



- (51) **International Patent Classification:**  
*E21B 19/16* (2006.01)    *E21B 11/00* (2006.01)  
*B25J 18/00* (2006.01)
- (21) **International Application Number:**  
PCT/CA2013/000377
- (22) **International Filing Date:**  
18 April 2013 (18.04.2013)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
61/637,566    24 April 2012 (24.04.2012)    US
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- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,

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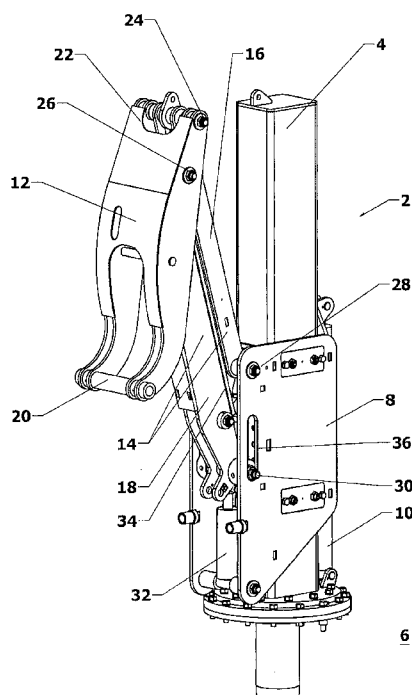
(54) **Title:** MECHANICAL ROUGHNECK POSITIONER

FIGURE 1

(57) **Abstract:** A device is taught for positioning drill pipe make up or break out equipment on a rig floor. The device comprises a forward arm connectable at a first end to the drill pipe make up or break out equipment, an upper rearward arm and a lower rearward arm, pivotably connectable between the forward arm and a column, said lower rearward arm further being axially movable along said column. The device further comprises means for maintaining the upper rearward arm in parallel relationship with the lower rearward arm and means for axially moving said lower rearward arm. Axial movement of said lower rearward arm acts to extend or retract said forward arm, while maintaining a constant axial position of the make up or break out equipment. A method is also provided for positioning drill pipe make up or break out equipment by connecting the make up or break out equipment to a forward arm of a positioning device and horizontally extending or retracting said forward arm while maintaining a constant vertical position of the equipment.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

— *of inventorship (Rule 4.17(iv))*

**Declarations under Rule 4.17:**

— *as to the identity of the inventor (Rule 4.17(i))*

**Published:**

— *with international search report (Art. 21(3))*

## Mechanical Roughneck Positioner

### Field of the Invention

The present invention relates to a device and a system for positioning drill pipe making up and breaking out equipment.

### Background

In down-hole drilling and extraction processes drill pipe is run down the wellbore for the purposes of drilling and performing wellbore operations. Drill pipe is made up by connecting multiple threaded drill pipe sections together and feeding them into the wellbore. A variety of equipment may be used to make up drill pipe sections including power tongs and mechanical roughnecks. Power tongs are also used in making up casing strings or tubular sections, and mechanical roughnecks are most commonly used to make up drill pipe.

In the process of making up or breaking out a drill pipe connection, the equipment must be positioned at the correct height relative to the pipe string, and must be horizontally moved into position around the drill string to thereby grasp the drill string. Positioners are typically used for this purpose. A positioner must be able to move both vertically and horizontally, supporting the weight of the make up equipment, while being fully supported on the rig floor. Typically, positioners are made up of multiple pairs of parallel arms, numerous linking plates and segments and multiple actuators that work together in a complex manner to move the make up equipment into position around the drill string. As well, in many positioners known in the art, further vertical positioning is required once the positioner is extended horizontally towards a piping string.

A need and interest therefore exists in the art to develop improved mechanical roughneck positioning devices and methods for extending and retracting mechanical roughnecks for drill pipe makeup and breakout operations.

### Summary

A device is taught for positioning drill pipe make up or break out equipment on a rig floor. The device comprises a forward arm connectable at a first end to the drill pipe make up or break out equipment, an upper rearward arm and a lower rearward arm, pivotably connectable between the forward arm and a column, said lower rearward arm further being axially movable along said column. The device further comprises means for maintaining the upper rearward arm in parallel relationship with the lower rearward arm and means for axially moving said lower rearward arm. Axial movement of said lower rearward arm acts to extend or retract said forward arm and said make up or break out equipment, while maintaining a constant axial position of the make up or break out equipment.

A method is also provided for positioning drill pipe make up or break out equipment. The method comprises the steps of connecting the make up or break out equipment to a first end of a forward arm of a positioning device and horizontally extending or retracting said forward arm while maintaining a constant vertical position of the equipment.

### Brief Description of the Drawings

The present invention will now be described in greater detail, with reference to the following drawings, in which:

Figure 1 is perspective view of one embodiment of the present positioning device in a retracted position;

Figure 2 is perspective view of one embodiment of the present positioning device in an extended position; and

Figure 3 is a schematic diagram depicting the present positioner in a retracted position; and

Figure 4 is a schematic diagram depicting the present positioner in an extended position; and

Figure 5 is a schematic diagram of one method of the present invention.

### Description of the Invention

The present invention relates to a device and system for positioning drill pipe or tubular make up and break out equipment. More specifically, the present invention relates to a positioner for a mechanical roughneck, power tong or similar equipment. The positioning device of present invention can be extended towards a pipe string or retracted therefrom without altering its axial position relative the pipe string. The present positioning device does not require axial position adjustment subsequent to being extended or retracted.

An example of a positioner of the present invention is shown in Figures 1 and 2. Figure 1 depicts the positioner in a retracted position and Figure 2 depicts the positioner in an extended position. With reference to these figures, the positioner 2 comprises a column 4 that is directly or indirectly connected into the rig floor 6. A column guide 8 travels axially along the column 4 to set the vertical position of the positioner 2, as required to position the make up equipment for the make up or break up operation to be conducted. An optional lift cylinder 10 preferably actuates movement of the column guide 8. Alternatively, the column guide 8 may be axially moved by manual means or by use of a separate lifting device.

The positioner preferably comprises a single forward arm 12 and a two-part reward arm 14. (I don't see #14 called out on any of your drawings?? OK 14 is 16 and 18 together) The reward arm 14 is preferably made up of an upper arm 16 and lower arm 18. The forward arm is connectable at a first end 20 to a make up and break out tool. The first end 20 may connect to the make up and break out tool in any number of ways and it is also possible for the second end 20 to be fitted with different connectors to allow a single positioning device to connect to a variety of tools by a variety of means.

A second end 22 of the forward arm is pivotably connected to a first upper arm end 24. A first lower arm end 26 further pivotably connects to the forward arm 12 at a point spaced in from the second end 22.

The upper arm 16 is pivotably connected at a second upper arm end 28 to the column guide 8. The lower arm 18 is further connected at a second lower arm end 30 to the column guide 8 in an arrangement that allows both pivotal and axial movement of the second lower arm end 30 relative to the column guide 8. Axial movement of the second lower arm end 30 is preferably actuated by an extend cylinder 32, although it may also be manually moved or moved by means of an external tool or equipment. In a most preferred embodiment, the pivotable connection of the second lower arm end is received in an elongated slot 36 formed on the column guide 8, and moves axial within said slot 36.

A rigid link 34 pivotably connects the second upper arm end 28 to the lower arm 18 at a point spaced inward to the second lower arm end 30. The length of the rigid link 34 is similar to the spacing between the second upper arm end 28 connection and the second lower arm end 30 connection to thereby form a parallelogram between the upper arm 16, the lower arm 18, the rigid link 34 and the rearward arm connections to the forward arm 12.

With reference to Figures 3, when the positioning device is in a retracted position, the second lower arm end 30 is at its lowest axial position. This is preferably effected by retracting the extend cylinder 32. Rigid link 34 is in turn pulled down into a nearly vertical position and in parallel, pivotal connections of the upper arm 16 and lower arm 18 to the forward arm 12 are approximately axially aligned, thereby retracting the forward arm in towards the column 4.

With reference to Figure 4, the second lower arm end 30 is moved axially upwardly along the column guide. The movement is preferably actuated by the extend cylinder 32. Axial movement of the second lower arm end 30 pushes rigid link 34 outwardly away from the column 4 thereby widening the space between parallel upper

arm 16 and lower arm 18. In parallel, the pivotal connection point of the first lower arm end 26 is axially extended beyond the pivotal connection point of the first upper arm end 24, to thereby extend the forward arm 12 axially away from the column 4. As forward arm 12 extends from a retracted position to an extended position, it maintains a constant axial height. This advantageously allows for axial positioning of the positioning device 2 to be set only once, preferably by means of the lift cylinder 10, without requiring further height adjustment to compensate for axial movement during extension.

The lift cylinder 10 and extend cylinder 32 can be actuated hydraulically or pneumatically. The lift cylinder 10 and extend cylinder 32 may be controlled by a local control system located at the rig floor 6, or by a remote control system. Alternatively, the control system may be mounted to a movable console that can be moved around the rig floor 6.

The column 4 may be directly mounted into the rig floor 6, or via a flange at the base of the column 4 and thereby bolted directly to the rig floor 6, or alternatively on a movable device to position the column 4 in numerous locations on the rig floor 6. The column 4 is depicted in the figures as preferably having a rectilinear shape and column guide 8 is shown as a rectilinear frame around said column 4. However a number of other shapes for the column 4 such as for example cylindrical, angular or conical and corresponding shapes for the column guide 8 are all possible without departing from the scope of the present invention.

The pivotal connections of the second upper arm end 28 and the second lower arm end 30, as well as the extend cylinder 32 are all shown as being part of a flanged segment of the column guide 8. It would, however, be understood by a person of skill in the art that these may be housed on a separate housing connected to and movable with the column guide 8.

Although a single forward arm 12 is shown in the figures, it would be well understood by a person of skill in the art that such forward arm 12 could take any

number of forms while not departing from the scope of the present invention.

Furthermore, the rigid link 34 is depicted as a rigid strip, although it could also take the form of a rigid rod with pivot points at either end, or a rigid plate of any shape having pivot points spaced equidistant to the spacing of first upper arm end 24 and first lower arm end 26 connections.

The present invention allows for horizontal extension of a positioning device to position a make up or break out tool, while maintaining the tool's vertical position relative to a drill pipe or casing string to be engaged. The present invention also provides a positioning device with minimal arms, linkages and without the need for gears to synchronize movement between the arms. This simplifies operation of the positioning device, as well as on-site maintenance. The present device is also less expensive to manufacture and less weight to transport.

In the foregoing specification, the invention has been described with a specific embodiment thereof; however, it will be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention.



Claims

1. A device for positioning drill pipe make up or break out equipment on a rig floor, said device comprising:

- a) a forward arm connectable at a first end to the drill pipe make up or break out equipment;
- b) an upper rearward arm and a lower rearward arm, pivotably connectable between the forward arm and a column, said lower rearward arm further being axially movable along said column;
- c) means for maintaining the upper rearward arm in parallel relationship with the lower rearward arm; and
- d) means for axially moving said lower rearward arm;

wherein axial movement of said lower rearward arm acts to extend or retract said forward arm and said make up or break out equipment, while maintaining a constant axial position of the make up or break out equipment .

2. The device of claim 1, wherein the upper rearward arm and lower rearward arm are pivotably connected to the column via a column guide.
3. The device of claim 2, wherein the column guide is axially movable along said column to set a vertical position of the make up or break out equipment.
4. The device of claim 3, further comprising a lift cylinder to actuate axial movement of the column guide.
5. The device of claim 1, wherein the upper rearward arm is pivotably connected at a first upper arm end to the forward arm at a second forward arm end and the lower rearward arm pivotably connects at a first lower arm end to the forward arm at a point spaced in from the second forward arm end.
6. The device of claim 4, further comprising an extend cylinder to actuate axial movement of the lower rearward arm at a second lower arm end.

7. The device of claim 1, wherein the means for maintaining the upper rearward arm in parallel relationship with the lower rearward arm comprises a rigid link pivotably connectable between the upper rearward arm end at a second upper arm end and the lower rearward arm at a point spaced inward to the second lower arm end.
8. The device of claim 7, wherein the upper rearward arm, the lower rearward arm, the rigid link and the upper and lower rearward arm connections to the forward arm form a parallelogram.
9. The device of claim 6, wherein the lift cylinder and the extend cylinder are hydraulically actuated.
10. The device of claim 9, wherein hydraulic actuation of the lift cylinder and the extend cylinder is controlled by a local control system located at the rig floor.
11. The device of claim 1, wherein the column is mounted into the rig floor.
12. A method of positioning drill pipe make up or break out equipment, said method comprising the steps of:
  - a) connecting the make up or break out equipment to a first end of a forward arm of a positioning device; and
  - b) horizontally extending or retracting said forward arm while maintaining a constant vertical position of the equipment.
13. The method of claim 12, further comprising:
  - a) connecting the forward arm to an upper rearward arm and a lower rearward arm, said upper rearward arm and lower rearward arm being in parallel relationship with one another; and
  - b) extending or retracting the an upper rearward arm and the lower rearward arm to extend or retract the forward arm.

14. The method of claim 13, further comprising;

- a) axially moving said lower rearward arm to extend or retract the upper rearward arm and lower rearward arm.

15. The method of claim 14, further comprising:

- a) linking said upper rearward arm to said lower rearward arm in parallel relationship by means of a rigid link, such that axial movement of the lower rearward arm extends or retracts said rigid link, which in turn extends or retracts said upper rearward arm.

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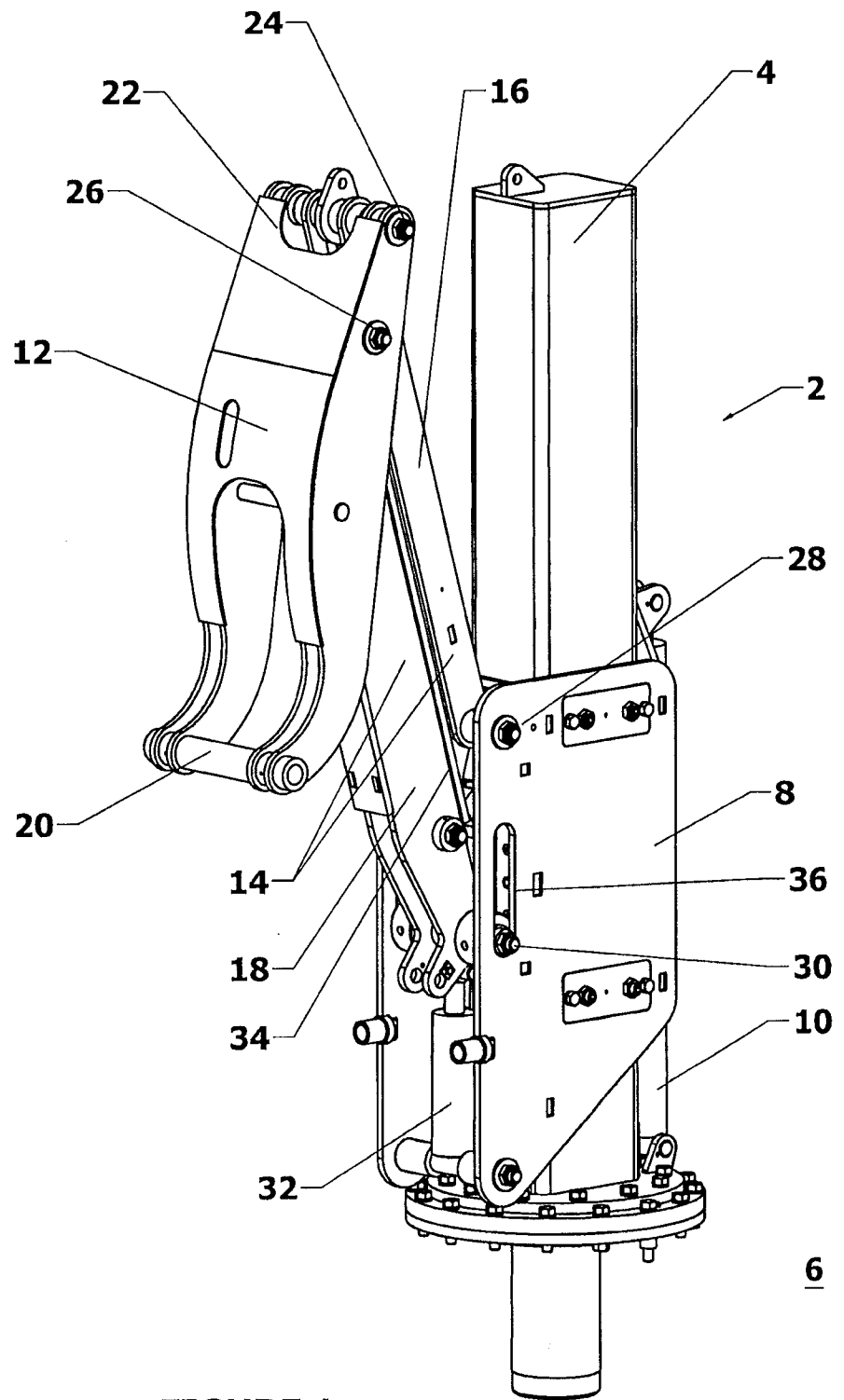
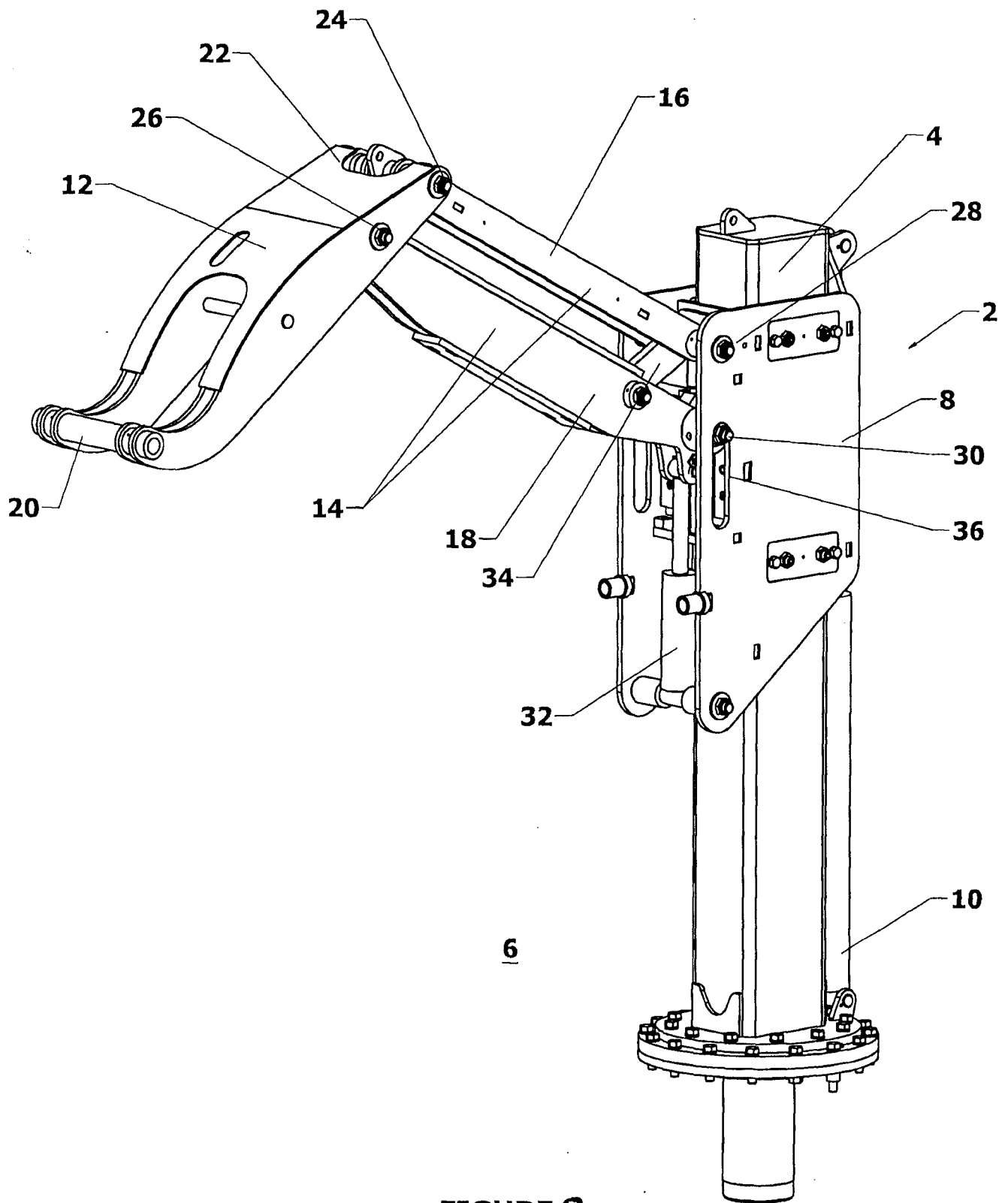


FIGURE 1

**FIGURE 2**

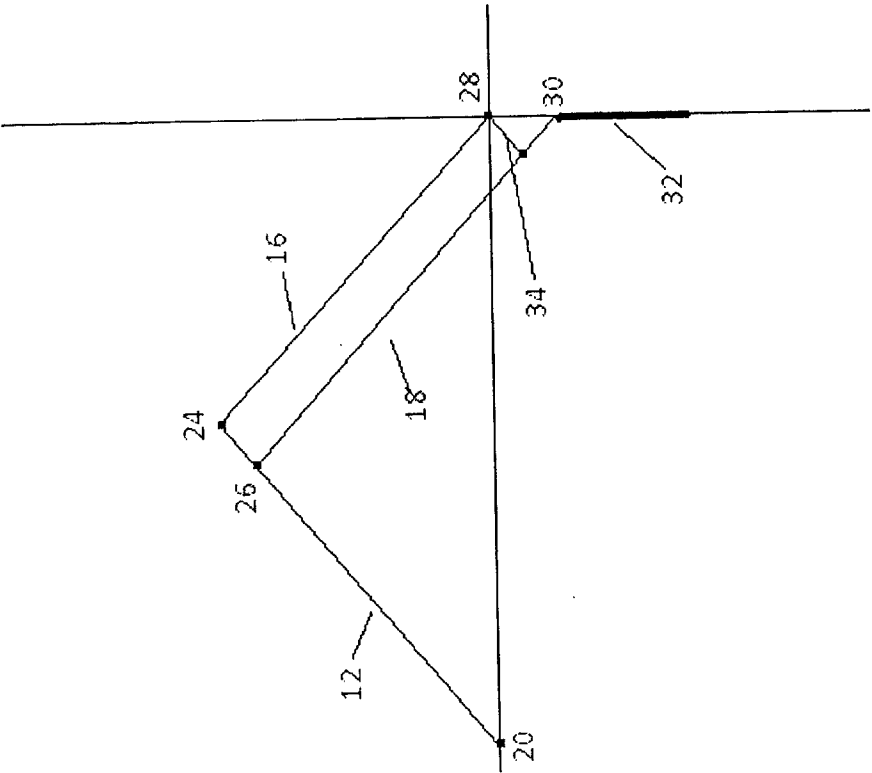


Figure 4

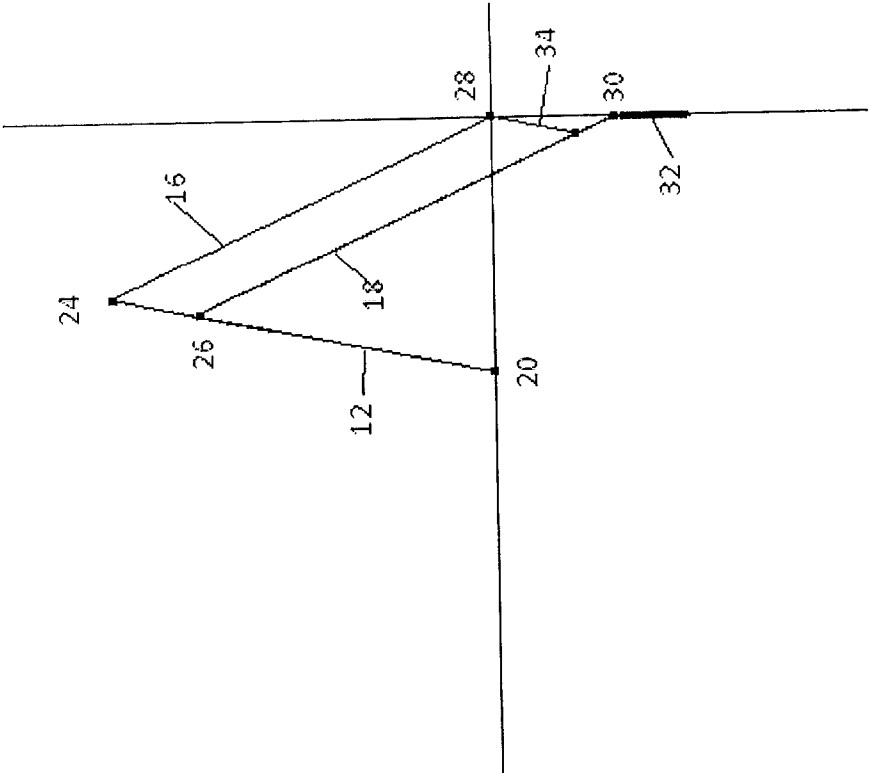
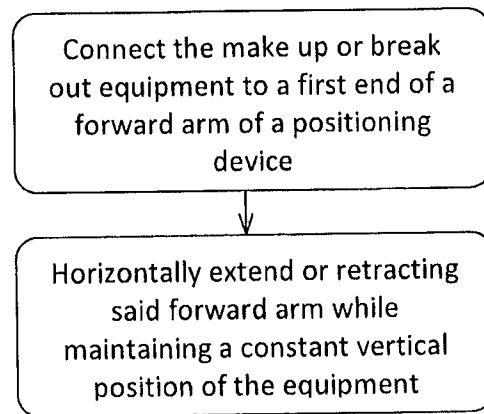


Figure 3

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**Figure 5**

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA2013/000377

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: **E21B 19/16** (2006.01) , **B25J 18/00** (2006.01) , **E21B 11/00** (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: **E21B 19/16** (2006.01) , **B25J 18/00** (2006.01) , **E21B 11/00** (2006.01); USPC - 175/85

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)

Total Patent, Canadian Patent Database. Keywords: positioner drill positioning device mechanical roughneck power tong unit makeup/breakout device axial horizontal.

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US20080217067A1 (GE) 11 September 2008 (11-09-2008) *Whole document*	1 - 4, 6, 9, 10, 11, 12 - 15
Y		5, 7, 8
A	US2703222A FEUCHT 1 March, 1955 (01-03-1955) *Whole document*	1 - 15
A	US7841415B2 (WINTER) 30 November 2010 (30-11-2010) *Whole document*	1 - 15
A	WO2011060270A2 (GE, et al.) 19 May 2011 (19-05-2011) *Whole document*	1 - 15

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

31 May 2013 (31-05-2013)

Date of mailing of the international search report

31 May 2013 (31-05-2013)

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/CA2013/000377**

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
US20080217067A1	11 September 2008 (11-09-2008)	None	
US2703222A	01 March 1955 (01-03-1955)	None	
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