

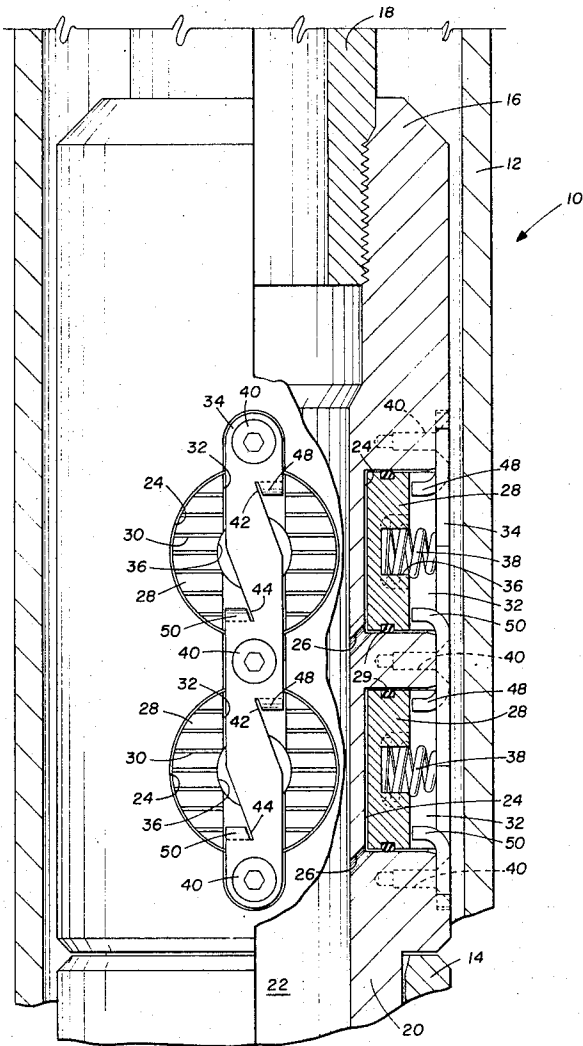
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3,454,087 7/1969 Pitts 166/212 X
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[54] HYDRAULIC ANCHOR DEVICE
5 Claims, 2 Drawing Figs.
[52] U.S. Cl. 166/212
[51] Int. Cl. E21b 23/04
[50] Field of Search 166/212,
206, 120

[56] References Cited
UNITED STATES PATENTS
2,915,011 12/1959 Hamil 166/212 X
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ABSTRACT: An anchoring device that is useful in well bores to retain tubing strings, packers or the like in a fixed position therein. The anchoring device includes several hydraulically actuated piston slips and is provided with a retaining member that includes one or more deformable tabs that engage the slips to prevent the slips from moving outwardly until the hydraulic force exceeds the deformation strength of the tabs. The arrangement is such that inadvertent expansion of the slips and, thus, dragging of the slips on the wall of the well bore in response to a differential pressure created by the movement of the tool through the well bore is prevented. The slips are positively restrained until a pressure sufficient to deform the tabs is deliberately applied whereupon the slips are moved into holding engagement.



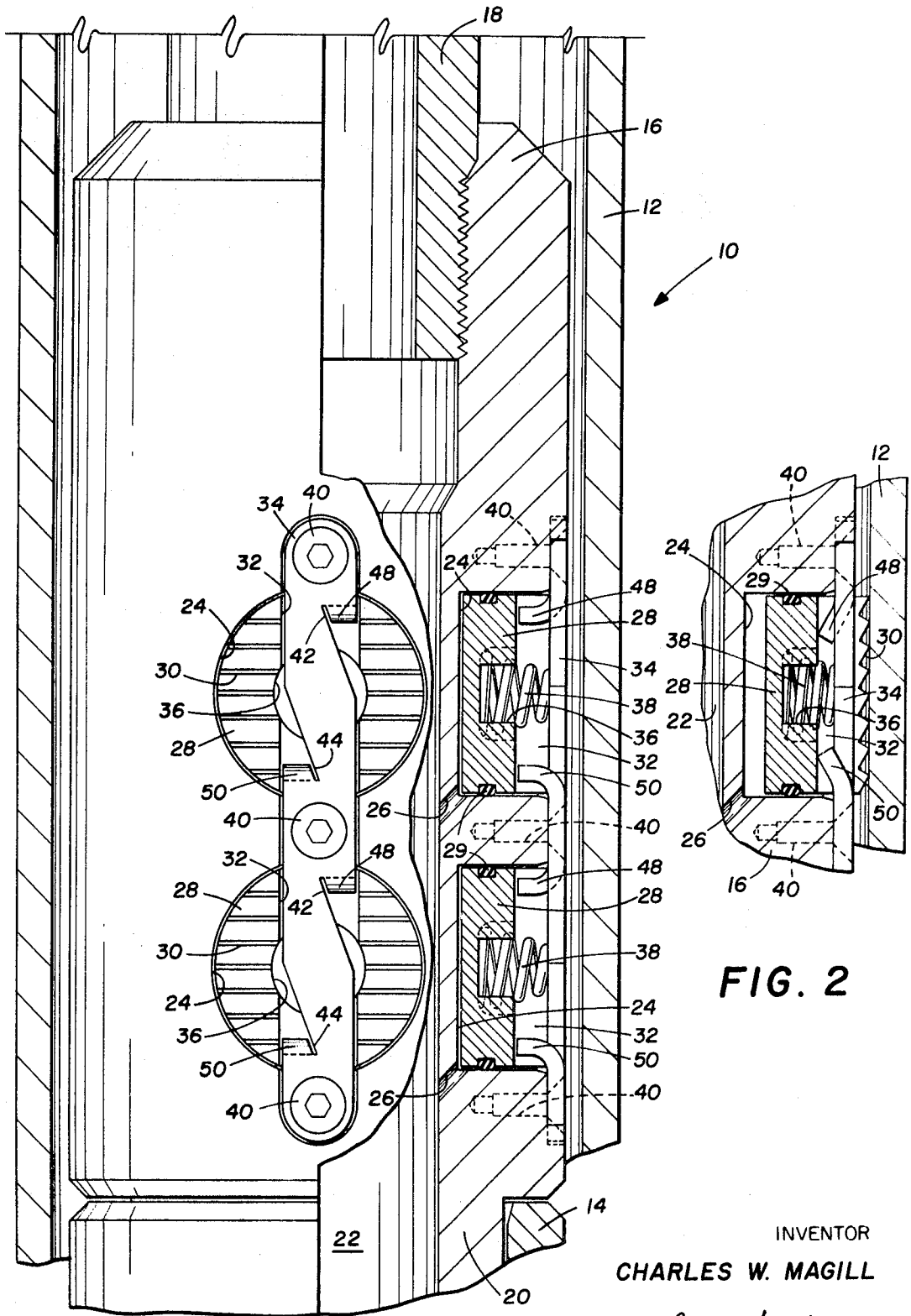


FIG. 1

FIG. 2

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HYDRAULIC ANCHOR DEVICE

BACKGROUND OF THE INVENTION

This invention relates generally to hydraulic anchoring devices for use in well bores. More particularly, but not by way of limitation, this invention relates to an improved hydraulic anchoring device and an improved slip-retaining device used thereon.

Hydraulically actuated, piston-type slips have been used in hydraulic anchors and packers for many years, but considerable difficulty is often encountered in moving the anchors through well bores. Frequently, the slips are moved outwardly into dragging engagement with the well bore wall under the influence of a pressure differential created as the tool is moved through the well bore. When the slips engage the wall under the influence of such pressure, the slips are most often destroyed or severely damaged as the tool is moved through the casing or the well bore.

Various structural arrangements have been utilized in the past in an effort to overcome the inadvertent outward movement of such slips. For example, U.S. Pat. No. 3,131,769 issued to J. F. De Rochemont on May 5, 1964, illustrates various arrangements of shear members interconnecting the slips and the tool body that function to retain the slips in their nonengaging position until sufficient force is exerted thereon to part the shear members. The shear-type retaining devices have been reasonably successful, but they are relatively expensive in that they must be very accurately machined in an effort to reproduce the parting strength for each slip. Also, the anchoring devices used in well bores are subjected to, in many instances, extremely corrosive environments that attack the shear-type devices and drastically change their parting value.

This invention provides an improved retaining device for hydraulically actuated, piston-type slips that is economical to manufacture and is very simple to install and replace.

Another object of the invention is to provide an improved anchoring device incorporating a retaining member that positively retains the slips in their nonengaging or retracted position until a predetermined hydraulic force is exerted thereon.

SUMMARY OF THE INVENTION

The improved anchoring device of this invention includes: a body having a fluid passageway and a lateral opening in the body communicating with the passageway; a gripping member movable in the lateral opening in response to pressure in the body into gripping engagement with the well bore wall; and, a retainer member mounted on the body and having a deformable tab portion engaging the gripping member. The retainer member prevents movement of the gripping member toward the well bore wall until the pressure in the body exerts a force on the gripping member sufficient to deform the tab portion.

The foregoing and additional objects and advantages of the invention will become more apparent as the following detailed description is read in conjunction with the accompanying drawings wherein like reference characters denote like parts in all views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view, partly in elevation and partly in cross section, of an anchoring device constructed in accordance with the invention and located in a well casing.

FIG. 2 is a cross-sectional view of a portion of the anchor of FIG. 1, illustrating another operative position of the anchor slips.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing and FIG. 1 in particular, shown therein and generally designated by the reference character 10 is a hydraulic anchor assembly that is disposed in a well casing 12. The anchor assembly 10 as shown is constructed to function in conjunction with a well packer. The only portion

of the well packer visible in FIG. 1 is the upper setting sleeve 14.

The anchor assembly 10 includes a generally cylindrical body 16 having its upper end threadedly attached to a tubing string 18 that extends to the surface of the well. A lower end 20 of the body 16 extends into the setting sleeve 14 of the well packer. A fluid passageway 22 extends through the body 16 and is in communication with the hollow interior of the tubing string 18.

A plurality of laterally extending openings 24 extend inwardly from the exterior surface of the body 16. Each opening 24 is in communication with the passageway 22 through a pressure port 26 that extends from the passageway 22 into each opening 24.

A piston-type slip 28 is sealingly and slidingly located in each of the openings 24. An O-ring seal 29 encircles each slip 28 and forms a fluidtight seal with the body 16 in the openings 24. The slips 28 are provided with an exterior toothed surface 30 for grippingly engaging the casing 12 as will be described more fully hereinafter. A slot 32 extends entirely across the toothed surface 30 of each slip 28. The slots 32 are sized to receive an elongated slip retainer member 34.

A centrally located recess 36 extends into each of the slips 28. A compression-type spring 38 is disposed in each of the recesses 36. The springs 38 have one end in engagement with the slips 28 and their opposite end in engagement with the retainer members 34 so that the slips 28 are continually biased relatively toward the passageway 22, that is, toward a nonengaging or retracted position with respect to the casing 12.

The retaining members 34 are connected to the body 16 by a plurality of threaded screws 40. Spaced, diagonally extending slits 42 have been formed in right sides of the retaining members 34 as viewed in FIG. 1. Similar slits 44 have been formed in the opposite or left-hand side of the retaining members 34 as viewed in FIG. 1. The members 34, on the outside of the slits 42, have been bent toward the slips 28 to form deformable tabs 48. The innermost ends of the tabs 48 engage the slips 28 in the slots 32. The material outside the slits 44 is bent toward the passageway 22 forming deformable tabs 50 that engage the slips 28 in the slots 32 at a point substantially diametrically opposed to the point of engagement between the tabs 48 and the slips 28.

The retaining member 34 is preferably constructed from a material having little or no resiliency so that the tabs 48 and 50 do not exert biasing forces on the slips 28. Instead, the tabs 48 and 50 positively retain the slips 28 in the position illustrated in FIG. 1 until sufficient force is exerted on the slips 28 to deform the tabs 48 and 50 as will be described.

OPERATION

When it is desired to use the anchor assembly 10, it is assembled as illustrated in FIG. 1 and connected with the tubing string 18. The tabs 48 and 50 of the retainer members 34 engage and retain the slips 28 in the retracted position.

As previously mentioned, one of the difficulties encountered in utilizing hydraulically actuated slips of the type described is that a differential pressure created as the tool moves through the well bore acts upon the slips to move them outwardly into dragging engagement with the casing. It can be appreciated that the retaining member 34 positively retains the slips 28 in the retracted position and, thus, the slips can not be inadvertently moved out by a pressure as low as that which will be created by moving the tool through the well bore.

Upon reaching the desired location in the well bore or casing 12 for setting the slips 28, hydraulic pressure is applied in the passageway 22. The pressure acts through the ports 26 and in the openings 24 to drive the pistons 28 outwardly. When the pressure reaches a sufficient magnitude, the tabs 48 and 50 are deformed outwardly, as illustrated in FIG. 2, permitting the toothed outer surface 30 of the slips 28 to engage the casing 12. In this position, the anchor 10 securely retains the tubing 18 in a fixed position in the well bore.

When desired, the hydraulic pressure in the passageway 22 is decreased to release the slips 28. The decrease in pressure permits the compression-type springs 38 to drive the slips 28 inwardly, that is, toward the passageway 22, moving the slips 28 out of engagement with the casing 12. The anchor assembly 10 and tubing string 18 may then be moved to any desired position in the casing 12 and reset by simply applying hydraulic pressure in the passageway 22.

After the anchor assembly 10 has been removed from the well bore, the retainer members 34, which are now deformed, can be removed very quickly by simply unscrewing the screws 40. The anchor assembly 10 is reconditioned for use by replacing the retainer members 34 with new retainer members or simply deforming the tabs 48 and 50 until they are again in the condition described in connection with FIG. 1 and replacing the screws 40.

The retainer members 34 are capable of being manufactured easily and economically since all that is required is to form the holes for the screws 40, cut the slits 42 and 44 therein and deform the tabs 48 and 50. Since the tabs 48 and 50 are relatively large in size, corrosive environments encountered in well bores will have little or no effect on the deformation strength thereof unless the anchor assembly 10 remains in such environments for an extended period.

From the foregoing detailed description, it can be appreciated that the anchor assembly 10 incorporating the improved retaining members 34 avoids the previous difficulties encountered with devices of this type. Furthermore, it can be appreciated that retaining members, constructed in accordance with the invention, can be quickly, easily and economically manufactured and utilized in the field opera-

tions.

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

1. In apparatus to be lowered into a well bore:

a body having a fluid passageway and a lateral opening in said body communicating with said passageway;

a gripping member moveable in said lateral opening in response to pressure in said body into gripping engagement with the well bore wall; and

a retainer member constructed from a substantially non-resilient material and mounted on said body and having a deformable tab portion engaging said gripping member, said retainer member preventing movement of said gripping member toward the well bore wall until the pressure exerts a force on said member sufficient to deform said tab portion.

2. The apparatus of claim 1 wherein said retainer member extends completely across said lateral opening.

3. The apparatus of claim 2 wherein said gripping member has a slot therein adjacent to and sized to receive said retainer member.

4. The apparatus of claim 3 and also including resilient means engaging said retainer member and said gripping member for biasing said gripping member relatively toward said passageway.

5. The apparatus of claim 4 wherein said retainer member has a deformable second tab portion, said second tab portion engaging said gripping member at a location substantially diametrically opposed to the location of engagement between said first-mentioned tab portion and said gripping member.

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