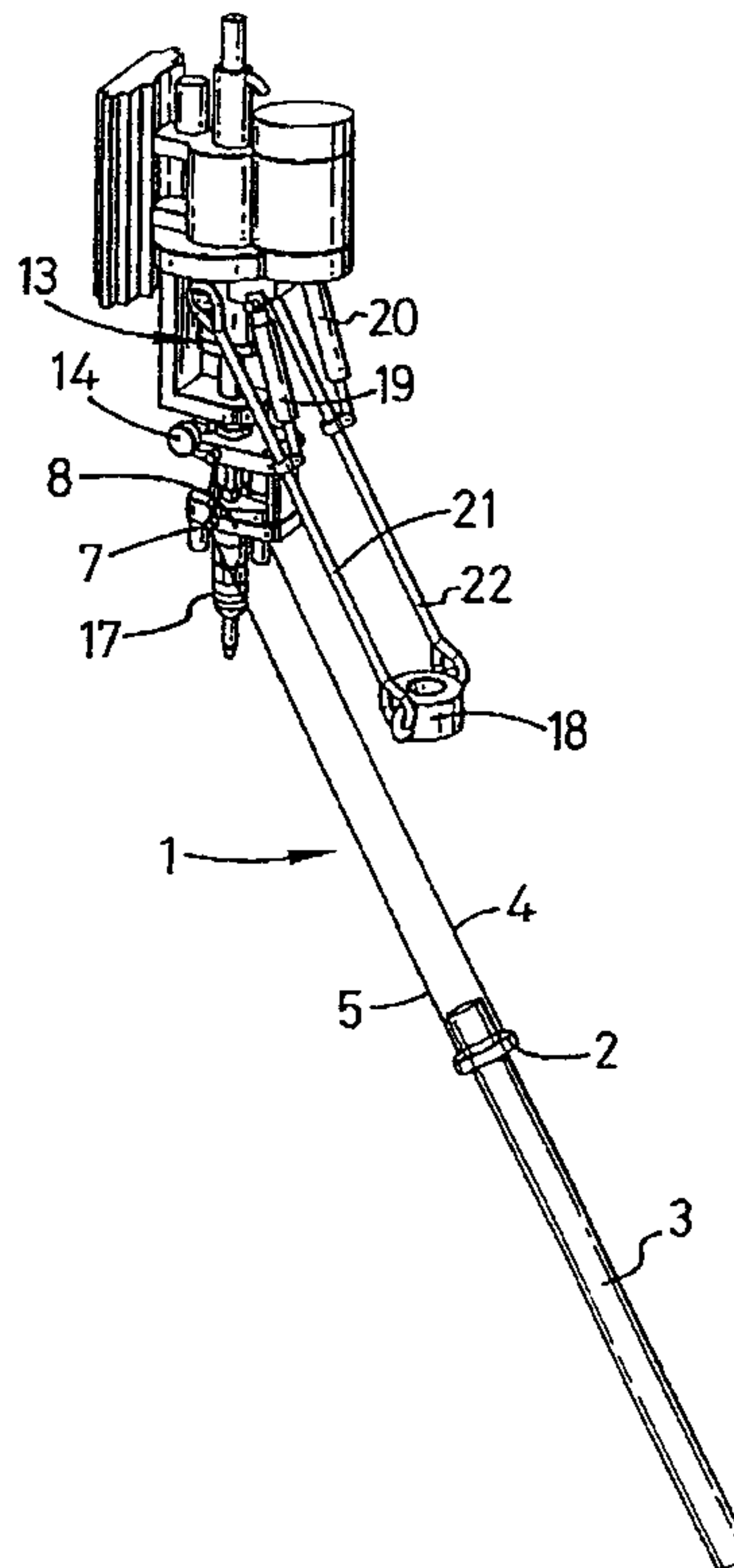




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(54) Titre : PROCÉDE ET APPAREIL DE RACCORDEMENT DE TUBAGES UTILISANT UNE COMMANDE SUPERIEURE
 (54) Title: METHOD AND APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE



(57) Abrégé/Abstract:

An apparatus for facilitating the connection of tubulars, said apparatus comprising a winch (15), at least one wire line (4, 5) and a device (2) for gripping a tubular (3), the arrangement being such that, in use, the winch (15) can be used to winch said at least one wire (4, 5) and said device (2) to position a tubular (3) below said top drive.

Abstract

An apparatus for facilitating the connection of tubulars, said apparatus comprising a winch (15), at least one wire line (4, 5) and a device (2) for gripping a tubular (3), the arrangement being such that, in use, the winch (15) can be used to winch said at least one wire (4, 5) and said device (2) to position a tubular (3) below said to top drive.

METHOD AND APPARATUS FOR CONNECTING TUBULARS
USING A TOP DRIVE

This is a divisional application of Canadian Patent Application Serial No. 2,340,994 filed on August 16, 1999.

This invention relates to a method and apparatus for facilitating the connection of tubulars using a top drive and is, more particularly but not exclusively, for facilitating the connection of a section or stand of casing to a string or casing.

It should be understood that the expression "the invention" and the like encompasses the subject-matter of both the parent and the divisional applications.

In the construction of wells such as oil or gas wells, it is usually necessary to line predrilled holes with a string of tubulars known as casing. Because of the size of the casing required, sections or stands of say two sections of casing are connected to each other as they are lowered into the well from a platform. The first section or stand of casing is lowered into the well and is usually restrained from falling into the well by a spider located in the platform's floor. Subsequent sections or stands of casing are moved from a rack to the well centre above the spider. The threaded pin of the section or stand of casing to be connected is located over the threaded box of the casing in the well to form a string of casing. The connection is made-up by rotation therebetween.

It is common practice to use a power tong to torque the connection up to a predetermined torque in order to perfect the connection. The power tong is located on the platform, either on rails, or hung from a derrick on a chain. However, it has recently been proposed to use a top drive for making such connection.

Prior to the present invention, pipe handling devices moved pipes to be connected to a tubular string from a rack to the well centre using articulated arms or, more commonly, a pipe elevator suspended from the drilling tower.

The present invention provides an alternative to these devices.

Accordingly, a first aspect of the present invention provides an apparatus for facilitating the connection of tubulars, said apparatus comprising a winch, at least one wire line and a device for gripping a tubular the arrangement being such that, in use, the winch can be used to winch said at least one wire and said device to position a tubular below said top drive.

In one embodiment, a guide can be located on said dynamic part of said suspension unit. Furthermore, a pulley wheel can be provided on said static part of said suspension unit.

According to a second aspect of the present invention there is provided a method of facilitating the connection of tubulars using a top drive and comprising the steps of attaching at least one wire to a tubular, the wire depending from the top drive or from a component attached thereto, and winching the wire and the tubular upwards to a position beneath the top drive.

According to a third aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising an elevator and a pair of bails, characterised in that said elevator is, in use, movable in relation to said pair of bails.

According to a fourth aspect of the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising an elevator and a pair of bails, characterised in that said elevator is, in use, movable relative to said pair of bails.

The present invention also provides an apparatus for facilitating the connection of tubulars using a top drive and comprising a suspension unit for coupling a tubular to the top drive, the suspension unit having a static part fixed with respect to a top drive and a dynamic part movable relative thereto, and a winch located on the static part of the suspension unit, at least one wire, and a device for gripping the tubular, the arrangement being such that, in use, the winch can be used to winch the at least one wire and the device to position the tubular below the top drive.

The present invention also provides an apparatus for facilitating the connection of tubulars using a top drive, the apparatus comprising an elevator, and a pair of bails attached to an axle disposed on the top drive and are movable thereabout, wherein the elevator is movable along the pair of bails.

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The present invention also provides an apparatus for facilitating the connection of tubulars using a top drive, the apparatus comprising an elevator, a pair of bails attached to an axle disposed on the top drive and are movable thereabout, wherein the elevator is movable along the pair of bails, and at least one piston and cylinder for moving the pair of bails.

The present invention also provides a method for facilitating the connection of tubulars using a top drive, the method comprising using an elevator to move a tubular to a position below the top drive, wherein the elevator is connected to the top drive using a pair of bails and wherein the elevator is movable along the pair of bails.

The present invention also provides a method for connecting a first tubular and a second tubular using a top drive, comprising gripping the first tubular with a clamp, raising the first tubular toward a tool, holding the first tubular with the tool, connecting the first tubular to the second tubular, releasing the first tubular from the clamp and the tool, gripping the first tubular with an elevator, and lower the first tubular.

The present invention also provides an apparatus for facilitating the connection of a first tubular to a second tubular using a top drive, comprising a first gripping member for retaining the first tubular, and a pair of bails, wherein the first gripping member is movable along the pair of bails.

The present invention also provides a method for facilitating the connection of a first casing to a second casing using a top drive, comprising providing the top drive with a first gripping member coupled to a pair of bails, retaining the first casing, and moving the first gripping member relative to the pair of bails.

The present invention also provides a method for connecting a first tubular and a second tubular using a top drive, comprising retaining the first tubular with a first gripping member, raising the first tubular toward a second gripping member, retaining the first tubular with the second gripping member, connecting the first tubular to the second tubular, releasing the first tubular from the first and second gripping members, gripping the first tubular with a third gripping member, and lowering the first tubular.

The present invention also provides a method for connecting tubulars using a top drive, comprising providing the top drive with a first gripping member, providing a second gripping member coupled to an elongated link, retaining a first tubular with the second gripping member, lifting the first tubular relative to the elongated link, engaging

the first tubular with the first gripping member, and rotating the first gripping member, thereby connecting the first tubular to a second tubular.

The present invention also provides an apparatus for connecting tubulars, comprising a top drive, a first gripping member adapted for rotation by the top drive, an elongated link coupled to the top drive, and a second gripping member coupled to the elongated link, the second gripping member movable along the elongated link.

The present invention also provides a method for connecting tubulars using a top drive, comprising providing the top drive with a first gripping member, providing a second gripping member coupled to an elongated link, moving the elongated link and the second gripping member laterally to engage a first tubular, retaining the first tubular with the second gripping member, moving the second gripping member and at least a portion of the first tubular into substantial alignment with the first gripping member, engaging the first tubular with the first gripping member; and rotating the first gripping member, thereby connecting the first tubular to a second tubular.

The present invention also provides a method of connecting casing sections by using a top drive, comprising closing a slip around a first casing section, engaging an elevator with a second casing section, operating a bail actuator to move the elevator and the second casing section into substantial alignment with the top drive, gripping an inner wall of a second casing section and supporting the weight of the second casing section with the top drive, rotating the second casing section using the top drive to join the second casing section to the first casing section to form a joint and a casing string, supporting the weight of the casing string with the top drive, and opening the slip.

The present invention also provides a top drive assembly for connecting casing sections, comprising a top drive, at least one elevator, at least one bail operatively coupled to the top drive at one end and the at least one elevator at another end, an actuator operatively coupled to the at least one bail and configured to rotate the at least one bail about a horizontal axis, whereby the at least one elevator is moved from a first location substantially below the top drive to a second location out from under the top drive, and at least one gripping element operatively coupled to the top drive and configured to be radially displaceable for engagement with an inner wall of a casing.

The present invention also provides a method of connecting casings using a top drive assembly, comprising providing a top drive assembly having a top drive and at least one radially displaceable gripping element for gripping a casing, supporting an elevator

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from the top drive assembly with at least one bail, the at least one bail having an actuator coupled thereto, the actuator adapted to pivot the at least one bail about a horizontal axis, closing a slip around a first casing, engaging a second casing with the elevator, moving the second casing to a well center by operating the actuator, gripping the second casing with the top drive assembly, threading the second casing to the first casing by rotating an output of the top drive to form a joint and a casing string, opening the slip, lowering the casing string through the slip, closing the slip around the casing string, and disengaging the top drive assembly from the casing string.

In another aspect, the invention also provides a method for facilitating the connection of tubulars using a top drive, comprising connecting an elevator to the top drive or a component attached to the top drive using a pair of bails, using the elevator to move a first tubular to a position below the top drive, gripping an inner wall of the first tubular and supporting the weight of the first tubular with the top drive, and rotating the first tubular using the top drive, thereby connecting the first tubular to a second tubular.

In another aspect, the invention provides a method for connecting tubulars using a top drive, comprising:

- providing the top drive with a first gripping member;
- providing a second gripping member coupled to an elongated link;
- moving the elongated link and the second gripping member laterally to engage a first tubular;
- retaining the first tubular with the second gripping member;
- lifting the first tubular relative to the elongated link;
- moving the second gripping member and at least a portion of the first tubular into substantial alignment with the first gripping member;
- engaging the first tubular with a first gripping member; and
- rotating the first gripping member, thereby connecting the first tubular to a second tubular.

In one aspect, the invention provides an apparatus for connecting casing sections by using a top drive, the apparatus comprising:

- at least one elevator;
- at least two bails operatively coupled to the top drive at one end and the at least one elevator at another end;

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an actuator operatively coupled to the at least two bails and configured to rotate the at least two bails about a horizontal axis, whereby the at least one elevator is moved from a first location substantially below the top drive to a second location out from under the top drive; and

at least one gripping element operatively coupled to the top drive and configured to be radially displaceable for engagement with an outer wall of a casing.

In one aspect, the invention provides an apparatus for connecting casing sections by using a top drive, the apparatus comprising:

at least one elevator;

at least two bails operatively coupled to the top drive at one end and the at least one elevator at another end;

an actuator operatively coupled to each of the at least two bails and configured to rotate the at least one bail about a horizontal axis, whereby the at least one elevator is moved from a first location substantially below the top drive to a second location out from under the top drive; and

at least one gripping element operatively coupled to the top drive and configured to be radially displaceable for engagement with an inner wall of a casing.

In one aspect, the invention provides an apparatus for connecting casing sections by using a top drive, the apparatus comprising:

an elevator;

at least one gripping element operatively coupled to the top drive and configured to be radially displaceable for engagement with a casing;

at least one extendable member operatively coupled to the top drive at one end and the elevator at another end, wherein the at least one extendable member is retractable to move the elevator closer to the at least one gripping element; and

an actuator operatively coupled to the at least one extendable member and configured to rotate the extendable member about a horizontal axis, whereby the at least one elevator is moved from a first location substantially below the top drive to a second location out from under the top drive.

In one aspect, the invention provides a method for handling a pipe in a rig, the rig including a spider, a top drive with a pipe engaging apparatus secured therebelow, and a

2e

link arm capable of pivoting relative to the pipe engaging apparatus, the method comprising:

coupling the link arm to a track on the rig;

using the link arm to pick up the pipe;

hoisting the top drive in the rig such that the pipe is rotated to a substantially vertical position while remaining engaged by the link arm;

positioning a lower end of the pipe onto a joint positioned in the spider such that the pipe is supported thereby;

slidably holding an upper portion of the pipe with the link arm;

engaging the upper portion of the pipe using the pipe engaging apparatus;

driving the pipe to connect it to the joint;

lowering the pipe until it is supported in the spider; and

disengaging the pipe engaging apparatus from the pipe.

In one aspect, the invention provides a method for handling a pipe in a rig, the rig including a spider, a top drive with a pipe engaging apparatus secured therebelow to define a main axis of the rig, the method comprising:

providing a link arm mounted by a pivotal connection to move with the top drive, the link arm driven to pivot about its pivotal connection through a plane of rotation at least between a lowered position and a raised position;

using the link arm to pick up the pipe;

hoisting the top drive in the rig such that the pipe is rotated to a substantially vertical position while remaining engaged by the link arm;

positioning a lower end of the pipe section onto a joint positioned in the rotary table such that the pipe is supported thereby;

slidably holding an upper portion of the pipe with the link arm;

engaging the upper portion of the pipe using the pipe engaging apparatus;

driving the pipe to connect it to the joint, wherein the link arm does not rotate relative to the pipe while the pipe is being driven;

lowering the pipe until it is supported in the spider; and

disengaging the pipe engaging apparatus from the pipe.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

Figures 1a to 1e are perspective views of an apparatus in accordance with a first embodiment of the present invention at various stages of operation; and

Figures 2a to 2d are perspective views of an apparatus in accordance with a second embodiment of the invention at various stages of operation.

Referring to Figures 1a to 1e there is shown an apparatus which is generally identified by reference numeral 1.

5 The apparatus 1 comprises a clamp 2 for retaining a tubular 3. The clamp 2 is suspended on wires 4, 5 which are connected thereto on opposing sides thereof. The wire 5 passes through an eye 6 in lug 7 which is attached to a spherical bearing in arm 8 of a suspension unit 9 at the point at which the arm 8 is connected to a hydraulic motor 10. The wire is connected to the hydraulic motor 10 in a corresponding manner. The
10 suspension unit 9 is of a type which enables displacement of the tubular 3 when connected to a tool 17 (see below), relative to a top drive 13, along a number of different axes. The wires 4, 5 pass across the suspension unit 9 and over pulley wheels 11 which are rotatably arranged on a plate 12. The plate 12 is fixed in relation to a top drive generally identified by reference numeral 13. The wires 4, 5 then pass over drums
15 14 to which the wires 4, 5 are also connected. The drums 14 are rotatable via a hydraulic winch motor 15.

In use, the clamp 2 is placed around a tubular below a box 16 thereof. The hydraulic winch motor 15 is then activated, which lifts the tubular 3 (conveniently from a rack) and towards a tool 17 for gripping the tubular 3 (Fig. 1b). The tubular 3
20 encompasses the tool 17 at which point the hydraulic winch motor 15 is deactivated (Fig. 1c). During this operation the elevator 18 is held away from the tool 17 by piston and cylinders 19, 20 acting on bails 21 and 22. The suspension unit 9 allows the hydraulic motor 10 and the arrangement depending therebelow to move in vertical and horizontal planes relative to the top drive 13. The eyes 6 in lugs 7 maintain the wires 4

and 5 in line with the tubular 3 during any such movement. The tool 17 may now be used to connect the tubular to the tubular string. More particularly, the tool may be of a type which is inserted into the upper end of the tubular, with gripping elements of the tool being radially displaceable for engagement with the inner wall of the tubular so as to secure the tubular to the tool. Once the tool is secured to the tubular, the hydraulic motor 10 is activated which rotates the tool 17 and hence the tubular 3 for engagement with a tubular string held in a spider.

The clamp 2 is now released from the tubular 3, and the top drive 13 and hence apparatus 1 is now lifted clear of the tubular 3. The elevator 18 is now swung in line with the apparatus 1 by actuation of the piston and cylinders 19 and 20 (Fig. 1d).

The top drive 13 is then lowered, lowering the elevator 18 over the box 16 of the tubular 3. The slips in the elevator 18 are then set to take the weight of the entire tubular string. The top drive is then raised slightly to enable the slips in the spider to be released and the top drive is then lowered to introduce the tubular string into the borehole.

Referring to Figures 2a to 2d there is shown an apparatus which is generally identified by reference numeral 101.

The apparatus 101 comprises an elevator 102 arranged at one end of bails 103, 104. The bails 103, 104 are movably attached to a top drive 105 via axles 106 which are located in eyes 107 in the other end of the bails 103, 104. Piston and cylinders 108, 109 are arranged between the top drive 105 and the bails. One end of the piston and cylinders 108, 109 are movably arranged on axles 110 on the top drive. The other end of the piston and cylinders 108, 109 are movably arranged on axles 111, 112 which are

located in lugs 113, 114 located approximately one-third along the length of the bails 103, 109.

The elevator 102 is provided with pins 115 on either side thereof and projecting therefrom. The pins 115 are located in slots 116 and 116a. A piston 117, 118 and
5 cylinder 119, 120 are arranged in each of the bails 103, 104. The cylinders are arranged in slot 121, 122. The piston 117, 118 are connected at their ends to the pins 115. The cylinders 119, 120 are prevented from moving along the bails 103, 104 by cross members 123 and 124. A hole is provided in each of the cross members to allow the pistons to move therethrough.

10 In use, a tubular 125 is angled from a rack near to the well centre. The tubular may however remain upright in the rack. The clamp 102 is placed around the tubular below a box 126 (Figure 2a). The top drive is raised on a track on a derrick. The tubular is lifted from the rack and the tubular swings to hang vertically (Figure 2b). The piston and cylinders 108, 109 are actuated, extending the pistons allowing the bails 103,
15 104 to move to a vertical position. The tubular 125 is now directly beneath a tool 127 for internally gripping and rotating the tubular 125 (Figure 2c). The pistons 117, 118 and cylinders 119, 120 are now actuated. The pins 115 follow slot 116 and the clamp 102 moves upwardly, lifting the tubular 125 over the tool 127 (Figure 2d). The tool 127 can now be actuated to grip the tubular 125.

20 At this stage the elevator 102 is released and the top drive 105 lowered to enable the tubular 125 to be connected to the string of tubulars in the slips and torqued appropriately by the top drive 105.

The pistons 117, 118 and cylinders 119, 120 are meantime extended so that after the tubular 125 has been connected the top drive 105 can be raised until the elevator 102

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is immediately below the box. The elevator 102 is then actuated to grip the tubular 125 firmly. The top drive 105 is then raised to lift the tubular string sufficiently to enable the wedges in the slips to be withdrawn. The top drive 105 is then lower to the drilling platform, the slips applied, the elevator 102 raised for the tubular 125 and the process

5 repeated.

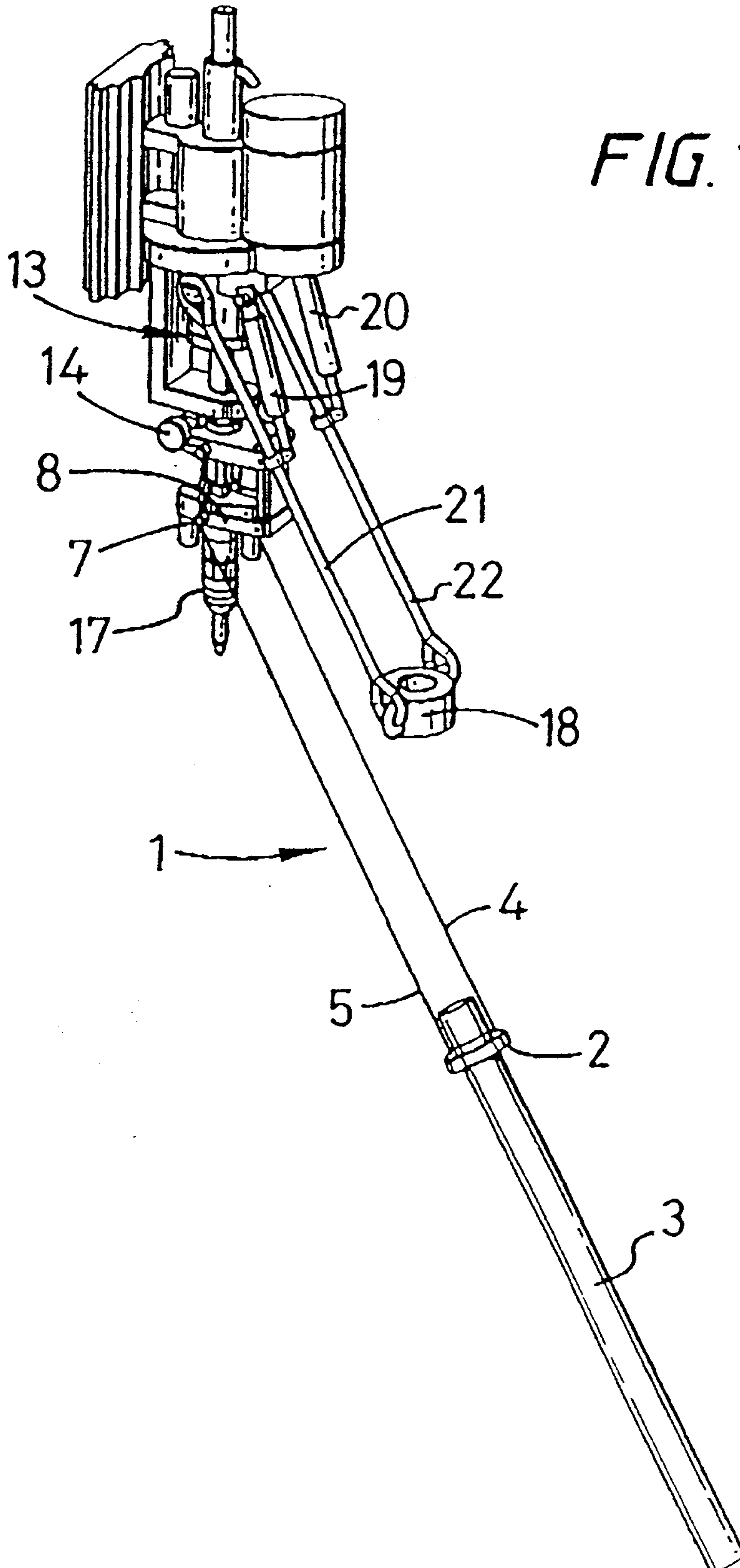
The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for connecting tubulars using a top drive, the method comprising:
providing the top drive with a first gripping member;
providing a second gripping member coupled to an elongated link;
moving the elongated link and the second gripping member laterally to engage a first tubular;
retaining the first tubular with the second gripping member;
moving the second gripping member and at least a portion of the first tubular into substantial alignment with the first gripping member;
engaging the first tubular with the first gripping member; and
rotating the first gripping member, thereby connecting the first tubular to a second tubular.
2. The method of claim 1, wherein the first gripping member comprises at least one movable gripping element.
3. The method of claim 2, wherein the at least one gripping element is radially movable.
4. The method of claim 2 or 3, wherein the at least one gripping element comprises a plurality of slips.
5. The method of any one of claims 1 to 4, further comprising providing the elongate link with a motive member.
6. The method of claim 5, further comprising actuating the motive member to move the second gripping member relative to the elongated link.
7. The method of any one of claims 1 to 6, wherein the elongated link is operatively coupled to a motive member and further comprising operating the motive member to move the elongated link laterally relative to the top drive.

8. The method of any one of claims 5 to 7, wherein the motive member comprises a fluid operated piston and cylinder assembly.
9. The method of any one of claims 1 to 8, wherein the first gripping member is rotated by the top drive.
10. The method of any one of claims 1 to 9, wherein engaging the first tubular comprises gripping an inner wall of the first tubular using the first gripping member.
11. The method of any one of claims 1 to 10, wherein the first tubular and the second tubular comprise casing.
12. The method of any one of claims 1 to 11, wherein the elongated link is coupled to the top drive.
13. The method of any one of claims 1 to 12, wherein the elongated link comprises a piston and cylinder assembly.

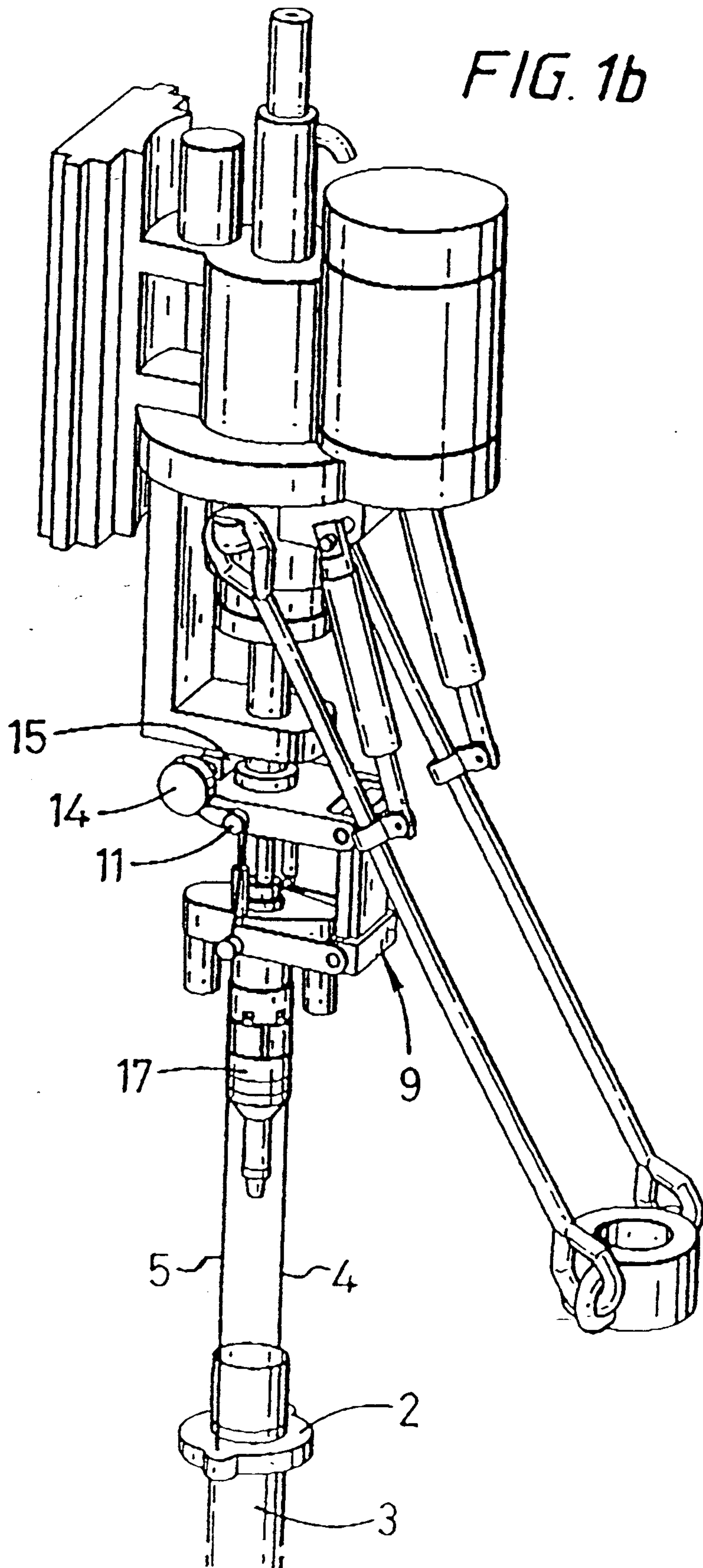
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FIG. 1a



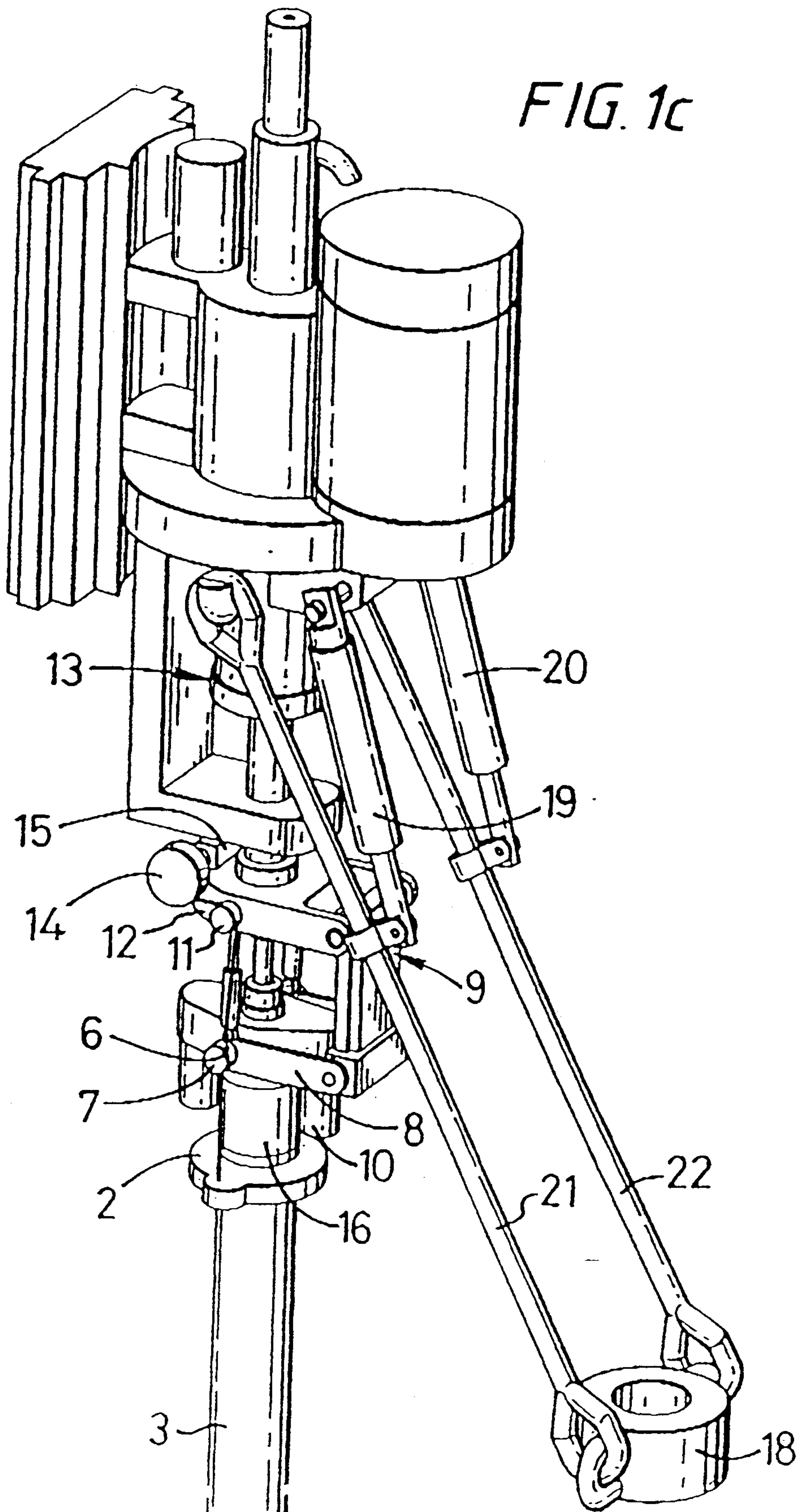
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FIG. 1b



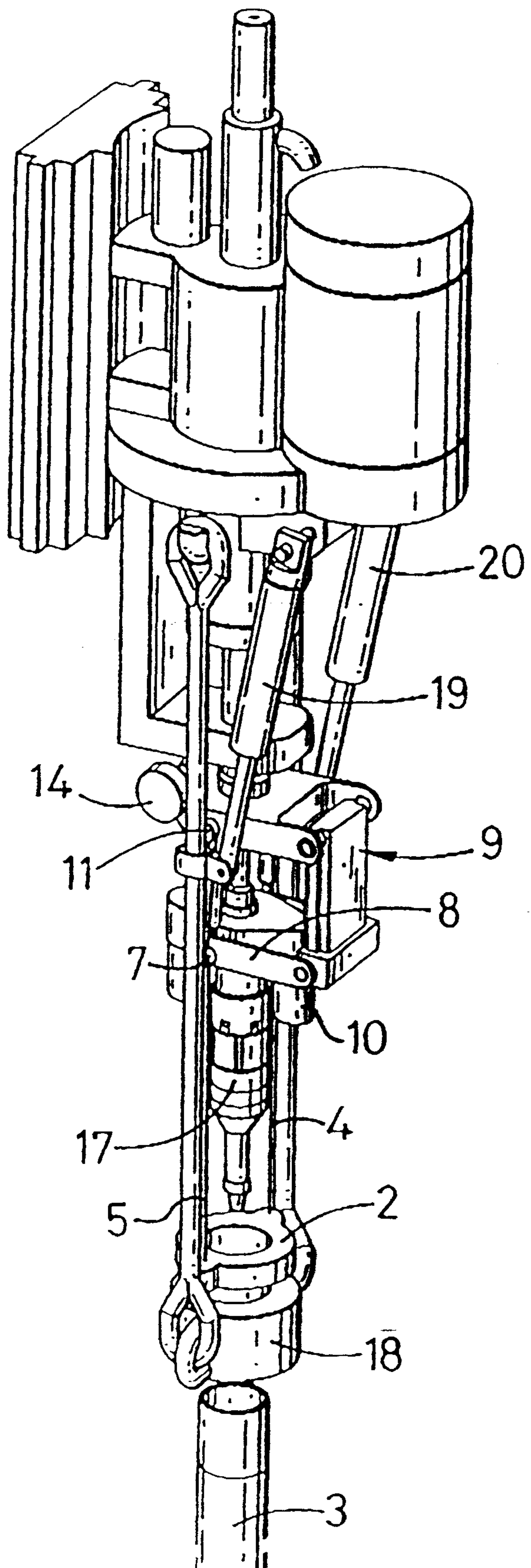
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FIG. 1c



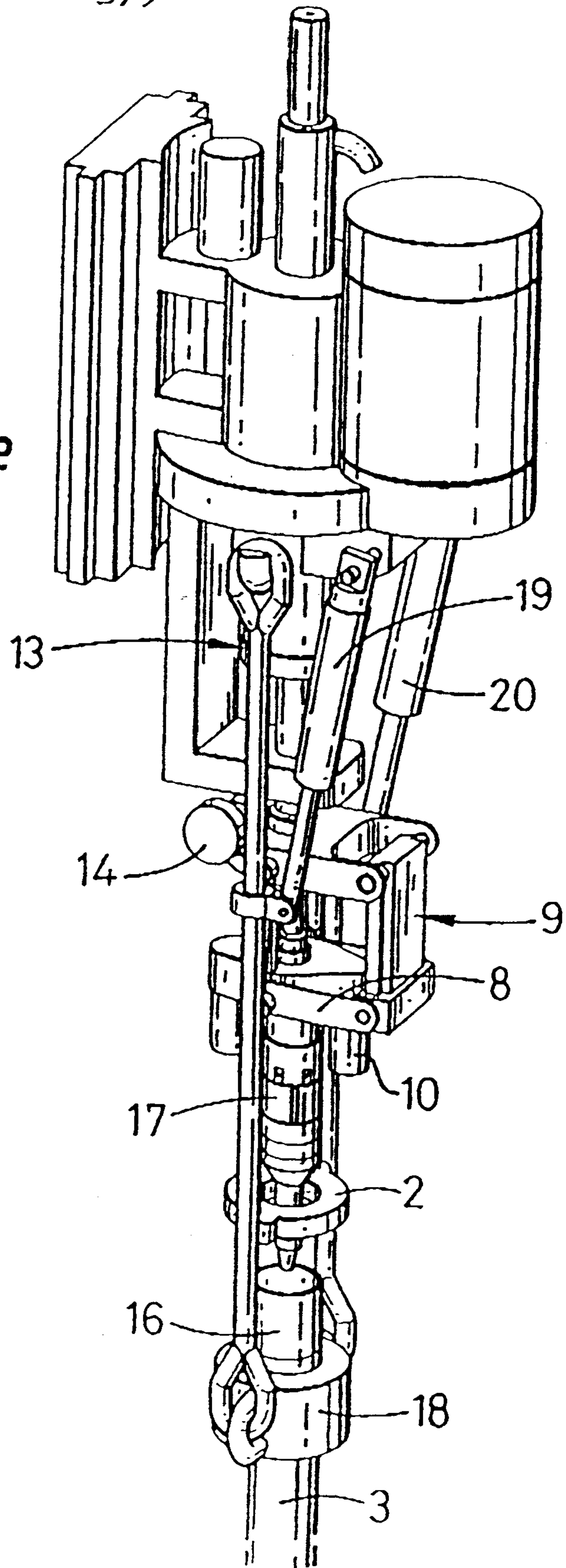
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FIG. 1d



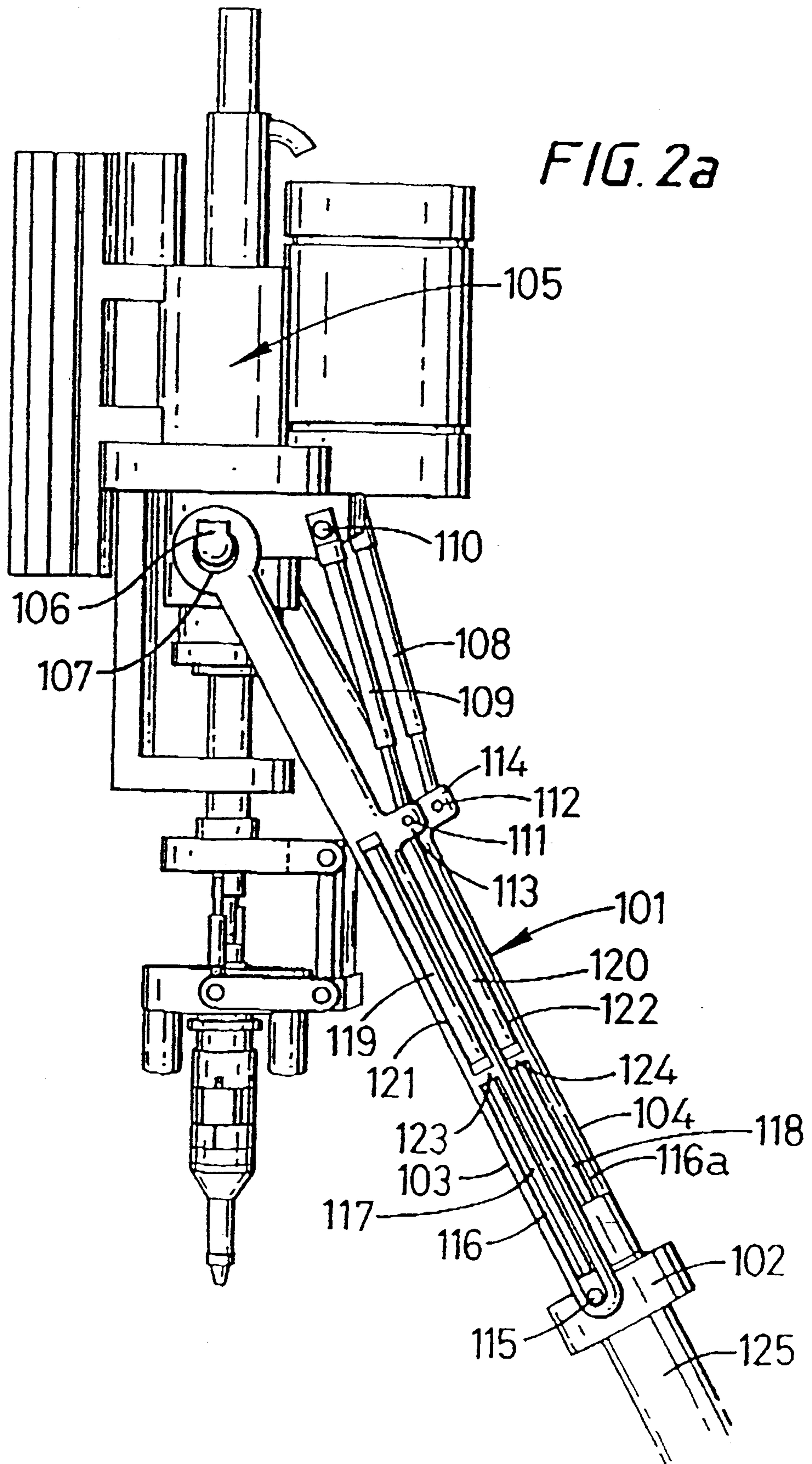
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FIG. 1e



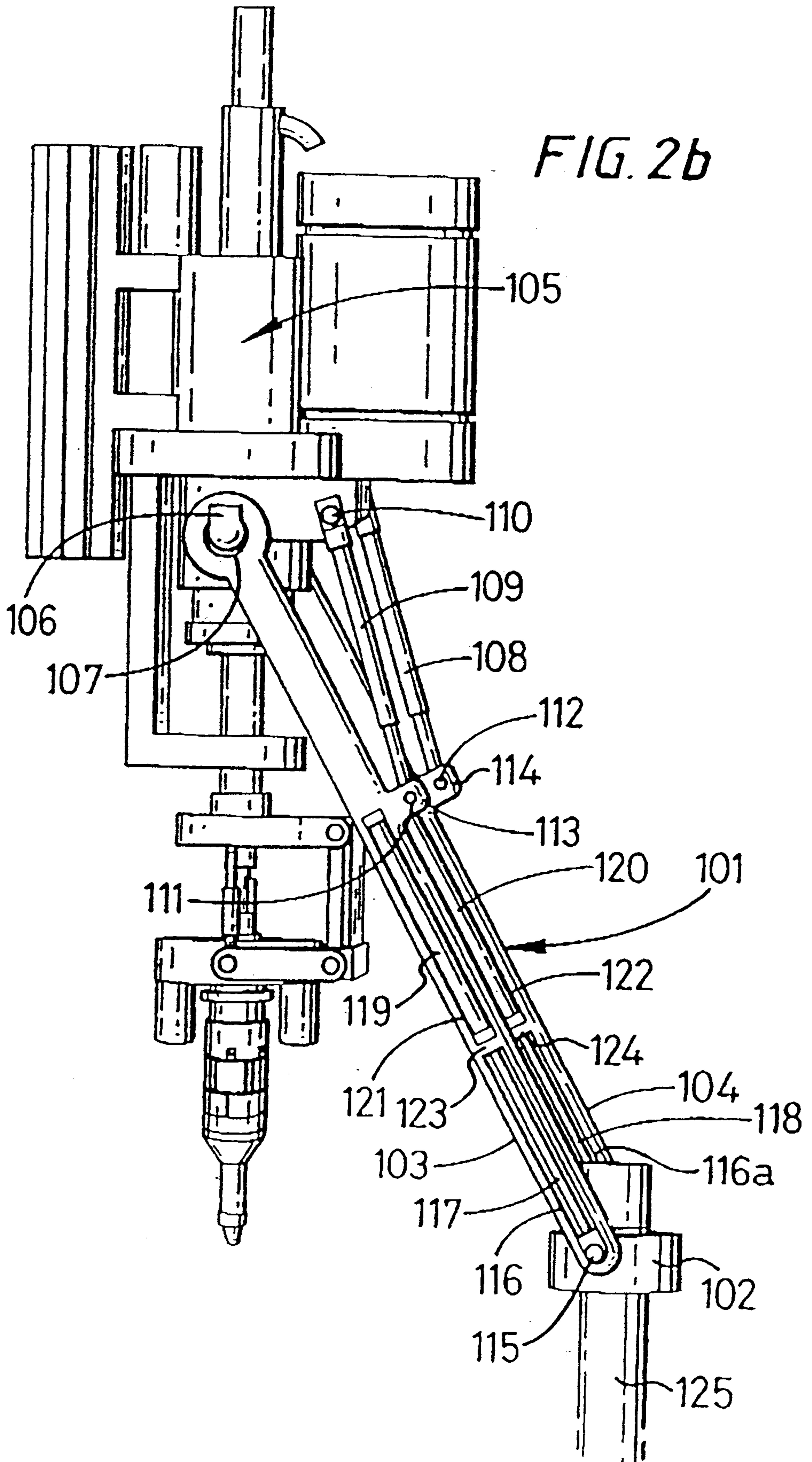
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FIG. 2a



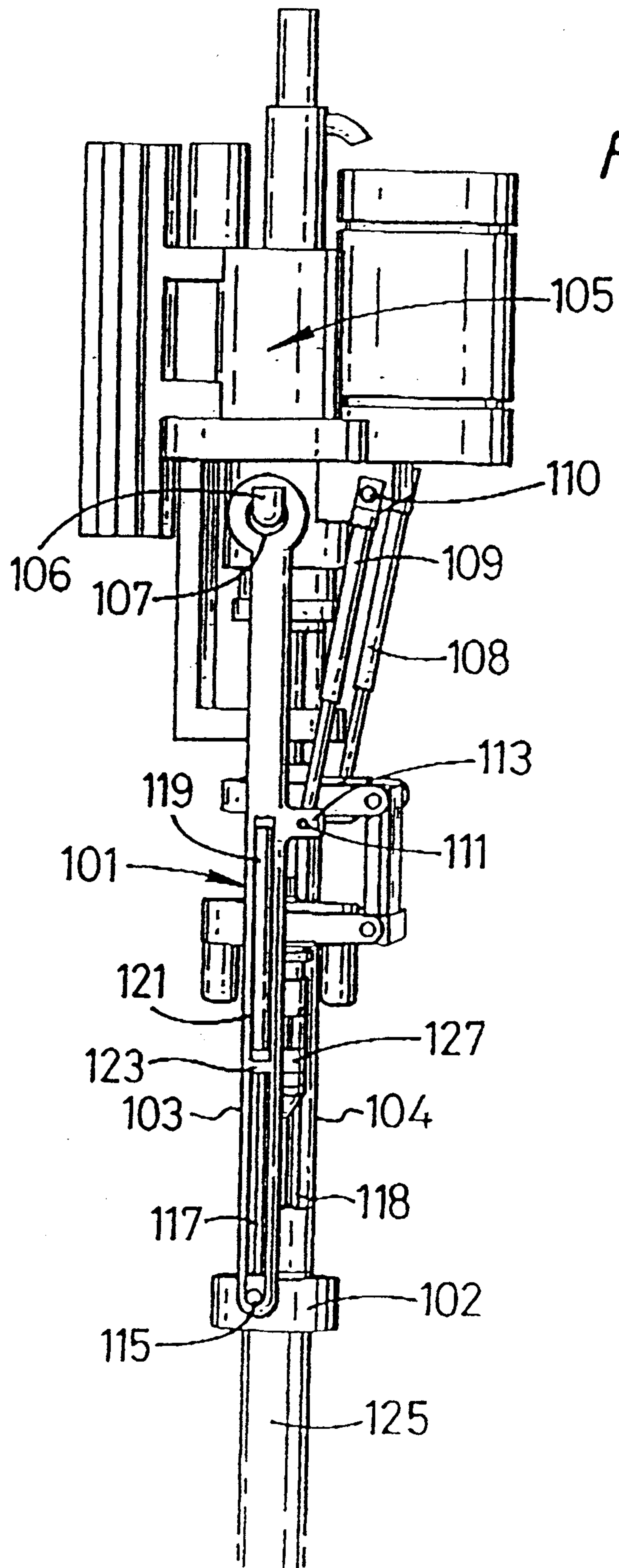
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FIG. 2b



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FIG. 2c



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FIG. 2d

