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(54) Title: POWER TONG FRAMES

(57) Abstract: Apparatus for securing a joint between two lengths of tubular. The apparatus comprises a tong arrangement (23) comprising a rotary tong (1) and a back-up tong (11). A frame (20) has a seat (21) for supporting the tong arrangement (23) from beneath, the tong arrangement (23) resting upon the seat (21) such that the tong arrangement (23) can be oriented in use at an angle to the longitudinal axis of the frame (20). Means (32) are provided for securing the tong arrangement (23) to the frame (20) at a chosen orientation.

Power Tong Frames

This invention relates to power tong frames.

In the construction of oil or gas wells it is usually necessary to prepare extremely long drill pipes or strings. Due to the length of pipe required, sections or stands of pipe are progressively added to the pipe as it is lowered into the well from a drilling platform. In particular, when it is desired to add a section the pipe is usually restrained from falling into the well by applying the slips of a spider located in the floor of the drilling platform. The new section of pipe is then moved from a rack to the well centre above the spider. The threaded pin of the section of pipe to be connected is then located over the threaded box of the pipe in the well and the connection is made up by rotation therebetween. An elevator is connected to the top of the new section and the whole pipe lifted slightly to enable the slips of the spider to be released. The whole pipe is then lowered until the top of the pipe is adjacent the spider whereupon the slips of the spider are re-applied, the elevator disconnected and the process repeated.

It is common practice to use a power tong to torque the connection up to a predetermined torque in order to make this connection. The power tong is located on the platform, either on rails, or hung from a derrick on a chain. In order to make up or break out a threaded connection, a two tong arrangement may be used. An active (or wrenching) tong supplies torque to the section of tubular above the threaded connection, while a passive (or back up) tong supplies a reaction torque below the threaded connection. The back up tong clamps the tubular below the threaded connection, and prevents it from rotating. This clamping can be performed mechanically, hydraulically or pneumatically. The wrenching tong clamps the upper part of the connection and is driven so that it supplies torque for a limited angle. This power tong arrangement is also used to torque up connections between other tubulars, for example sections of casing and tubing.

Conventionally, power tongs including the two tong arrangement described above and other commercially available tongs are suspended by chains from a crane or other

support. However, such chains can get in the way of other equipment, for example drill pipe spinners which are used to run in a threaded connection between sections of pipe prior to a final tightening of the connection with the wrenching and backup tongs.

It is an object of the present invention to provide a support for a power tong arrangement which reduces the overhead interference above the arrangement. It is a further object of the invention to support a power tong arrangement in such a way that the arrangement may be titled to allow its use with non-vertical tubular strings.

According to a first aspect of the present invention there is provided apparatus for securing a joint between two lengths of tubular, the apparatus comprising:

a tong arrangement comprising a rotary tong and a back-up tong;

a frame;

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can be oriented in use at an angle to the longitudinal axis of the frame; and

means for securing the tong arrangement to the frame at a chosen orientation.

Preferably, said rigid support means comprises a seat for supporting the tong arrangement from beneath. Preferably, the tong arrangement is supported on the seat such that the arrangement is able to move with respect to the seat in a substantially transverse plane, relative to the axis of the tubulars.

Preferably, said seat comprises means for tending to return the tong arrangement to a central position following deflection of the tong arrangement from that central position.

Preferably, the tong arrangement rests upon two or more support points of the seat. The support points, and/or the respective contact members on the tong arrangement which contact the support points each comprise a resilient member which provides a mechanism for tending to return the tong arrangement to a centre position following

deflection of the tong. The resilient members may be of rubber or synthetic rubber, or may be helical or wound springs.

Preferably, said seat is substantially "V" shaped and lies in use in a substantially horizontal plane. Respective support points are located at the end of each leg of the seat and each comprises a part of a sphere or a spherical recess formed in a base member. Complimentary shaped parts or recesses are provided on the base of the tong arrangement for engagement with the support points on the seat. The radii of the part sphere and recess differ to allow relative transverse displacement of the tong arrangement and the seat. More preferably, the part spherical members or the base members in which the spherical recesses are formed are supported on resilient members to provide suspension for the tong arrangement.

Preferably, the tong arrangement is coupled to the frame, above said seat, by an elongate alignment member having a variable length. The orientation of the tong arrangement may be varied by varying the length of said elongate member. More preferably, the member comprises a hydraulically or pneumatically operated telescopic rod. Alternatively however, the member may be a chain.

Preferably, said seat is movable up and down said frame in order to allow the tong arrangement to be moved up and down.

According to a second aspect of the present invention there is provided a frame for supporting a tong arrangement comprising a rotary tong and a backup tong, the frame comprising:

rigid support means for supporting the tong arrangement such that the tong arrangement can be oriented in use at an angle to the longitudinal axis of the frame; and

means for securing the tong arrangement to the frame at a chosen orientation.

Preferably, said rigid support means comprises a seat for supporting the tong arrangement from beneath.

According to a third aspect of the present invention there is provided apparatus for securing a joint between two lengths of tubular, the apparatus comprising:

a tong arrangement comprising a rotary tong and a back-up tong;

a frame;

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can move to a limited extent relative to the support means in a plane transverse to the longitudinal axis of the tubulars; and

means for securing the tong arrangement to the frame at a chosen orientation.

According to a fourth aspect of the present invention there is provided a frame for supporting a tong arrangement comprising a rotary tong and a backup tong, the frame comprising:

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can move to a limited extent relative to the support means in a plane transverse to the longitudinal axis of tubulars to be connected; and

means for securing the tong arrangement to the frame at a chosen orientation.

Some preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is a view of an arrangement of a wrenching tong and a back-up tong;

Figure 2 is a side view of a frame for supporting the tong arrangement of Figure 1;

Figure 3 is a front view of the frame of Figure 2, with a wrenching tong in place;

Figure 4 shows in more detail a support point of the frame of Figures 2 and 3; and

Figure 5 shows a side view of the frame of Figure 2, with a wrenching tong in place and tilted at an angle to the vertical.

Figures 1 shows a power tong arrangement comprising a wrenching tong 1 and a back-up tong 11. This arrangement is the subject of co-pending British patent application number 9927825.1 filed 26 November 1999. The wrenching tong 1 is generally in the form of a cylinder with an opening 2 through the centre thereof for receiving a stand of drill pipe (not shown), and a recess 3 running from the edge to the opening 2 at the centre.

The back-up tong 11 is located beneath the wrenching tong 1. The back-up tong is generally in the form of a disc with similar dimensions to the wrenching tong 1. The back-up tong is also provided with an opening 12 through the centre and a recess 13 from the edge to the opening at the centre. The opening 12 and recess 13 correspond to the opening 2 and recess 3 of the wrenching tong when the back-up tong 11 and the wrenching tong 1 are correctly aligned. A plurality of guide rollers 10 or other guide elements are spaced around the edge of the wrenching tong 1 in order to maintain the alignment of the wrenching tong 1 with the back-up tong 11.

The back-up tong 11 is provided with two pinion drives 4 arranged opposite each other at the periphery of the disc, equally spaced either side of the opening 12. Each pinion drive comprises a drive motor 5, drive shaft (not shown) and pinion (hidden in Figure 1 but indicated generally by the numeral 7) attached to the drive shaft. A gear 14 is provided around the periphery of the wrenching tong 1, broken by the recess 3. The gear 14 meshes with the pinions attached to the motors 5 on the back-up tong, so that when the drive motors 5 drive the drive shafts and pinions 7, the wrenching tong 1 rotates relative to the back-up tong 11. The angle of rotation is limited by the recess 3 of the wrenching tong 1.

Three clamping jaws (not shown) are located inside each of the wrenching tong 1 and back-up tong 11 as illustrated in Figure 1. These are hydraulically driven for clamping the drill pipe stand in place in the centre of the wrenching tong. The hydraulic power supply may be provided by hoses (not shown).

Figure 2 illustrates a frame 20 for supporting a tong arrangement. The frame 20 comprises a "V" shaped seat 21 which lies in a horizontal plane and can be raised and lowered relative to the frame upright section 22. Figure 3 illustrates a tong arrangement 23, such as that described with reference to Figure 1, located in the frame 20 and supported on the seat 21 so that substantially all of the weight of the tong arrangement 23 is borne by the frame 20 via the seat 21.

At the end of each leg of the seat 21 there is arranged a support unit 24. One such support unit is illustrated in more detail in Figure 4. Each support unit 24 comprises a bearing 25 having a part spherical upper portion 26. In contact with the part spherical portion 26 is a base member 27 having a spherically shaped recess 28 formed therein. A flange 29 is secured to the base member 27 and rests upon an annular rubber member 30 which surrounds the bearing 25. The base members 27 are secured to the base of the tong arrangement 23.

It will be understood that the base member 27 is at all times in contact with the top of the bearing 25. When the tong arrangement is deflected from the horizontal plane in which the seat 21 is located, the rubber member 30 is compressed on one side by the weight of the tong arrangement. The reaction force produced by the member 30 on the tong arrangement tends to push the tong arrangement back to its central position. The support mechanism comprising the seat 21 and the support units 24 helps to secure the tong arrangement against the effects of vibrations whilst the wrenching tong is rotating.

As illustrated in Figure 4, the radius of the spherical recess 28 is greater than that of the spherical portion 26 on which it is supported. This allows the tong arrangement 23 to move (or float) in a substantially horizontal plane, relative to the seat 21 and frame 20. Typically, the dimensions of the various components are such as to allow several centimetres of relative movement such as is required during the gripping of a drill pipe in order to avoid problems which will arise when the frame is not correctly aligned with the drill pipe. The ability of the tong arrangement to "float" above the

seat also prevents damage resulting from movement of the backup tong during operation of the tong arrangement.

Figure 5 illustrates the frame 20 of Figures 2 to 4, with the tong arrangement 23 being coupled to an upright member 31, which is attached to the seat 21 at right angles thereto. The upright member 31 moves up and down in the frame 20 with the seat 21. More particularly, the tong arrangement 23 is coupled to the upright member 31 by a hydraulically or pneumatically driven rod 32. The rod 32 is coupled at its ends to the tong arrangement 23 and the upright member 31 by respective pivotable joints. By extending and retracting the rod 31, it is possible to vary the alignment of the tong arrangement 23 with respect to the vertical axis and to hold the tong arrangement in the desired position against the reaction force of the rubber member 30. When the power which actuates the rod 31 is switched off, the tong arrangement will return to its central position.

The frame of Figures 2 to 5 is suitable for use in situations where the well being drilled is at an angle to the vertical. By avoiding the need for chains to support the tong arrangement from above, the overall height of the frame is reduced compared to conventional frames. In addition, it is easier to introduce tools above the tong arrangement, for example a drill pipe spinner, because chains are no longer present in this area.

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, rather than providing a seat to support the tong arrangement from underneath, the tong arrangement may be held by some other rigid support means which grips or is attached to the sides or top of the tong arrangement.

CLAIMS:

1. Apparatus for securing a joint between two lengths of tubular, the apparatus comprising:

a tong arrangement comprising a rotary tong and a back-up tong;

a frame;

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can be oriented in use at an angle to the longitudinal axis of the frame; and

means for securing the tong arrangement to the frame at a chosen orientation.

2. Apparatus according to claim 1, wherein said rigid support means comprises a seat for supporting the tong arrangement from beneath.

3. Apparatus according to claim 2, wherein the tong arrangement is supported on the seat such that the arrangement is able to move with respect to the seat in a substantially transverse plane, relative to the axis of the tubulars.

4. Apparatus according to claim 2 or 3, wherein the tong arrangement rests upon two or more support points of the seat.

5. Apparatus according to claim 4, wherein the support points, and/or the respective contact members on the tong arrangement which contact the support points, each comprise a resilient member which reacts against deflection of the tong arrangement from a central position.

6. Apparatus according to any one of claims 2 to 5, wherein said seat is substantially "V" shaped and lies in use in a substantially horizontal plane.

7. Apparatus according to claim 6, wherein respective support points are located at the end of each leg of the seat and each support point comprises a part of a sphere or a spherical recess formed in a base member, with complimentary shaped parts or

recesses being provided on the base of the tong arrangement for engagement with the support points on the seat.

8. Apparatus according to claim 7, wherein the radii of the part sphere and recess differ to allow relative transverse displacement of the tong arrangement and the seat.

9. Apparatus according to claim 8 when appended to claim 5, wherein the part spherical members or the base members in which the spherical recesses are formed are supported on resilient members.

10. Apparatus according to claim 2, wherein said seat comprises means for tending to return the tong arrangement to a central position following deflection of the tong arrangement from that central position.

11. Apparatus according to any one of claims 2 to 10, wherein the tong arrangement is coupled to the frame, above said seat, by an elongate alignment member having a variable length so that the orientation of the tong arrangement may be varied by varying the length of said elongate member.

12. Apparatus according to claim 11, wherein the elongate member comprises a hydraulically or pneumatically operated telescopic rod.

13. Apparatus according to any one of the preceding claims, wherein said rigid support means is movable up and down in said frame in order to allow the tong arrangement to be moved up and down.

14. A frame for supporting a tong arrangement comprising a rotary tong and a backup tong, the frame comprising:

rigid support means for supporting the tong arrangement such that the tong arrangement can be oriented in use at an angle to the longitudinal axis of the frame; and

means for securing the tong arrangement to the frame at a chosen orientation.

15. Apparatus for securing a joint between two lengths of tubular, the apparatus comprising:

a tong arrangement comprising a rotary tong and a back-up tong;

a frame;

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can move to a limited extent relative to the support means in a plane transverse to the longitudinal axis of the tubulars; and

means for securing the tong arrangement to the frame at a chosen orientation.

16. A frame for supporting a tong arrangement comprising a rotary tong and a backup tong, the frame comprising:

rigid support means coupled to the frame for supporting the tong arrangement such that the arrangement can move to a limited extent relative to the support means in a plane transverse to the longitudinal axis of tubulars to be connected; and

means for securing the tong arrangement to the frame at a chosen orientation.

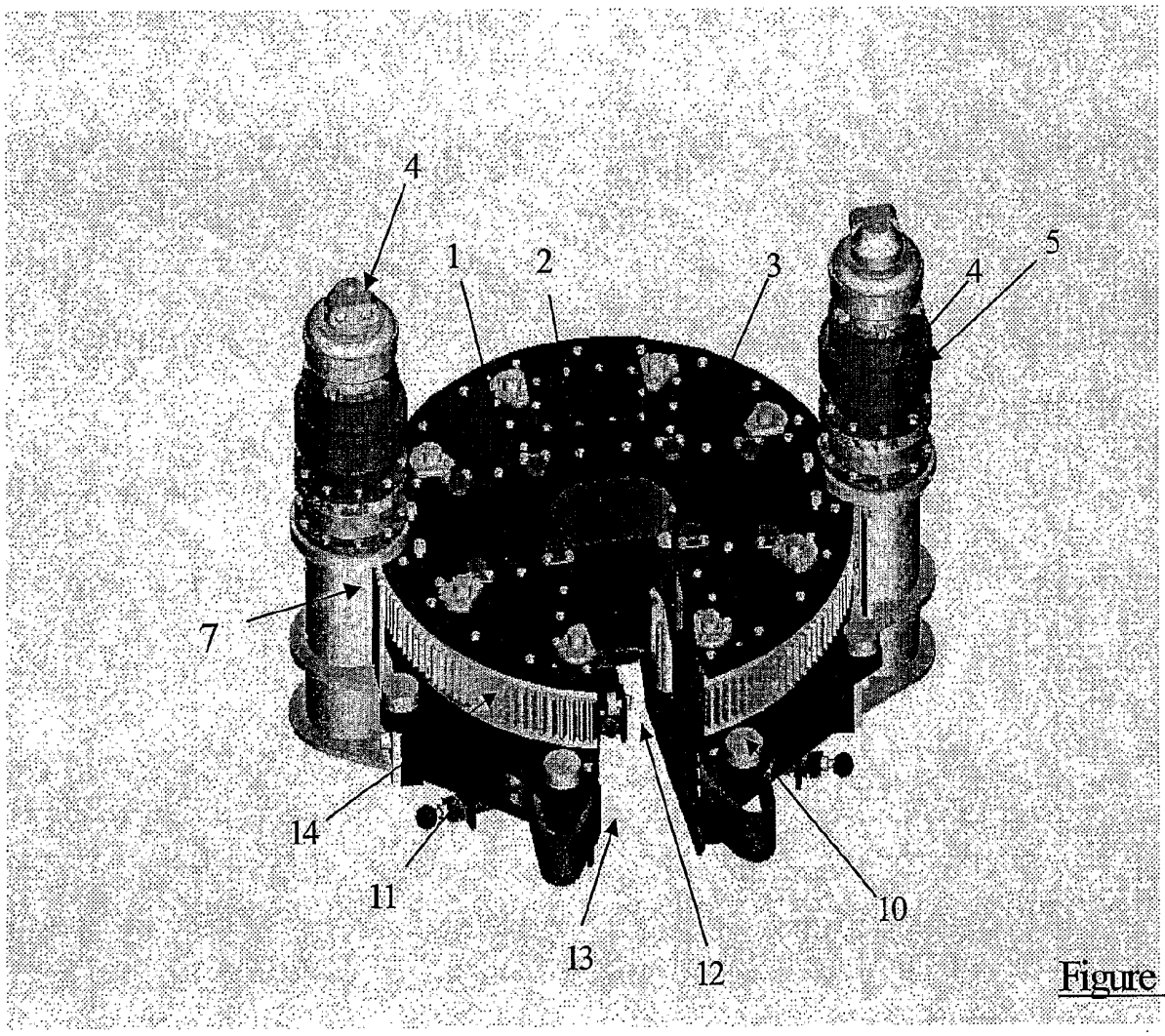

Figure 1

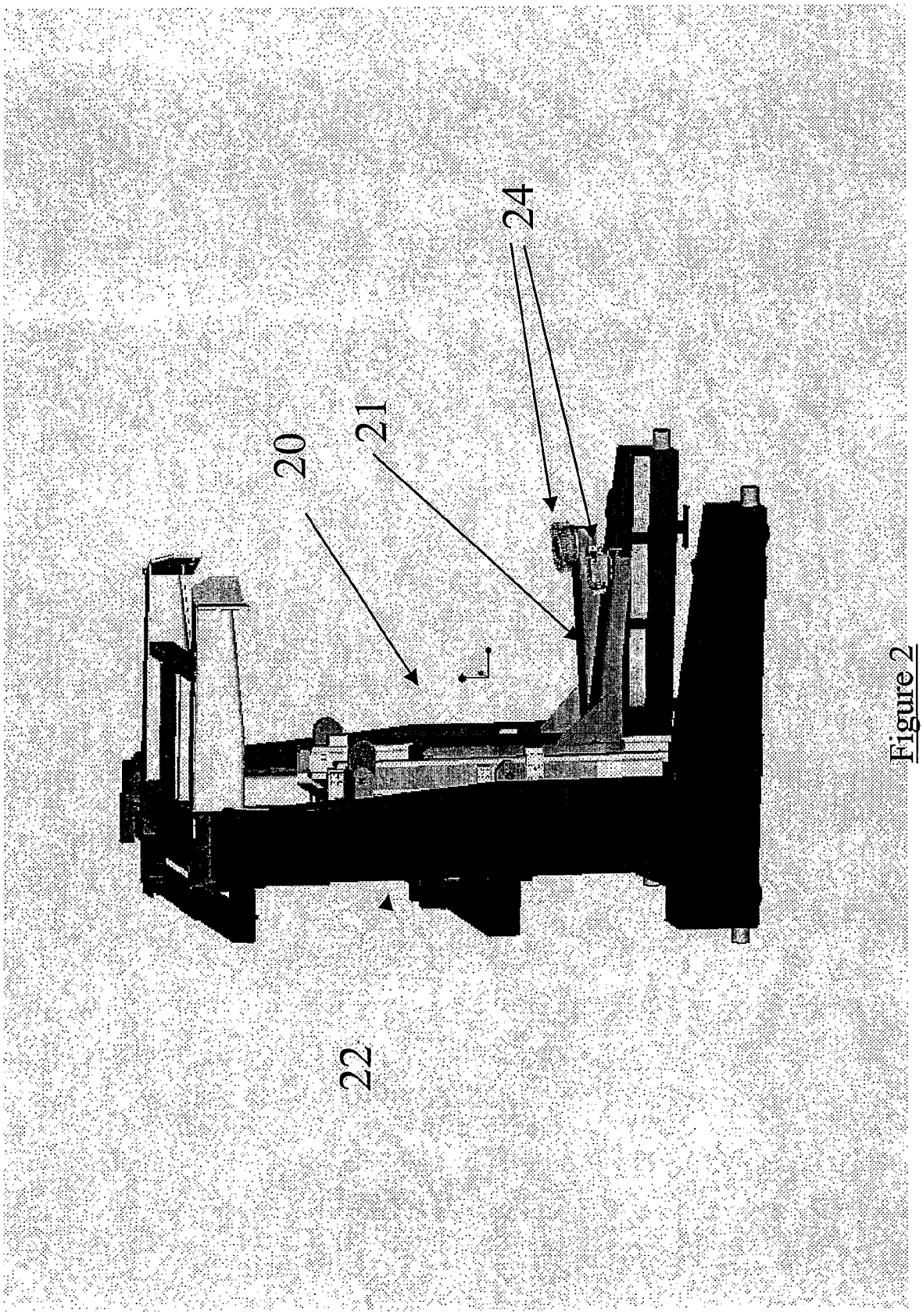

Figure 2

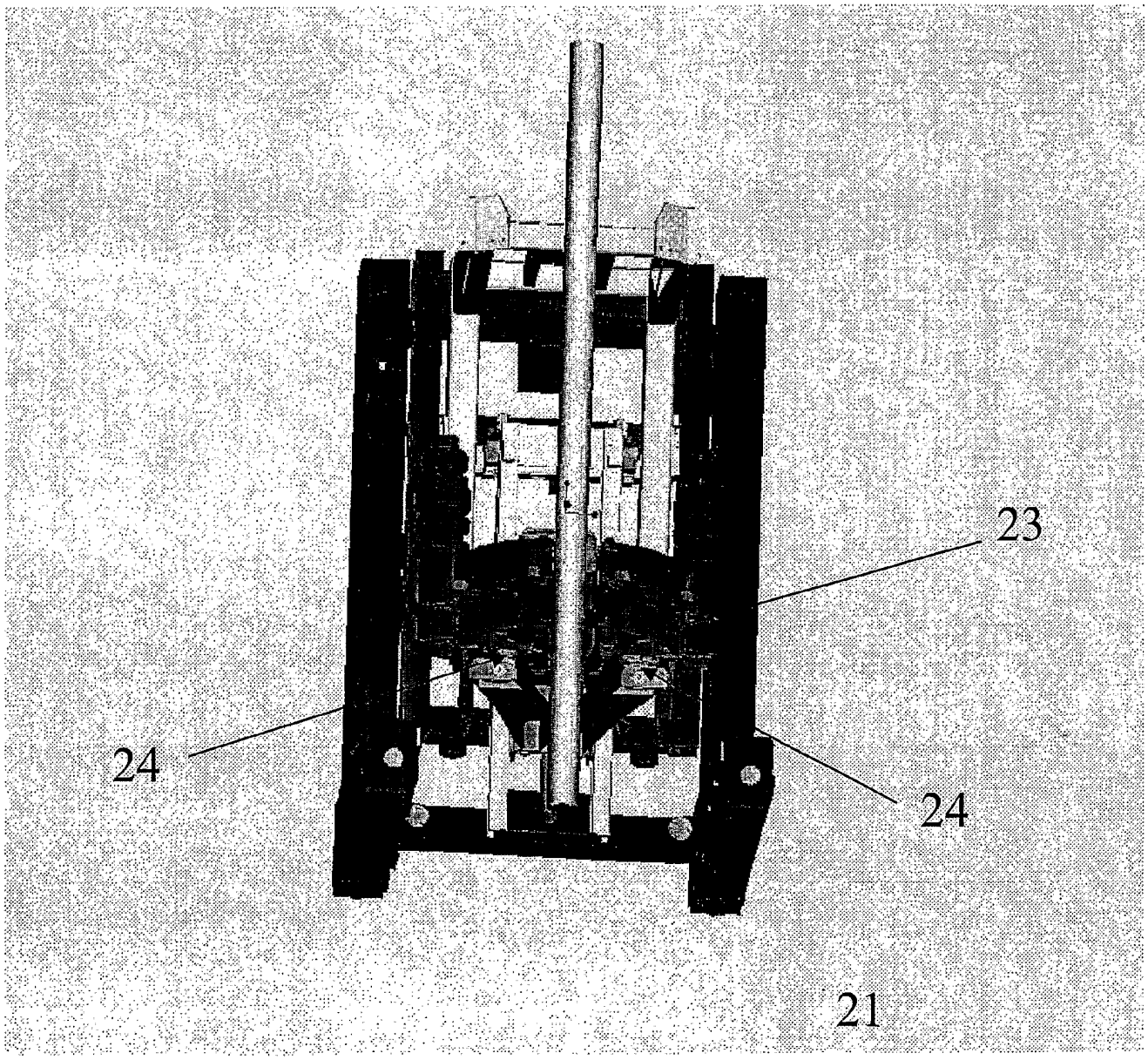

Figure 3

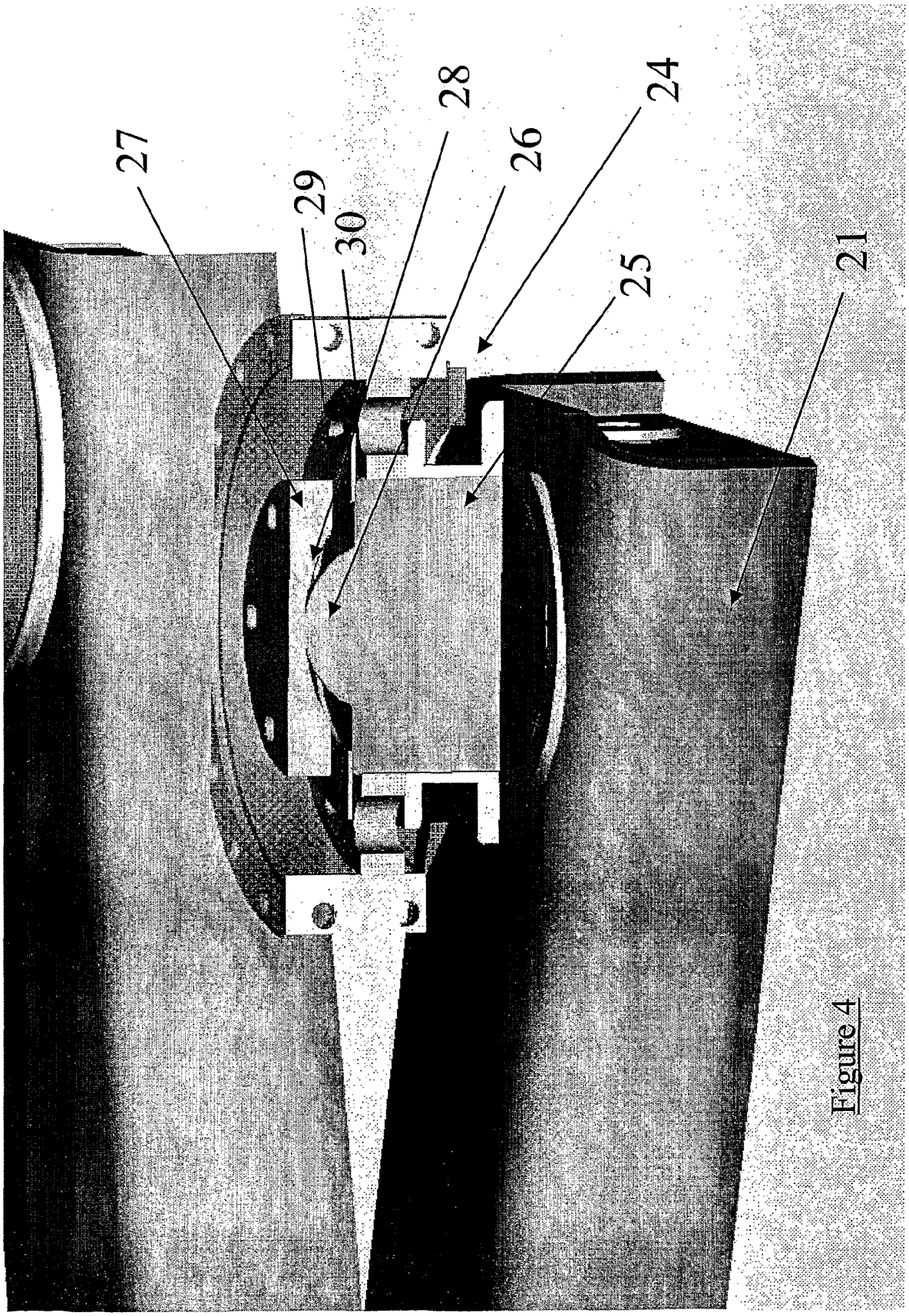

Figure 4

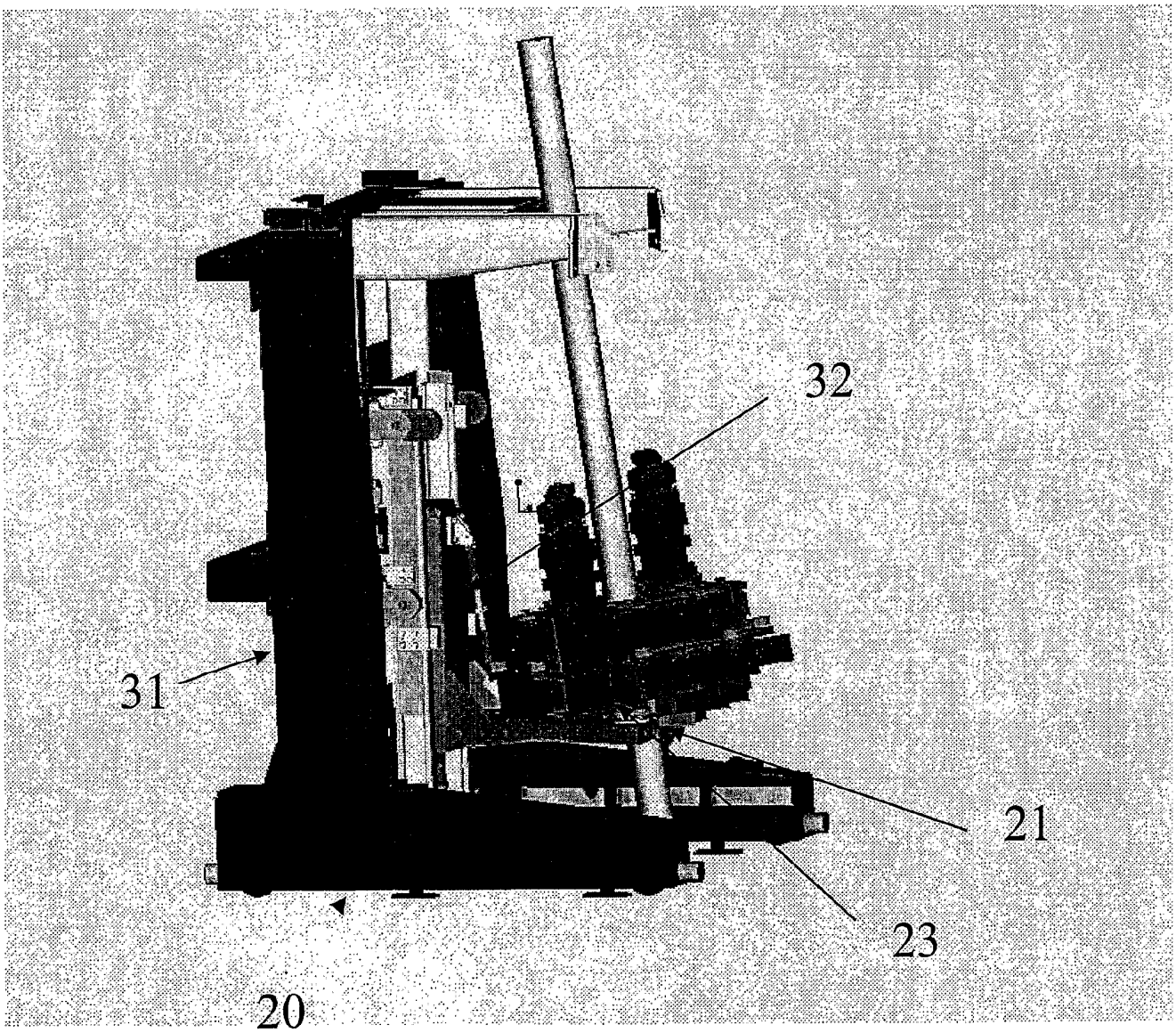

Figure 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/05121

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B19/16

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 7 E21B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A Y	US 2 668 689 A (CORMANY DAVID R) 9 February 1954 (1954-02-09) column 1, line 39-44 column 3, line 52-55 column 3, line 65-74 figures 1-4,8 --- -/--	1 5,6,10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/05121

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 297 874 A (RAINES KENNETH W J) 29 March 1994 (1994-03-29) abstract column 1, line 8-11 column 3, line 39-63 figures	7-9
A	US 3 288 000 A (LEWIS FOSTER JAMES) 29 November 1966 (1966-11-29) column 2, line 57 -column 3, line 10 column 5, line 21-35 figures	1,13
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 01/05121

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