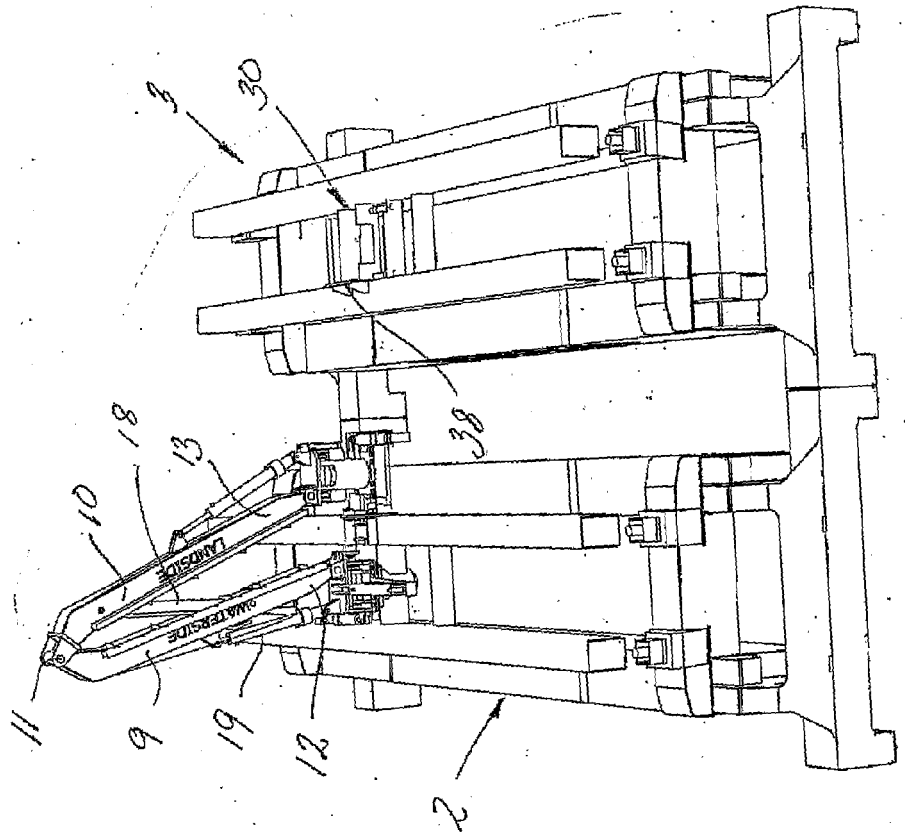

Fig. 2

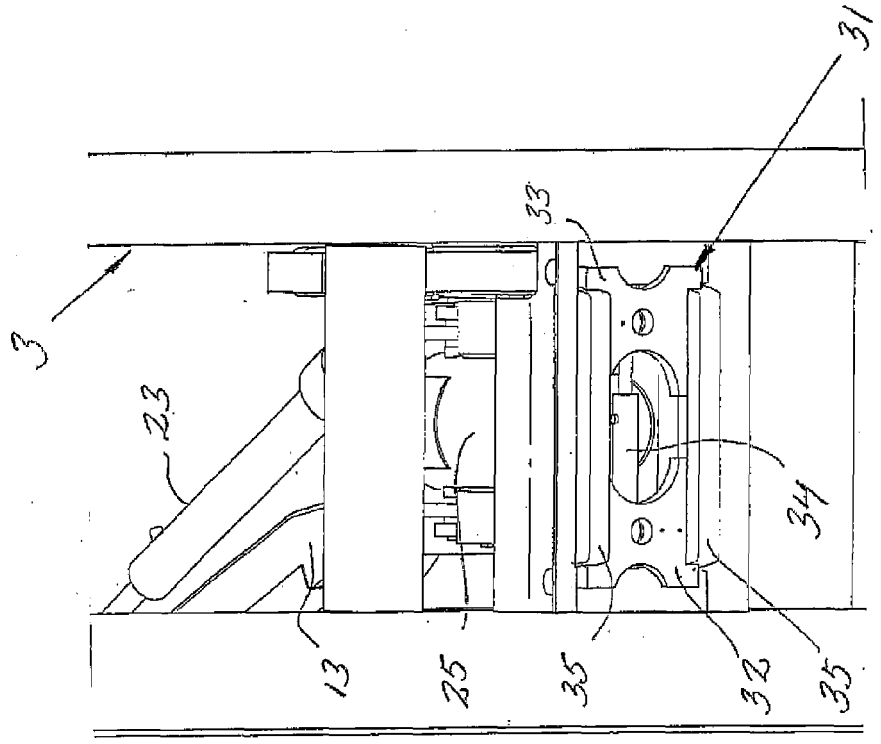

Fig. 5

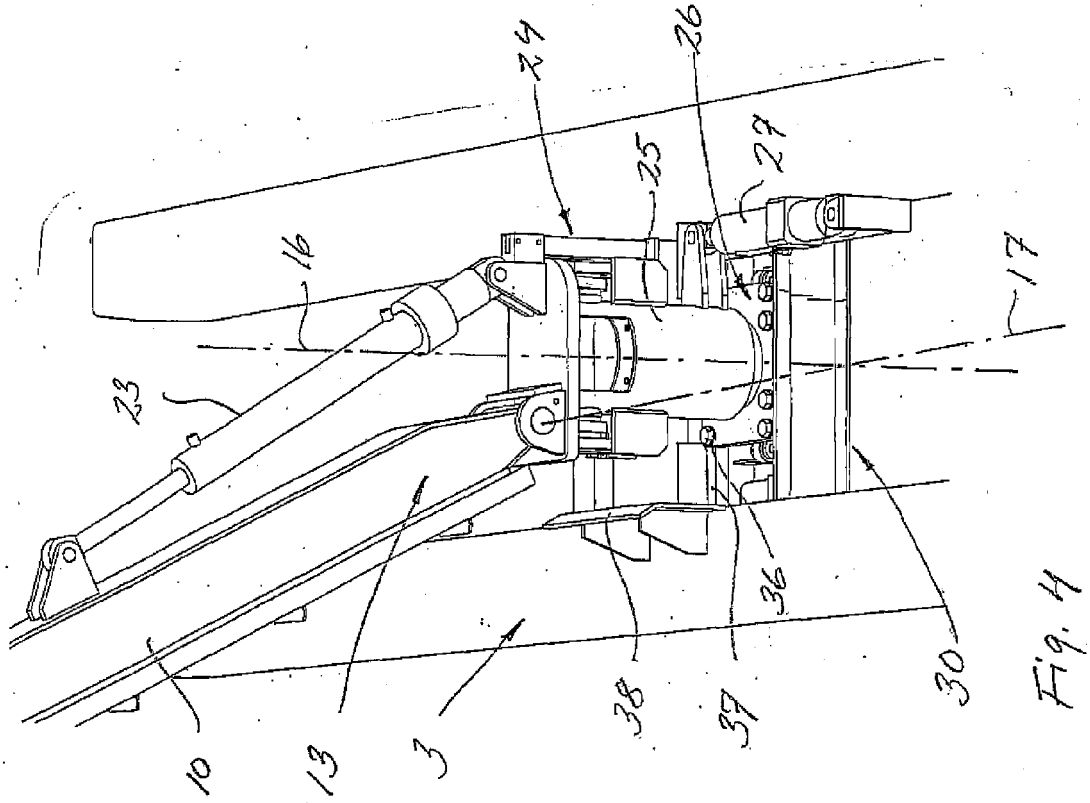

Fig. 4

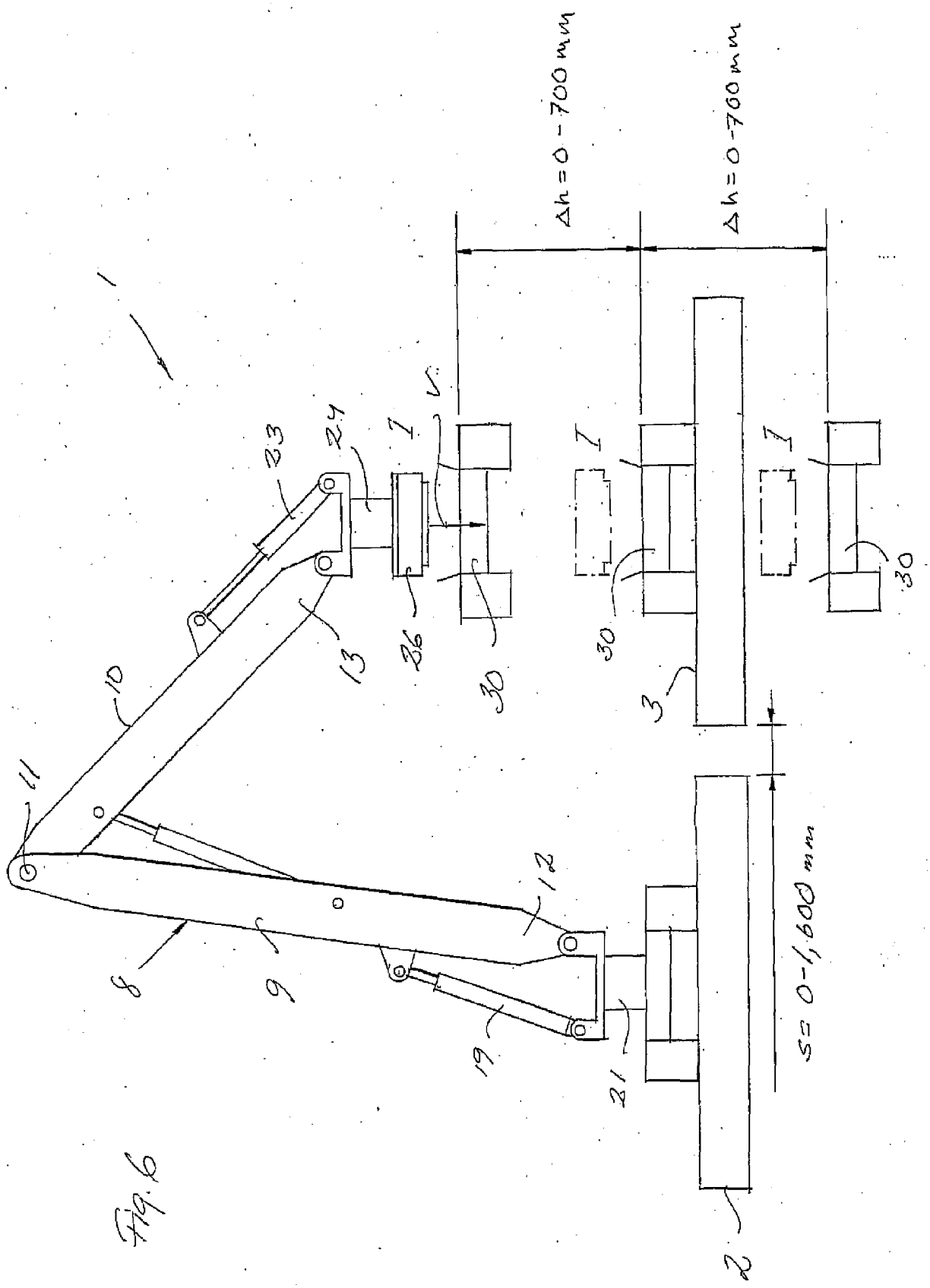

Fig. 6

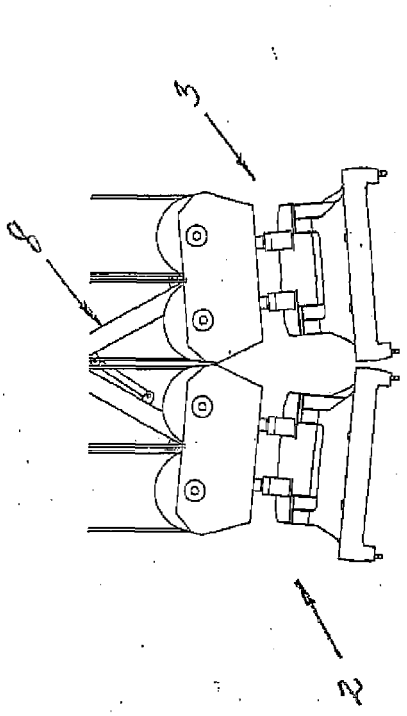

Fig. 7b

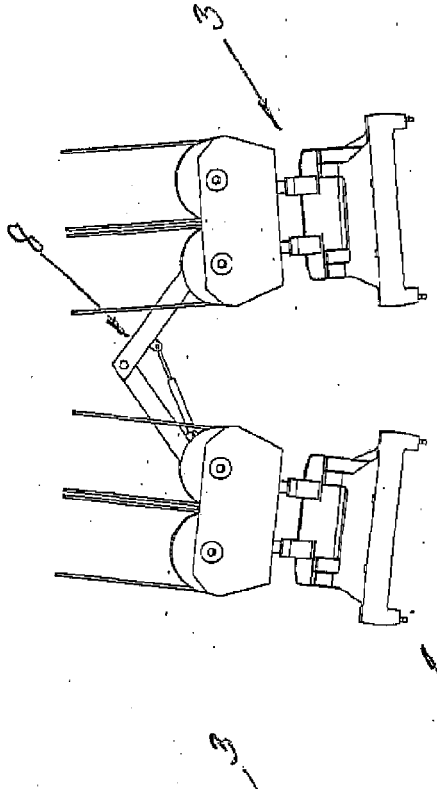

Fig. 7d

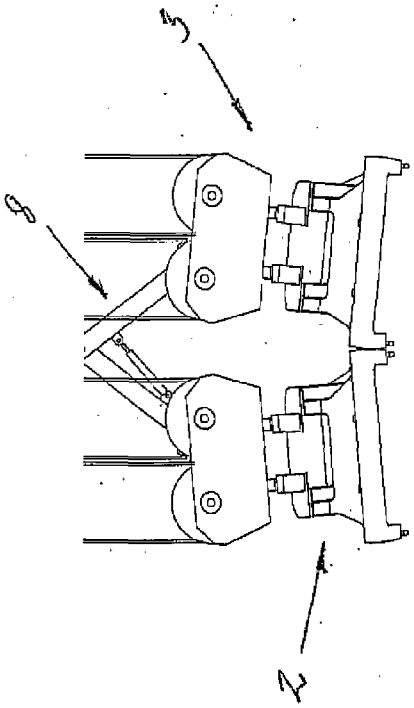

Fig. 7a

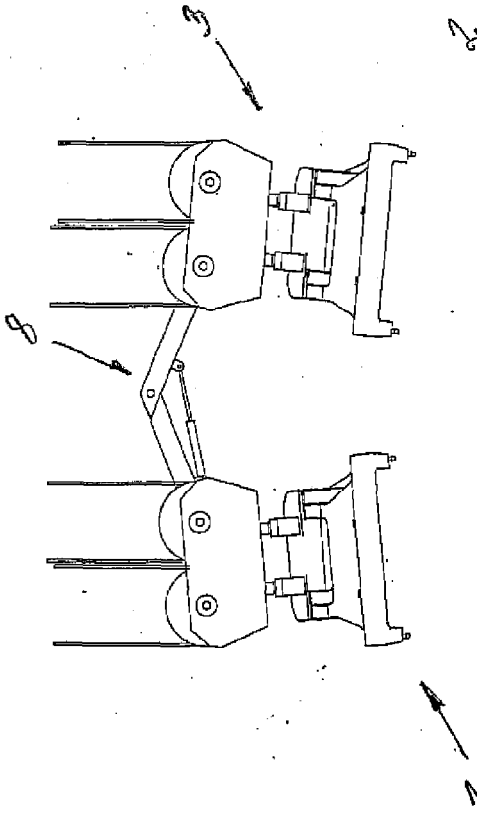

Fig. 7c

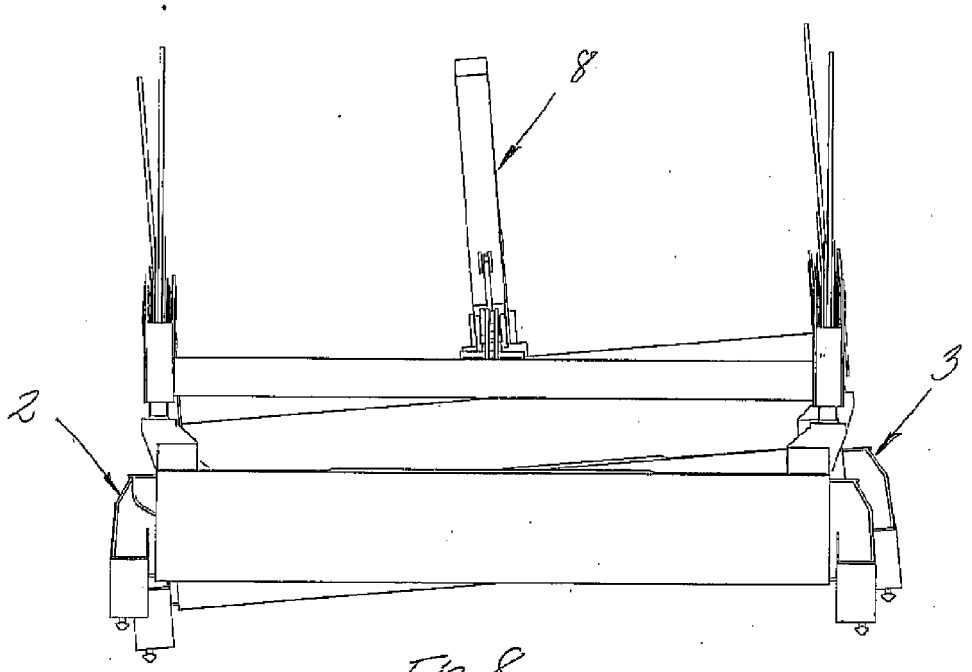

Fig. 8

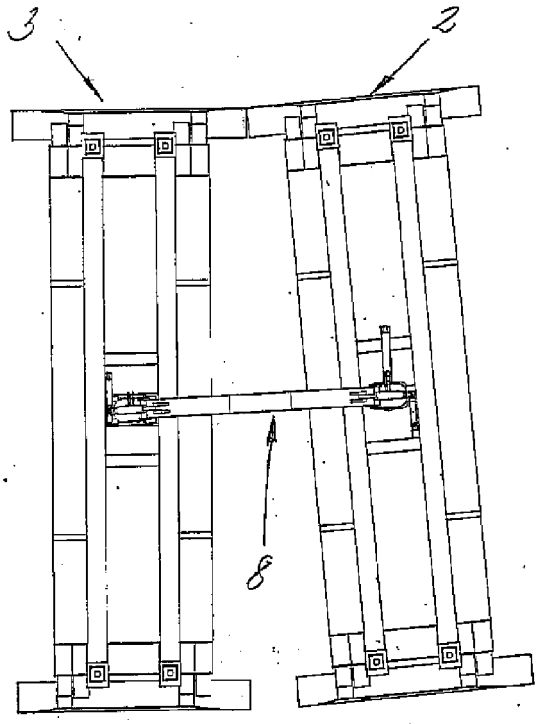

Fig. 10

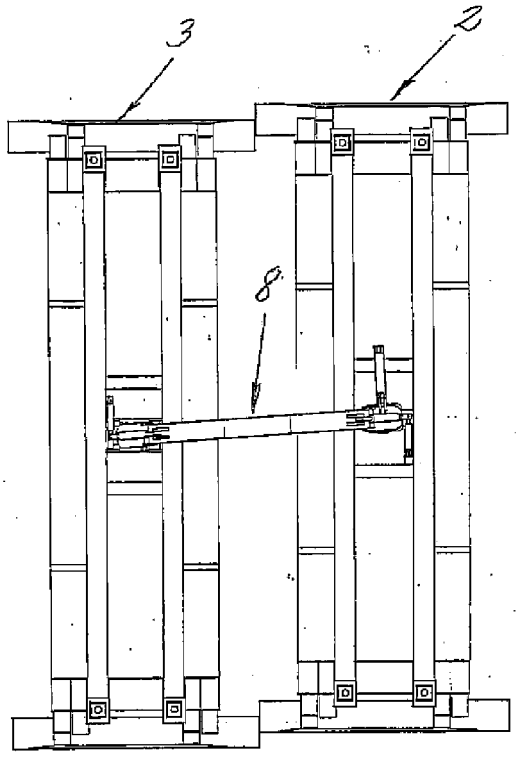

Fig. 11

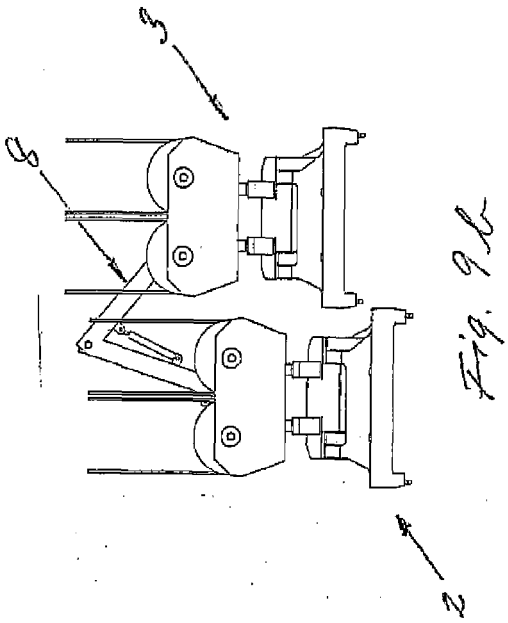

Fig. 9b

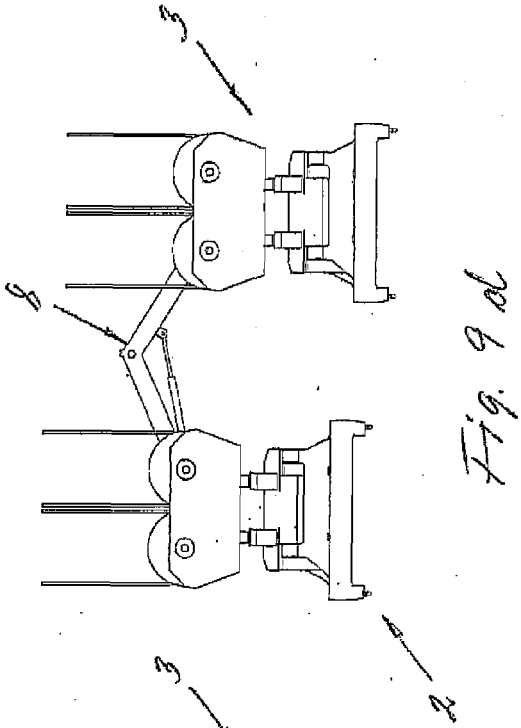

Fig. 9d

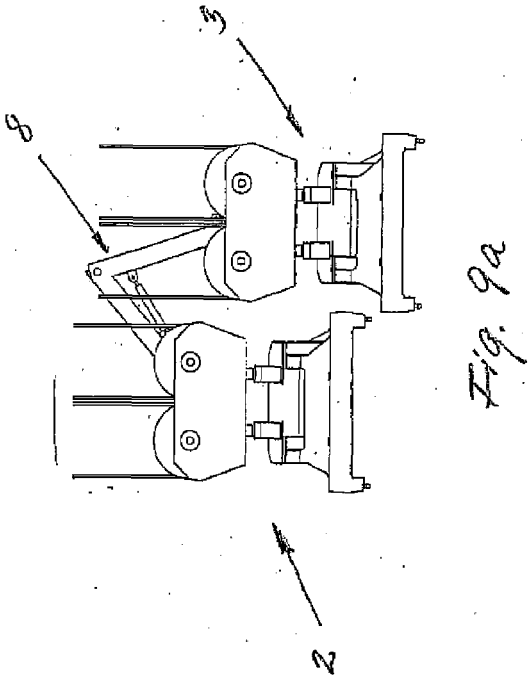

Fig. 9a

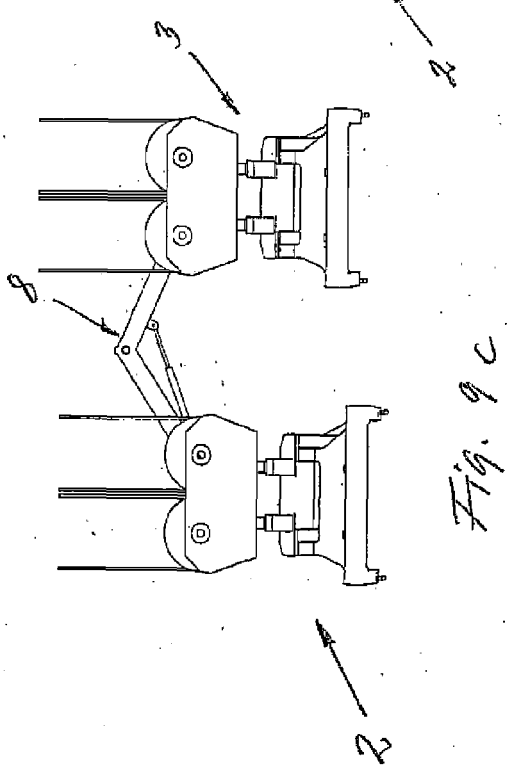

Fig. 9c

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EUROPEAN SEARCH REPORT

Application Number
EP 06 11 4214

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	US 2006/043748 A1 (STINIS CORNELIS ET AL) 2 March 2006 (2006-03-02) * figures * * paragraphs [0011], [0055], [0061], [0081] * * claim 6 *	1	INV. B66C1/66
A	WO 2005/090223 A (NSL ENGINEERING PTE LTD; MILLS, ROBERT, ARTHUR; TANG, JINBEI) 29 September 2005 (2005-09-29) * abstract; figures *	1	
A	US 4 370 079 A (PIZZIRANI ET AL) 25 January 1983 (1983-01-25) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B66C
B66F

The present search report has been drawn up for all claims

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The Hague	29 August 2006	Verheul, O

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29-08-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006043748 A1	02-03-2006	AU 2003238489 A1	22-12-2003
		CN 1659096 A	24-08-2005
		WO 03104132 A1	18-12-2003
		EP 1521716 A1	13-04-2005
WO 2005090223 A	29-09-2005	NONE	
US 4370079 A	25-01-1983	DE 3065625 D1	22-12-1983
		EP 0027200 A2	22-04-1981
		IT 1126024 B	14-05-1986

EPO FORM P0459

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