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US-A- 3 051 239 US-A- 3 150 718
US-A- 3 352 593 US-A- 3 638 988
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Description

This invention relates to a packer retrieval assembly for the retrieval of packers from oil well bores.

Oil well bores are provided with packers which fit within the well bore and may, for example, be provided with a valve or some other assembly. The packers are cylindrical in shape and have a through bore to permit the passage of fluid through the packer.

It is common for the packer to be secured in the well bore by means of two sets of radially extending barbs. The barbs engage the wall of the bore, the upper set of barbs preventing upward movement of the packer and the lower set of barbs preventing downward movement of the packer.

Such packers may become damaged and have to be removed from the well bore. This is achieved by lowering a tool into the well bore on the end of a drill string. The tool is provided with a milling cutter which is rotated to remove the upper set of barbs from the packer, and a retaining member which extends through the packer to retain the freed packer on the tool such that the packer is retained on the tool and may be retracted from the well bore.

One such tool is described in US-A-3 352 593, which discloses a tool for retrieving a packer having a through bore, the tool comprising an elongated body having a packer-cutting mill at one end and a packer retainer at the other end, the retainer being movable from a first position to a second position, in the first position the retainer having the diameter of its outer edge greater than the packer bore diameter to prevent the tool entering the packer bore, and in the second position the packer having the diameter of its outer edge less than the packer bore diameter to permit the tool to enter the packer bore and reach below the packer whereupon the retainer may return to said first position such that the retainer can support the packer.

However, when a tool such as described in US-A-3 352 593 is being lowered into the bore it is often difficult to judge when the tool has reached the packer. Debris and other obstructions, which the tool may encounter in the well bore before reaching the packer, may lead the operator to assume wrongly that the tool has encountered the packer and cause him to actuate the milling cutter prematurely.

It is an object of the present invention to obviate or mitigate this disadvantage.

According to present invention there is provided a packer retrieval assembly for retrieving a packer from an oil well bore, said packer having a through bore, the packer retrieval assembly comprising an elongate body member having a packer

releasing milling cutter and a packer retaining member mounted thereon, the packer retaining member being releasable from a first position to a second position, the first position being such that an outer face of the packer retaining member defines a diameter greater than the diameter of the packer bore, thus preventing the assembly from entering the bore, and the second position being such that the outer face of the packer retaining member defines a diameter less than the diameter of the packer bore, thus permitting the packer retrieval assembly to enter the bore and extend below the packer, whereupon the packer retaining member may return to the said first position such that the packer retaining member may support the packer, characterised in that the packer retaining member is initially retained in the first position by a set of first shear pins, the first shear pins being adapted to shear when the packer retaining member contacts the upper portion of the packer and when a pre-selected force is applied to the elongate body member, thus permitting the packer retaining member to be moved upwardly relative to the body member and inwardly to the second position.

Preferably the packer retaining member is releasable to a third position upon a force above a pre-selected magnitude being applied to the packer retrieval assembly, whereupon the packer is no longer supported by the packer retrieval assembly and the packer retrieval assembly disengages the packer. The retaining member may be released to the third position when the packer sticks in the well bore resulting in said force above a pre-selected magnitude being applied to the assembly.

Preferably also, when the packer retaining member supports the packer, the packer retaining member is supported in the first position by a second set of shear pins which are adapted to shear to permit the packer retaining member to be moved downwardly relative to the elongate body member and inwardly to the third position. Should the packer stick within the well bore the second set of pins may be sheared to permit the packer retaining member to be moved downwardly relative to the elongate body member and inwardly to the third position.

Preferably also, the packer retaining member is in the form of a grapple provided with a number of fingers having radially extending lower portions.

Preferably also, the packer retaining member is mounted on a mandrel having a shoulder portion on which the lower portion of the packer retaining member bears when in the first position.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a part sectional side view of a packer

retrieval assembly in accordance with the present invention;

Fig. 2 is a part sectional side view of the lower portion of the packer retrieval assembly of Fig. 1, showing the retaining member in a first position;

Fig. 3 is a part sectional side view of the lower portion of the packer retrieval assembly of Fig. 1, showing the retaining member in a second position; and

Fig. 4 is a part sectional side view of the lower portion of the packer retrieval assembly of Fig. 1 showing the retaining member in a third position.

Referring to the drawings, a packer retrieval assembly, for retrieving a packer having a through bore from an oil well bore, comprises an elongate body member 1 having a packer releasing milling cutter 2 and a packer retaining member 3 mounted thereon.

The body member 1 comprises three main parts; an upper mandrel 4, an extension piece 5, and a lower mandrel 6, and is provided with a central through bore 7 to permit drilling mud to be passed through the assembly.

The upper mandrel 4 is provided with a standard cone type screw thread 8 to enable the assembly to be fixed to the end of a drill string (not shown). A drive bushing 9 is located on the mandrel 4 directly below the screw thread 8.

Below the drive bushing 9 a second conical thread 10 is provided on the mandrel to co-operate with a screw thread 11 which is provided on an upper portion 12 of the packer releasing milling cutter 2. The cutter 2 is in the form of a milling shoe and comprises the above mentioned upper portion 12, which is of substantially the same diameter as the drive bushing 9, and a lower portion 13 which is of a greater diameter. The lower end 14 of the lower portion 13 is provided with a number of cutting teeth 15 which are coated with a suitably hard cutting material 16. Lateral grooves 17 on the outer surface of the lower portion 13 allow drilling mud, carrying debris that has been cut from the upper portion of a packer (not shown) by the cutting teeth 15, to pass upwardly towards the surface.

The extension piece 5 is threadably fixed at 18 to the lower end of the upper mandrel 4 and passes through and extends from the lower portion 13 of the cutter 2. The length of the extension piece 5 used in the assembly is chosen to suit the length of the packer which the assembly is being used to retrieve.

The lower mandrel 6, is threadably fixed at 19 to the lower end of the extension piece 5. At the lower end portion of the mandrel 6 there is provided a bullnose 20 having an outer diameter that

is slightly smaller than the diameter of the through bore of the packer to be retrieved. The lower edge 21 of the bullnose 20 is rounded to facilitate entry of the bullnose 20 into the packer bore.

The retaining member 3 is mounted on the lower mandrel 6 above the bullnose 20. The retaining member 3 is in the form of a grapple 22 having a number of downwardly extending fingers 23.

The grapple 22 is suspended from the mandrel 6 by a helical spring 24 which is situated within a cylindrical sleeve 25 which extends downwardly from the upper end portion of the mandrel 6.

The grapple 22 is provided with a collar 26 from which the fingers 23 extend. Each finger 23 comprises a relatively thin walled upper portion 27 and an outwardly tapering lower portion 28.

Each lower portion 28 is provided with a bevelled edged radially extending shoulder 29 above which is provided a through bore 30 for accommodating an end portion of a respective one of a first set of shear pins 31.

The outer surface of the lower mandrel 6 is provided with an annular shoulder 32, the edges 33 and 34 of which are bevelled. Bores 35 are provided in the shoulder to receive the end portions of the first set of shear pins 31.

Above the shoulder 32, on the mandrel 6, there is an inwardly stepped portion 36 which extends upwardly towards the extension piece 5. Bores 37 are provided on the stepped portion 36, in which there are fitted annular carbide holders 39 for receiving the end portions of a second set of shear pins 38. A quenched shear ring 40, having a number of threaded apertures 41 for receiving the opposite end portions of pins 38, is provided on the mandrel 6 and is retained by the shear pins 38.

When the assembly is to be used to retrieve a damaged packer the assembly is lowered down the oil well on the end of a drill string.

At this stage the grapple 22 is in a first position as is shown in Fig. 2. In this position the lower face of the collar 26 of the grapple 22 rests upon the shear ring 40 which is held in position by the second set of shear pins 38 and the lower portion of each grapple finger 23 is positioned on the shoulder 32 of the lower mandrel 6.

In this first position the fingers 23 are secured to the mandrel 6 by the first set of shear pins 31 and the shoulder 29 of each finger 23 extends radially beyond the outer face of the bullnose 20 such that the shoulders 29 define a circle of greater diameter than the bullnose 20.

Thus, when the assembly encounters the upper end portion of packer the bullnose 20 enters the bore of the packer and moves through the packer until the lower face of the shoulder 29 of each grapple finger 23 contacts the upper end portion of the packer causing the downward movement of the

assembly and drill string to be stopped. The operator then applies a downward force to the drill string. If the assembly is in contact with and has been halted by, for example, a piece of debris, the force applied to the drill string should be sufficient to force the debris out of the way of the assembly. However, if the assembly is in contact with the packer the force applied is increased until it reaches a predetermined magnitude which is sufficiently large to shear the first set of shear pins 31. This allows the grapple 22 to be forced upwards in relation to the mandrel 6, and inwards against the spring 24 to a second position as shown in Fig. 3.

In this second position the grapple fingers 23 are pressed inwards by the walls of the packer bore and the lower portion of the assembly may pass through the packer.

On leaving the lower end portion of the packer the grapple 22 is urged by the spring 24 to return to the first position, where the lower portions of each grapple finger 23 is positioned on the shoulder 32 of the mandrel 6.

The assembly is lowered further until the lower end 14 of the milling cutter 2 contacts the upper end portion of the packer.

The drill string and the assembly are then rotated such that cutting teeth 15 cut away the upper portion of the packer which secures the packer in the oil well bore. Drilling mud pumped down through the central bore of the body member 7 flows upwards past the milling cutter 2 acting as a coolant and carrying debris away from the cutting teeth 15.

Once the upper portion of the packer has been cut away the rotation of the drill string and assembly is stopped and the drill string is pulled upwards.

The assembly moves up through the packer until the shoulder 29 of each grapple finger 23 contacts the lower end portion of the packer.

The grapple 22 is prevented from moving downwards relative to the mandrel 6 under the weight of the packer by the collar 26 bearing against the shear ring 40 which is retained by the second set of shear pins 38. Thus, the packer is retained on the assembly and may be retrieved from the well bore with the assembly.

However, should the packer jam in the well bore the pulling forces on the drill string required to free the packer and the assembly may be such that the drill string, or the assembly, may break leaving the packer and parts of the assembly, or the drill string, in the well bore.

To prevent this the dimensions and the material of the second set of shear pins 38 are chosen such that the pins 38 will be sheared by the force applied from the grapple 22 before the magnitude of force necessary to damage the drill string or the

assembly is reached.

When the shear pins 38 shear, the ring 40 may fall to the step 36 and the grapple 22 may move downwardly relative to the mandrel 6 to a third position as is shown in Fig. 4.

In this third position the lower portion 28 of each grapple finger 23 is pushed inwards permitting the packer to slip over the grapple finger shoulders 29 releasing the assembly from the packer.

Thus, the packer retrieval assembly of the present invention gives the operator a clear indication when the assembly is in contact with the packer to be removed and provides a releasable grapple or drill string if the packer becomes jammed during retrieval.

Claims

1. A packer retrieval assembly for retrieving a packer from an oil well bore, said packer having a through bore, the packer retrieval assembly comprising an elongate body member (1) having a packer releasing milling cutter (2) and a packer retaining member (3) mounted thereon, the packer retaining member (3) being releasable from a first position to a second position, the first position being such that an outer face (29) of the packer retaining member (3) defines a diameter greater than the diameter of the packer bore, thus preventing the packer retrieval assembly from entering the bore, and the second position being such that the outer face (29) of the packer retaining member (3) defines a diameter less than the diameter of the packer bore, thus permitting the packer retrieval assembly to enter the bore and extend below the packer, whereupon the packer retaining member (3) may return to the said first position such that the packer retaining member (3) may support the packer, characterised in that the packer retaining member (3) is initially retained in the first position by a set of first shear pins (31), the first shear pins (31) being adapted to shear when the packer retaining member (3) contacts the upper portion of the packer and when a pre-selected force is applied to the elongate body member (1), thus permitting the packer retaining member (3) to be moved upwardly relative to the elongate body member (1) and inwardly to the second position.
2. A packer retrieval assembly as claimed in claim 1, characterised in that the packer retaining member (3) is releasable to a third position

upon a force above a preselected magnitude being applied to the packer retrieval assembly, whereupon the packer is no longer supported by the packer retrieval assembly and the packer retrieval assembly disengages the packer.

3. A packer retrieval assembly as claimed in claim 2, characterised in that when the packer retaining member (3) supports the packer, the packer retaining member (3) is supported in the first position by a second set of shear pins (38), which are adapted to shear to permit the packer retaining member (3) to be moved downwardly relative to the elongate body member (1) and inwardly to the third position.
4. A packer retrieval assembly as claimed in any preceding claim, characterised in that the packer retaining member (3) is in the form of a grapple (22) provided with a number of fingers (23) having radially extending lower portions (28).
5. A packer retrieval assembly as claimed in any preceding claim, characterised in that the packer retaining member (3) is mounted on a mandrel (6) having a shoulder portion (32) on which the lower portion of the packer retaining member (3) bears when in the first position.

Revendications

1. Dispositif de récupération de garniture de puits ou packer, pour extraire une garniture d'un puits de pétrole, ladite garniture ayant un alésage traversant, le dispositif de récupération de garniture comprenant un corps allongé (1) sur lequel sont montées une fraise de coupe (2) de libération de la garniture et une pièce de retenue de garniture (3), la pièce de retenue de garniture (3) étant libérable d'une première position à une deuxième position, la première position étant telle qu'une face extérieure (29) de la pièce de retenue de garniture (3) définit un diamètre plus grand que le diamètre de l'alésage de la garniture, ce qui empêche le dispositif de récupération de garniture de pénétrer dans l'alésage, et la deuxième position étant telle que la face extérieure (29) de la pièce de retenue de garniture (3) définit un diamètre inférieur au diamètre de l'alésage de la garniture, ce qui permet au dispositif de récupération de garniture de passer dans l'alésage et de s'étendre au-dessous de la garniture, après quoi la pièce de retenue de garniture (3) peut revenir à ladite première position de sorte que la pièce de retenue de garniture (3)

peut supporter la garniture, caractérisé en ce que la pièce de retenue de garniture (3) est initialement retenue dans la Première position par un jeu de premières goupilles de cisaillement (31), les premières goupilles de cisaillement (31) étant prévues pour se cisailer lorsque la pièce de retenue de garniture (3) est en contact avec la partie supérieure de la garniture et lorsqu'une force prédéterminée est appliquée au corps allongé (1), ce qui permet à la pièce de retenue de garniture (3) de se déplacer vers le haut par rapport au corps allongé (1) et vers l'intérieur jusqu'à la deuxième position.

2. Dispositif de récupération de garniture de puits suivant la revendication 1, caractérisé en ce que la pièce de retenue de garniture (3) est libérable à une troisième position lorsqu'une force supérieure à une valeur prédéterminée est appliquée au dispositif de récupération de garniture, après quoi la garniture n'est plus supportée par le dispositif de récupération de garniture, et le dispositif de récupération de garniture est dégagé de la garniture.
3. Dispositif de récupération de garniture suivant la revendication 2, caractérisé en ce que, lorsque la pièce de retenue de garniture (3) supporte la garniture, la pièce de retenue de garniture (3) est supportée dans la première position par un deuxième jeu de goupilles de cisaillement (38), qui sont prévues pour se cisailer de manière à permettre à la pièce de retenue de garniture (3) de se déplacer vers le bas par rapport au corps allongé (1) et vers l'intérieur jusqu'à la troisième position.
4. Dispositif de récupération de garniture suivant l'une quelconque des revendications précédentes, caractérisé en ce que la pièce de retenue de garniture (3) est sous la forme d'un grappin (22) comportant une pluralité de doigts (23) ayant des parties inférieures s'étendant radialement (28).
5. Dispositif de récupération de garniture suivant l'une quelconque des revendications précédentes, caractérisé en ce que la pièce de retenue de garniture (3) est montée sur un mandrin (6) présentant un épaulement (32) sur lequel la partie inférieure de la pièce de retenue de garniture (3) repose lorsqu'elle est dans la première position.

Ansprüche

1. Vorrichtung zur Wiederbeschaffung eines Dichtungsstückes aus einer Ölbohrung, wobei das Dichtungsstück eine Durchgangsbohrung aufweist und die Vorrichtung einen länglichen Hauptkörper (1) mit einem das Dichtungsstück freisetzen-
5 den Fräswerkzeug (2) und einem daran befestigten Halteteil (3) für das Dichtungsstück umfaßt, das aus einer ersten Position in eine zweite Position freisetzbar ist, wobei die erste Position derart beschaffen ist, daß eine Außenfläche (29) des Dichtungsstück-Halteteils (3) einen Durchmesser größer als der Durchmesser der Bohrung des Dichtungsstückes ergibt, so daß die Vorrichtung an einem Eintritt in die Bohrung gehindert wird, und wobei die zweite Position derart beschaffen ist, daß die Außenfläche (29) des Dichtungsstück-Halteteils (3) einen Durchmesser kleiner als der Durchmesser der Bohrung des Dichtungsstückes ergibt, so daß die Vorrichtung in die Bohrung eintreten kann und sich bis unterhalb des Dichtungsstückes erstreckt, worauf das Halteteil (3) für das Dichtungsstück in die erste Position zurückkehren kann, so daß das Dichtungsstück-Halteteil (3) das Dichtungsstück abstützen kann,
10 dadurch **gekennzeichnet**, daß das Dichtungsstück-Halteteil (3) anfänglich in der ersten Position durch einen Satz von ersten Abscherbolzen (31) gehalten wird, welche sich abscheren lassen, wenn das Dichtungsstück-Halteteil (3) den oberen Abschnitt des Dichtungsstückes berührt und wenn eine vorgewählte Kraft auf den länglichen Hauptkörper (1) ausgeübt wird, so daß das Dichtungsstück-Halteteil (3) relativ zu dem länglichen Hauptkörper (1) nach oben und nach innen in die zweite Position bewegt werden kann.
15
2. Vorrichtung zur Wiederbeschaffung eines Dichtungsstückes nach Anspruch 1,
20 dadurch **gekennzeichnet**, daß das Dichtungsstück-Halteteil (3) in eine dritte Position freisetzbar ist, wenn eine Kraft oberhalb einer vorgewählten Größe auf die Vorrichtung ausgeübt wird, worauf das Dichtungsstück nicht länger durch die Vorrichtung abgestützt wird und die Vorrichtung von dem Dichtungsstück gelöst wird.
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3. Vorrichtung zur Wiederbeschaffung eines Dichtungsstückes nach Anspruch 2,
30 dadurch **gekennzeichnet**, daß wenn das Dichtungsstück-Halteteil (3) das Dichtungsstück abstützt das Dichtungsstück-Halteteil (3) in der ersten Position durch einen zweiten Satz von Abscherbolzen (38) abgestützt wird, die sich abscheren lassen, damit das
35
4. Vorrichtung zur Wiederbeschaffung eines Dichtungsstückes nach einem der vorhergehenden Ansprüche,
40 dadurch **gekennzeichnet**, daß das Dichtungsstück-Halteteil (3) nach Art eines Fangeisens (22) ausgebildet ist und eine Anzahl von Fingern (23) mit radial verlaufenden unteren Abschnitten (28) aufweist.
45
5. Vorrichtung zur Wiederbeschaffung eines Dichtungsstückes nach einem der vorhergehenden Ansprüche,
50 dadurch **gekennzeichnet**, daß das Dichtungsstück-Halteteil (3) an einem Dorn (6) befestigt ist, der einen Schulterbereich (32) aufweist, an welchem der untere Abschnitt des Dichtungsstück-Halteteils (3) anliegt, wenn es sich in der ersten Position befindet.
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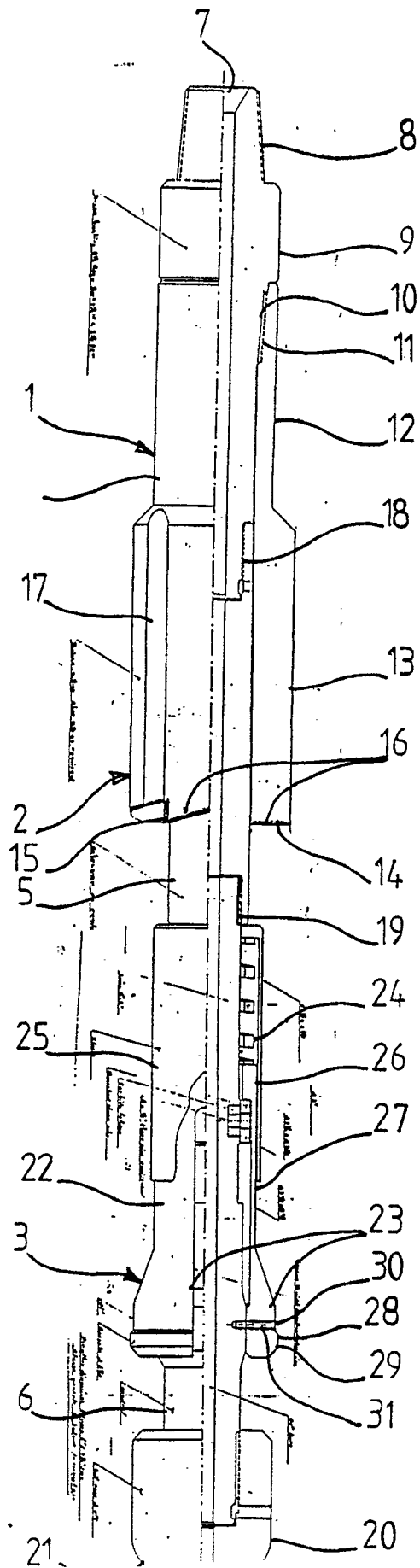
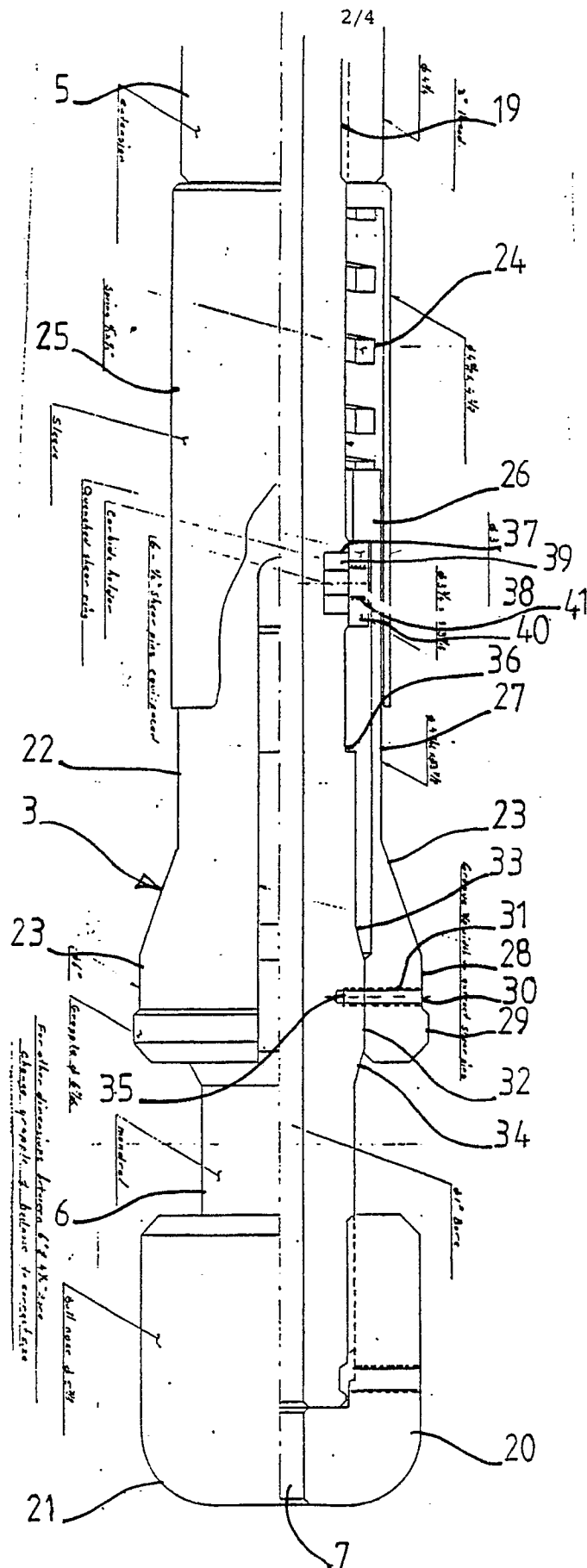


Fig.1



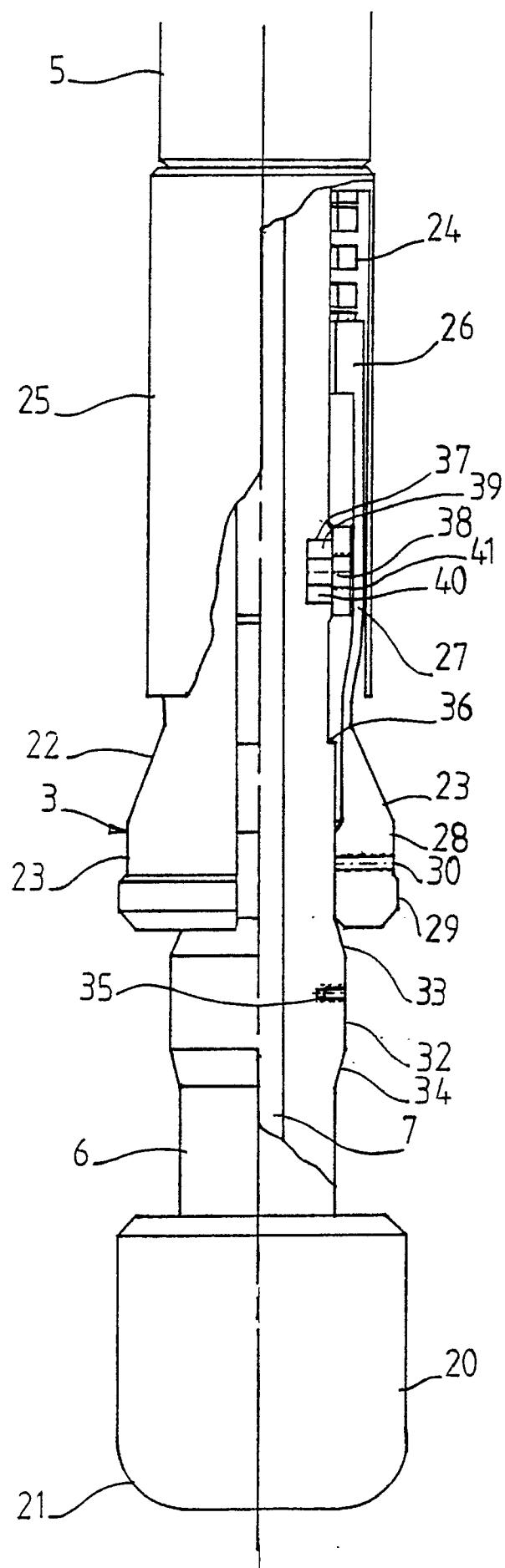


Fig.3

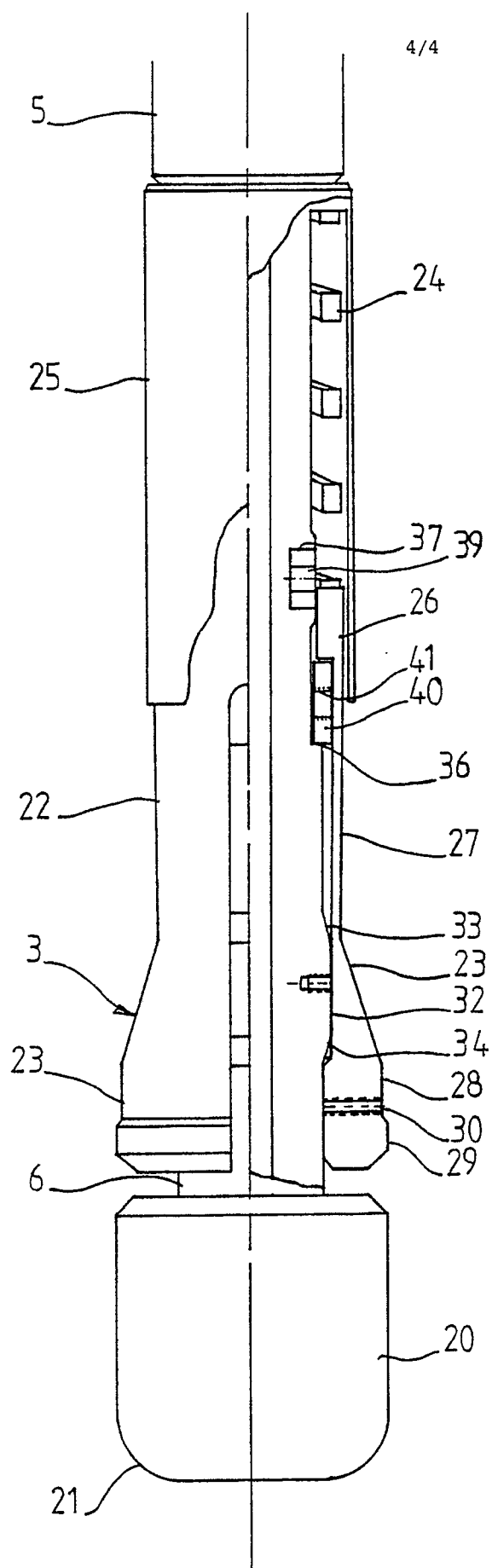


Fig. 4