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(54) Packer retrieval assembly.

(57) There is described a tool for retrieving from an oil well bore a packer. The packer has a through bore through which the retrieval assembly passes. The retrieval assembly comprises an elongate body member having a packer releasing milling cutter and a packer retaining member mounted thereon, the 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 assembly to enter the bore and extend from the packer, whereupon the retaining member may return to the said first position such that the retaining member may support the packer.

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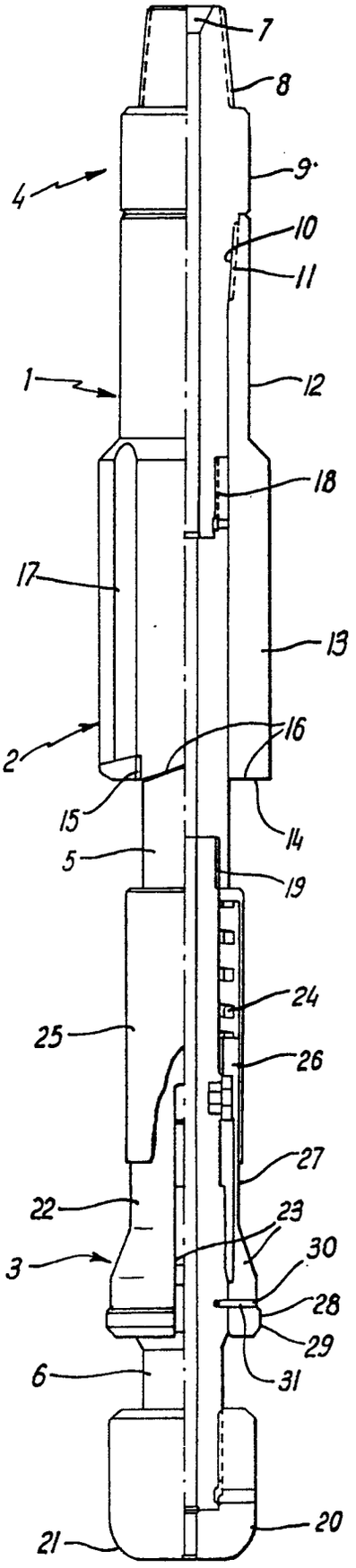
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Фиг. 1

Packer Retrieval Assembly

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.

When the tool 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 having a through bore from an oil well bore, comprising an elongate body member having a packer releasing milling cutter and a packer retaining member mounted thereon, the 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 assembly to enter the bore and extend from the packer, whereupon the retaining member may return to the said first position such that the retaining member may support the packer.

Preferably, the retaining member is initially retained in the first position by a set of first shear pins. On the retaining member contacting the upper portion of the packer and a pre-selected force being applied to the body member, the pins may shear, permitting the retaining member to be moved upwardly relative to the body member and inwardly to the second position.

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

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

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

Preferably also, the retaining member is mounted on a mandrel having a shoulder portion on which the lower portion of the 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 threadaoly 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.

Modifications and improvements may be incorporated without departing from the scope of the invention.

Claims

1. A packer retrieval assembly, for retrieving from an oil well bore a packer having a through bore, the assembly comprising an elongate body member having a packer releasing milling cutter and a packer retaining member mounted thereon, the 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 assembly to enter the bore and extend from the packer, whereupon the retaining member may return to the said first position such that the retaining member may support the packer.

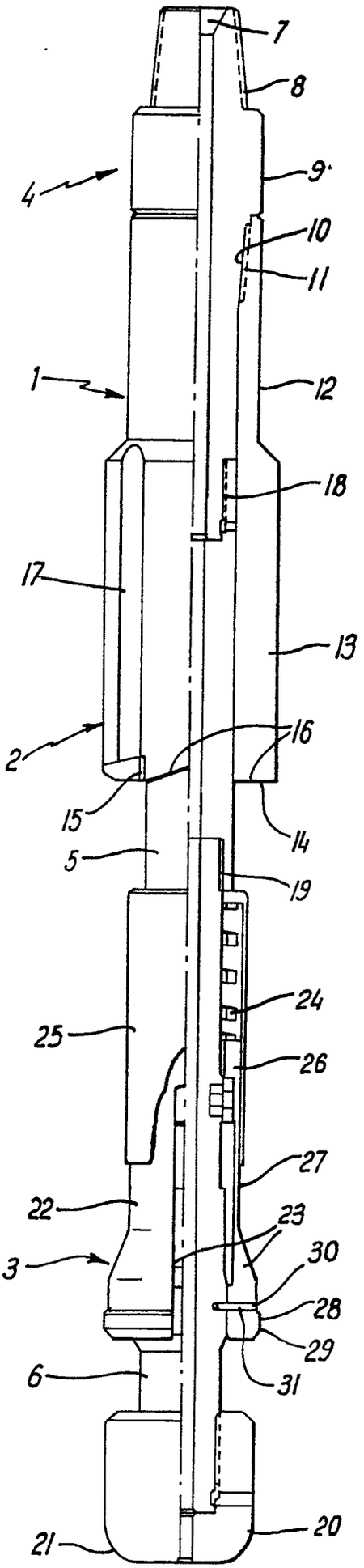
2. An assembly as claimed in Claim 1, wherein the retaining member is initially retained in the first position by a set of first shear pins, the pins being adapted to shear when the retaining member contacts the upper portion of the packer and a preselected force is applied to the body member, thus permitting the retaining member to be moved upwardly relative to the body member and inwardly to the second position.

3. An assembly as claimed in either preceding claim, wherein the retaining member is releasable to a third position when a force above a preselected magnitude being applied to the assembly. whereupon the packer is no longer supported by the assembly and the assembly disengages the packer.

4.An assembly as claimed in any preceding claim, wherein the retaining member is supported in the first position by a second set of shear pins, which are adapted to shear thus permitting the retaining member to be moved downwardly relative to the body member and inwardly to the third position.

5. An assembly as claimed in any preceding claim, wherein the retaining member is in the form of a grapple provided with a number of fingers having radially extending lower portions.

6. An assembly as claimed in any preceding claim, wherein the retaining member is mounted on a mandrel having a shoulder portion on which the lower portion of the retaining member bears when in the first position.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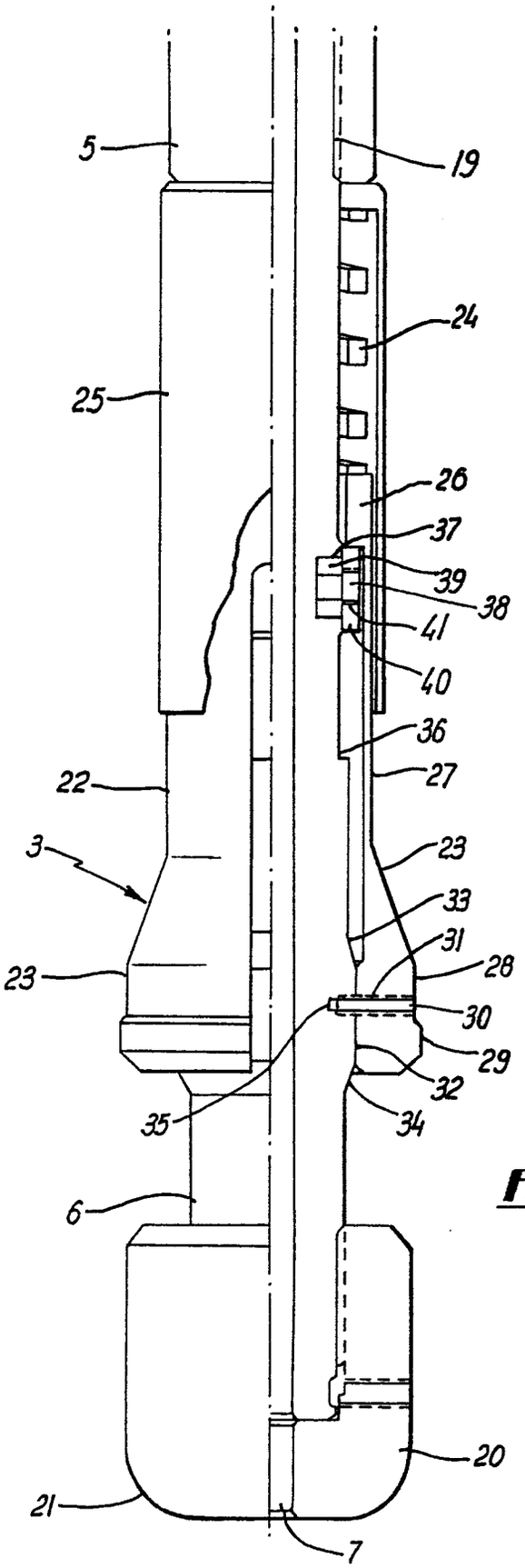
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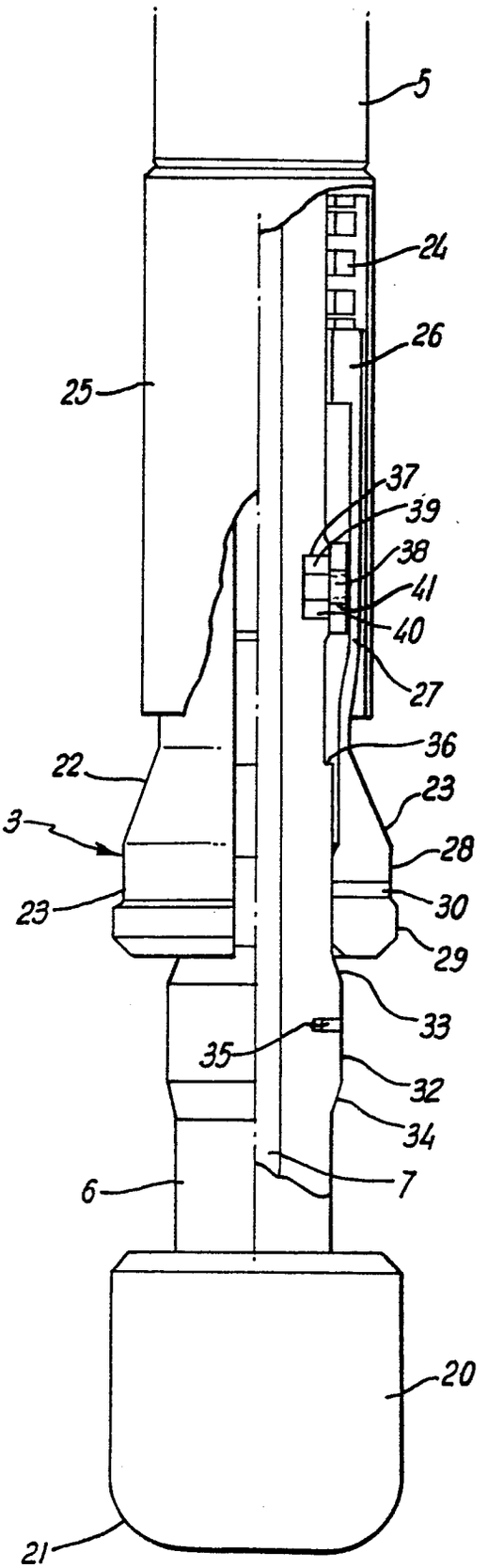

FIG_3

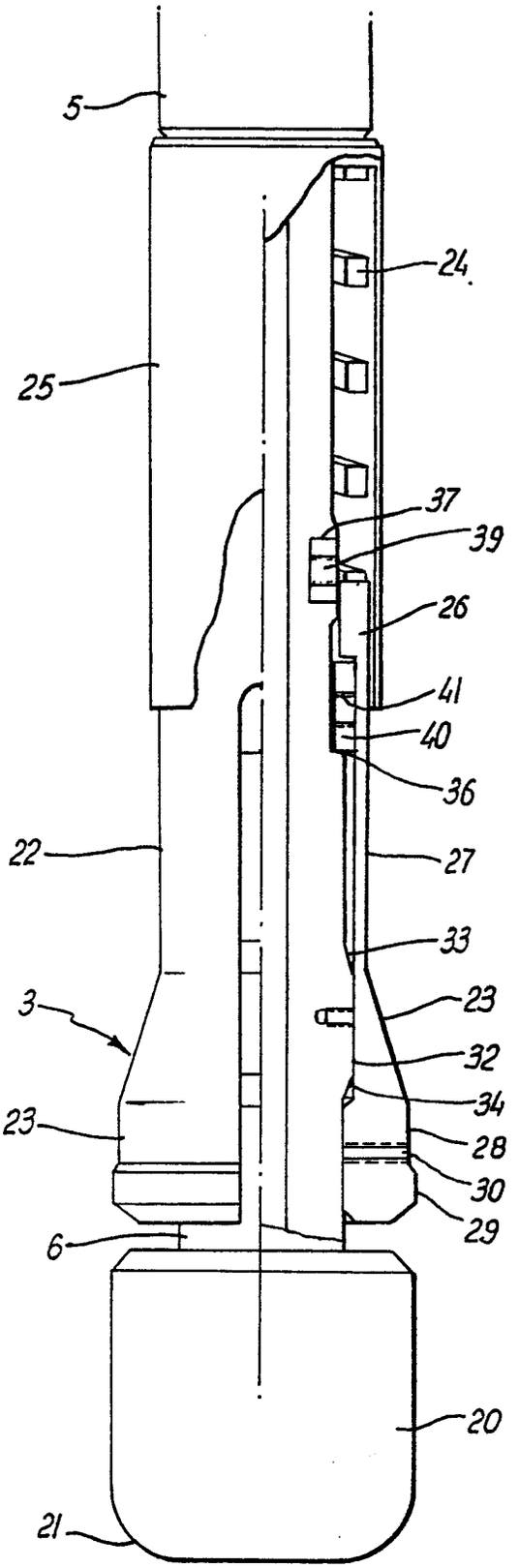

FIG_4