

Description

This invention relates to a tool for removing and retrieving packers from oil wells.

Production oil wells are fitted with a packer which is a solid metal cylindrical body which is secured to the well casing against upward and downward movement by circumferential upward- and downward-facing barbs. The packer has a central bore through which liquid can pass, the bore having an upper cylindrical portion and a lower cylindrical portion of greater diameter with a taper therebetween.

The packer is sealed to the casing by resilient sealing rings. Packers of the type described are of a widely standardised design throughout the oil production industry.

Should the well packer require replacement, for example, if the seals should break permitting escape of gas, a milling tool is fed down the well to mill and thus destroy the packer retainers and a retrieving tool is used to fish the remaining parts of the packer from the well.

Combined milling and retrieving tools are known. One such known tool has a central probe which penetrates the central bore of the packer and locates in the large diameter lower portion thereof. A cylindrical mill with a tungsten carbide cutting face located on the upper cylinder rim mills away the packer barbs and frees it from the well casing permitting withdrawal from the well. Particulate metal millings flow through the cylinder and up the well into debris collectors.

A prior art packer retriever of this nature is exemplified by the model CJ retriever of Baker Oil Tools as described in the Baker Service Tools technical manual unit 4113; see particularly page 12 of 54 dated 1 June 1981.

The known packer retrievers can have difficulty when used in highly angled deep wells, more particularly in emergency situations if the packer should tilt and jam in the well casing. This problem is aggravated if the well is being operated from a relatively unstable rig such as a semi-submersible oil rig for undersea production. If a packer should jam during retrieval and too great a force is applied in an attempt to free it breakage may occur either in the screwed connections of the retriever itself or in joints further up. When such circumstances occur it is necessary to sink a further milling tool to mill away all the remainder of the retriever and this is an extremely time-consuming and expensive operation particularly if the tungsten carbide cutting edge of the packer retriever has to be milled away as this obviously causes great wear of the second milling tool.

An object of the present invention is to obviate or mitigate the aforesaid disadvantages.

Accordingly the present invention relates to an oil well packer retriever comprising a packer miller for milling the packer to release it from the well casing, and a packer catcher mounted on a tubular member extending from the miller for engaging the packer once the packer is released;

the packer catcher comprising a sleeve slidable along said tubular member and slotted to define resilient fingers, and including an emergency release means;

and is characterised in that the packer miller comprises a plurality of radial blades having end faces and side faces provided with abrasive material, the end faces being dimensioned to mill substantially the entire annular surface of the packer, and the side faces having said abrasive material extending along a major portion thereof; and

the catcher sleeve is urged by resilient means into engagement with a collar and said emergency release means comprises the collar being secured to the tubular member by shear pins or bolts adapted to shear at a predetermined stress.

The packer retriever may also include a terminating milling tool dimensioned to pass through the bore of the packer.

It is further preferred that the packer is provided with ports proximate the milling fins and the milling tool located at the end of the retriever, said ports communicating with the central bore of the retriever and providing means for delivering a jet of liquid from the central bore to the area of milling to sweep milling debris therefrom.

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

Fig. 1 is a layout sketch showing the arrangement of parts throughout the length of a packer retriever incorporating this invention;

Fig. 2 is a longitudinal section of the length indicated by "A" in Fig. 1;

Fig. 3 is an elevation from the direction indicated by arrow C in Fig. 2;

Fig. 4 is a section taken on line D—D in Fig. 2;

Fig. 5 is a longitudinal part-section of the length indicated by "B" in Fig. 1;

Fig. 6 is an end view from the direction indicated by arrow E in Fig. 5;

Fig. 7 is a drawing of the shear sleeve indicated by 33 in Fig. 5;

Fig. 8 is a section taken on line F—F in Fig. 7; and

Fig. 9 is an enlargement of the area encircled in Fig. 5.

Referring to Fig. 1 of the drawings, a packer retriever of this invention is an elongate assembly of parts, the main features of which are shown schematically to illustrate their sequential arrangement from top to bottom.

The retriever 1 has a tubular bore 2 extending from end to end for throughflow of liquid. The assembly is attachable to a drill string by standard AP1 conical screwed connectors, for example as indicated at 3.

The assembly includes one or, preferably, more debris collectors 4 (shown in part-section in Fig. 1).

A packer miller 5 has radially extending fin-like projections 6 faced on their leading faces with tungsten carbide.

A packer catcher consists of a catch sleeve 7

having a series of spring steel fingers arranged for spring-engagement in the mill-out extension bore of a packer.

A shear collar 8 is fixed by shear bolts or pins (and pin retainer screws) and is released by excessive pressure being applied to it during withdrawal of the retriever from the oil well. Once released the shear ring and catch sleeve fall into engagement with a retaining ring 9.

The assembly terminates in a milling head 10 dimensioned to pass through the bore of a packer to remove any debris therein.

Liquid is pumped through the assembly during use to exit therefrom via ports located at 11 and 12 as debris-removing jets.

Referring to Figs. 2, 3 and 4, a packer miller 20 has an internal bore 21 with an exit port 22 for outflow as a jet of liquid pumped through the bore 21. The miller 20 carries a number, normally three, of radially directed fin-like blades 23 (only one is shown in Figs. 2 and 3, for clarity) the leading faces and lower edges of which carry a dressing 24 of tungsten carbide as shown. Each blade 23 has a radially enlarged upper extension 25 angled to the blade as shown in Fig. 3. The diameter of the circle of rotation of blade extension 25 is approximately equal to that of the oil well in which the packer retriever is to be used, the purpose being to assist centering of the retriever and more particularly to prevent damage to the well casing by the blades 23. An alternative arrangement which is not illustrated and which is convenient for larger diameter wells is to provide further up the string a non-rotating ribbed rubber sleeve which has approximately the same diameter of the well.

Referring now to Figs. 5 to 8, a packer catcher 30 has a catch sleeve 31 which is of cylindrical form with a series of axial slots cut along part of its length forming a series of fingers. To impart more flexibility to the fingers and to provide a degree of stress relief a bore is provided extending from the head of each axial slot into the metal of the catcher.

The lower edge 32 of the sleeve 31 is of arrow-head shape in cross-section. This edge 32 bears on the upper rim of a shear collar 33 which is fixed to the central tube of the retriever by one or more shear bolts or pins inserted in apertures 34 in the collar. At a lower level, a retaining collar 35 is provided to prevent loss of the shear collar 33 should it be released during use. The upper end of the catcher 30 engages a helical compression spring 36 held against a spring retainer 37 which is fixed to the central tube of the assembly.

The lowest end of the retriever carries a milling head 38 which has the cross sectional shape shown in Fig. 6, having curved faces 39 and flat faces 40. The milling head 38 is dressed with tungsten carbide on the curved faces 39 and on its underside but the flat faces 40 are not so dressed. A liquid exit port 41 communicates with the internal bore of the retriever assembly for outflow of a jet of liquid therefrom.

The manner of operation of the packer retriever

will now be described. The retriever is screwed to a drill string and lowered into the oil well from which a packer has to be removed. The milling head 38 enters the bore of the packer which frequently contains debris. The retriever is then rotated and liquid is pumped through its internal bore. A jet of this liquid exits from port 41 in the milling head and flushes the debris up the well where it is caught in debris collectors 4 or carried to surface. The shape of the milling head 38 is such that it self-centres in the bore of the packer and the wide spaces between the flat faces 40 and the bore of the packer permit a fast free-flow jet of liquid to flush away large and small pieces of debris and swarf.

As the milling head 38 proceeds further through the packer, (and any string of pipes below) the packer catcher 31 passes progressively through the packer and into the mill-out extension of the packer. The length of the packer is known and if necessary an extension string may be included in the retriever to increase the distance between the miller 20 and the catcher 30.

The blades 23 contact the uppermost surface of the packer and begin to mill out the packer. A jet of liquid flowing from ports 22 sweeps swarf and debris upwards into the debris collectors 4 or to surface.

Once the milling has proceeded sufficiently to release the packer from the well casing, the remains of the packer, and ancilliary pipework hung below, drop under gravity and are caught by catcher 30, the weight of the remains urging the catcher 30 against the shear collar 33 and splaying the fingers of the catcher 30 outwards into tight gripping engagement with the packer remains. The packer is then withdrawn from the well. As withdrawal proceeds it is possible for the packer remains to tilt and jam against the well casing or for pieces of debris to become trapped between the packer and the casing causing the packer to jam. This, of course, puts considerable strain on the string and can indeed result in breakage at any point between the retriever and the surface.

The shear collar 33 of this invention is designed to prevent such breakage. The collar 33 is provided with a number of apertures 34 registering with apertures in the central tube. Before sending the retriever down-hole a number of shear bolts are screwed into these apertures to secure the collar. The number of the bolts and the shear strength of the material of which they are made determine the stress at which the bolts shear releasing the collar.

The interaction between the packer catcher 31 and the shear collar 33 is illustrated in greater detail in Fig. 9A and B. Fig. 9A shows a packer 50 (indicated by broken lines) held by the catcher 31 and bearing on the shear collar 33. Fig. 9B shows the relative position of these parts after release of the shear collar 33. A packer 50 is held by catcher 31 by means of a shoulder 51 on the mill-out extension, the shoulder bearing on sloping surface 52 of the catcher 31. If the stress preset by

selection of the shear bolts located in apertures 34 is exceeded the bolts shear releasing the collar 33 which falls out of engagement with the catcher 31, the weight of the packer then compresses the sprung fingers of the catcher releasing the grip on the packer and allowing the retriever to be withdrawn from the well. After resetting the shear bolts the retriever may again be sent down-hole and the retrieval operation begun afresh.

The shear bolts may be screw-threaded bolts the shear strength of which is known or alternatively simple cylindrical pins may be used which are held in place by a separate screw-threaded plug.

Claims

1. An oil well packer retriever comprising a packer miller (5) for milling the packer to release it from the well casing, and a packer catcher (7, 8) mounted on a tubular member extending from the miller for engaging the packer once the packer is released;

the packer catcher (7, 8) comprising a sleeve (7) slidable along said tubular member and slotted to define resilient fingers, and including an emergency release means (33);

characterised in that the packer miller (5) comprises a plurality of radial blades (23) having end faces and side faces provided with abrasive material (24), the end faces being dimensioned to mill substantially the entire annular surface of the packer, and the side faces having said abrasive material extending along a major portion thereof; and

the catcher sleeve (7) is urged by resilient means (36) into engagement with a collar (33) and said emergency release means comprises the collar (33) being secured to the tubular member by shear pins or bolts adapted to shear at a predetermined stress.

2. The packer retriever of claim 1, in which the surface of the shear collar (33) on which said fingers bear is formed as a cam surface arranged to spread said fingers as upward load is applied to the retriever.

3. The packer retriever of claim 1 or claim 2, in which said blades (23) are further provided with non-abrasive radial extensions (25).

4. The packer retriever of any preceding claim, including means (11; 21, 22) for delivering a jet of liquid proximate the blades (6).

5. The packer retriever of any preceding claim, including a milling head (10) on the end of said tubular member dimensioned to penetrate the bore of the packer.

6. The packer retriever of claim 5, in which said milling head (10), in plan view has curved faces (39) matching the bore of the packer and joined by flat faces (40) to define spaces between the milling head and the packer bore.

7. The packer retriever of claim 5 or claim 6, including means (41) for delivering a jet of liquid proximate the milling head (10).

Patentansprüche

1. Vorrichtung zur Entfernung von Packern aus Erdölbohrlöchern, umfassend einen Packerfräser (5) zum Fräsen des Packers, um diesen von der Bohrlochwandung loszulösen, und einen Packergreifer (7, 8), der auf einem, sich vom Fräser erstreckenden rohrförmigen Träger befestigt ist, zum Aufnehmen des Packers, sobald dieser gelöst ist, wobei der Packergreifer (7, 8) eine Muffe (7) aufweist, die entlang des rohrförmigen Trägers verschiebbar ist sowie zur Ausbildung von Fingern geschlitzt ist und Notloslöseeinrichtungen (33) enthält, dadurch gekennzeichnet, daß der Packerfräser (5) eine Mehrzahl von radialen Schneidblättern (23) umfaßt, deren End- und Seitenflächen mit einem Schleifmaterial (24) versehen sind, wobei die Endflächen im wesentlichen zum Fräsen der gesamten Ringoberfläche des Packers ausgelegt sind, und das Schleifmaterial an den Seitenflächen sich entlang eines Hauptbereiches derselben erstreckt, und die Fangmuffe (7) durch Federeinrichtungen (36) in Eingriff mit einer Manschette (33) gehalten wird, und wobei die Notloslöseeinrichtungen die Manschette (33) umfassen, die am rohrförmigen Träger mit Scherstiften oder -bolzen befestigt ist, die bei einer vorbestimmten Belastung abgesichert werden.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Oberfläche der Schermanschette (33), auf welcher sich die genannten Finger abstützen, als Schulter ausgebildet ist, damit die Finger gespreizt werden, wenn eine nach oben gerichtete Belastung auf die Vorrichtung ausgeübt wird.

3. Vorrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die Schneidblätter (23) zusätzlich mit radialen Vorsprüngen (25) versehen sind, die kein Schleifmaterial aufweisen.

4. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, dadurch gekennzeichnet, daß Einrichtungen (11; 21, 22) zum Zuführen eines Flüssigkeitsstrahls zur Nähe der Blätter (6) enthalten sind.

5. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, dadurch gekennzeichnet, daß am Ende des rohrförmigen Trägers ein Fräskopf (10) angeordnet ist, der zum Durchbohren des Packers ausgelegt ist.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der Fräskopf (10) in Vorderansicht gekrümmte Seitenflächen (39) aufweist, die an die Bohrung des Packers angepaßt und über ebene Seitenflächen verbunden sind, um Zwischenräume zwischen dem Fräskopf und der Packerbohrung zu bilden.

7. Vorrichtung nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß Einrichtungen (41) zum Zuführen eines Flüssigkeitsstrahls zur Nähe des Fräskopfes (10) enthalten sind.

Revendications

1. Outil de récupération d'une garniture d'étan-

16

selection of the shear bolts located in apertures 34 is exceeded the bolts shear releasing the collar 33 which falls out of engagement with the catcher 31, the weight of the packer then compresses the sprung fingers of the catcher releasing the grip on the packer and allowing the retriever to be withdrawn from the well. After resetting the shear bolts the retriever may again be sent down-hole and the retrieval operation begun afresh.

The shear bolts may be screw-threaded bolts the shear strength of which is known or alternatively simple cylindrical pins may be used which are held in place by a separate screw-threaded plug.

Claims

1. An oil well packer retriever comprising a packer miller (5) for milling the packer to release it from the well casing, and a packer catcher (7, 8) mounted on a tubular member extending from the miller for engaging the packer once the packer is released;

the packer catcher (7, 8) comprising a sleeve (7) slidable along said tubular member and slotted to define resilient fingers, and including an emergency release means (33);

characterised in that the packer miller (5) comprises a plurality of radial blades (23) having end faces and side faces provided with abrasive material (24), the end faces being dimensioned to mill substantially the entire annular surface of the packer, and the side faces having said abrasive material extending along a major portion thereof; and

the catcher sleeve (7) is urged by resilient means (36) into engagement with a collar (33) and said emergency release means comprises the collar (33) being secured to the tubular member by shear pins or bolts adapted to shear at a predetermined stress.

2. The packer retriever of claim 1, in which the surface of the shear collar (33) on which said fingers bear is formed as a cam surface arranged to spread said fingers as upward load is applied to the retriever.

3. The packer retriever of claim 1 or claim 2, in which said blades (23) are further provided with non-abrasive radial extensions (25).

4. The packer retriever of any preceding claim, including means (11; 21, 22) for delivering a jet of liquid proximate the blades (6).

5. The packer retriever of any preceding claim, including a milling head (10) on the end of said tubular member dimensioned to penetrate the bore of the packer.

6. The packer retriever of claim 5, in which said milling head (10), in plan view has curved faces (39) matching the bore of the packer and joined by flat faces (40) to define spaces between the milling head and the packer bore.

7. The packer retriever of claim 5 or claim 6, including means (41) for delivering a jet of liquid proximate the milling head (10).

Patentansprüche

1. Vorrichtung zur Entfernung von Packern aus Erdölbohrlöchern, umfassend einen Packerfräser (5) zum Fräsen des Packers, um diesen von der Bohrlochwandung loszulösen, und einen Packergreifer (7, 8), der auf einem, sich vom Fräser erstreckenden rohrförmigen Träger befestigt ist, zum Aufnehmen des Packers, sobald dieser losgelöst ist, wobei der Packergreifer (7, 8) eine Muffe (7) aufweist, die entlang des rohrförmigen Trägers verschiebbar ist sowie zur Ausbildung von Fingern geschlitzt ist und Notloslöseeinrichtungen (33) enthält, dadurch gekennzeichnet, daß der Packerfräser (5) eine Mehrzahl von radialen Schneidblättern (23) umfaßt, deren End- und Seitenflächen mit einem Schleifmaterial (24) versehen sind, wobei die Endflächen im wesentlichen zum Fräsen der gesamten Ringoberfläche des Packers ausgelegt sind, und das Schleifmaterial an den Seitenflächen sich entlang eines Hauptbereiches derselben erstreckt, und die Fangmuffe (7) durch Federeinrichtungen (36) in Eingriff mit einer Manschette (33) gehalten wird, und wobei die Notloslöseeinrichtungen die Manschette (33) umfassen, die am rohrförmigen Träger mit Scherstiften oder -bolzen befestigt ist, die bei einer vorbestimmten Belastung abgesichert werden.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Oberfläche der Schermanschette (33), auf welcher sich die genannten Finger abstützen, als Schulter ausgebildet ist, damit die Finger gespreizt werden, wenn eine nach oben gerichtete Belastung auf die Vorrichtung ausgeübt wird.

3. Vorrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß die Schneidblätter (23) zusätzlich mit radialen Vorsprüngen (25) versehen sind, die kein Schleifmaterial aufweisen.

4. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, dadurch gekennzeichnet, daß Einrichtungen (11; 21, 22) zum Zuführen eines Flüssigkeitsstrahls zur Nähe der Blätter (6) enthalten sind.

5. Vorrichtung nach einem oder mehreren der vorangehenden Ansprüche, dadurch gekennzeichnet, daß am Ende des rohrförmigen Trägers ein Fräskopf (10) angeordnet ist, der zum Durchbohren des Packers ausgelegt ist.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der Fräskopf (10) in Vorderansicht gekrümmte Seitenflächen (39) aufweist, die an die Bohrung des Packers angepaßt und über ebene Seitenflächen verbunden sind, um Zwischenräume zwischen dem Fräskopf und der Packerbohrung zu bilden.

7. Vorrichtung nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß Einrichtungen (41) zum Zuführen eines Flüssigkeitsstrahls zur Nähe des Fräskopfes (10) enthalten sind.

Revendications

1. Outil de récupération d'une garniture d'étan-



chéité, dite "Packer", dans un puits de pétrole, cet outil comportant une fraise (5) pour attaquer la garniture afin de la séparer de l'enveloppe de tubage du puits, et un organe d'accrochage (7, 8), monté sur un élément tubulaire qui prolonge la fraise pour saisir la garniture une fois celle-ci libérée; l'organe d'accrochage (7, 8) comportant un manchon (7) qui peut coulisser le long de l'élément tubulaire, et qui comporte des fentes servant à réaliser des doigts élastiques, cet organe d'accrochage comportant en outre un système de décrochage d'urgence (33); caractérisé en ce que la fraise (5) prévue pour attaquer la garniture d'étanchéité comporte plusieurs lames radiales (23) ayant des faces terminales et des faces latérales garnies d'un matériau abrasif (24), les faces terminales ayant des dimensions qui permettent de fraiser sensiblement toute la surface annulaire de la garniture à enlever, et les faces latérales étant garnies dudit matériau abrasif le long de la plus grande partie de ces faces; et en ce que le manchon d'accrochage (7) est sollicité par un système élastique (36) qui tend à le pousser en position d'engagement contre un collier (33), ce collier faisant partie du système de décrochage d'urgence, et se trouvant fixé à l'élément tubulaire qui prolonge la fraise par des goupilles ou des boulons de cisaillement adaptées à céder sous une contrainte de valeur prédéterminée.

2. Outil de récupération selon la revendication 1, caractérisé en ce que le collier de cisaillement

(33) sur lequel viennent en appui les doigts élastiques du manchon (7) présente une surface profilée adaptée à agir à la manière d'une came pour déployer radialement les doigts élastiques lorsqu'on applique une charge par en haut sur l'outil de récupération.

3. Outil selon l'une des revendications 1 ou 2, caractérisé en ce que lesdites lames (23) comportent en outre des extensions radiales non abrasives (25).

4. Outil selon l'une des revendications 1 à 3, caractérisé en ce qu'il comporte des moyens (11; 21, 22), pour faire arriver un jet de liquide à proximité des lames (6).

5. Outil selon l'une des revendications 1 à 4, caractérisé en ce qu'il comporte une tête de fraisage (10) montée à l'extrémité dudit élément tubulaire et ayant des dimensions appropriées pour pénétrer dans l'alésage de la garniture d'étanchéité à enlever.

6. Outil selon la revendication 5, caractérisé en ce que la tête de fraisage (10) vue en plan présente des faces de profil courbe (39) correspondant à l'alésage de la garniture d'étanchéité à enlever, ces faces de profil courbe étant reliées par des faces planes (40) pour ménager des espaces libres entre la tête de fraisage de la garniture d'étanchéité à enlever.

7. Outil selon l'une des revendications 5 ou 6, caractérisé en ce qu'il comporte des moyens (41), pour faire arriver un jet de liquide à proximité de la tête de fraisage (10).

35

40

45

50

55

60

65

5

