Description

This invention relates to blowout preventers.

Blowout preventers are used on wells to control the pressure which may build within the well. They have been used on wells to close on dual tubing strings. It is desirable that when running or pulling such strings that they be supported by the blowout preventer rams. Normal support of a tubing string by a blowout preventer is accomplished by resting the joint enlargement on the rams. With dual strings in more recent wells which are much deeper, such support of both strings on the rams is not possible because the joints are normally vertically staggered and the length of the strings are such that both would not be supported adequately with only one resting on the rams. Additionally, tubing strings have safety valves installed therein and require the running of their control lines, often in encapsulated form along the exterior of the strings. Supporting the dual strings with their encapsulated control lines on a blowout preventer has not been possible with existing structures.

One prior blowout preventer structure was suitable for handling dual strings. It included an upper set of rams which sealed on the dual strings after they had been properly oriented by the lower set of rams. This structure is shown in U.S. Patent No. 4,215,747. Another prior structure includes shear rams in an upper preventer and slip bowl rams in the lower preventer as shown in U.S. Patent No. 4,043,389.

A blowout preventer structure shown in U.S. Patent No. 4,057,887 includes upper and lower rams for a single string which has its shoulder supported on the lower ram, the upper and lower rams provide sealing on the string and intermediate rams are used for unthreading the string at the joint resting on the lower ram.

U.S. Patent Nos. 2,746,710, 2,855,172, 2,947,508 and 4,229,012 all disclose blowout preventer structures in which the packing includes a series of inserts which support the packing material and which can move inwardly in varying degrees to accommodate the shape of the string on which the rams close. None of these structures are suitable for supporting dual strings and their encapsulated control lines and sealing about the dual strings and the control line.

According to one aspect of the present invention there is provided a blowout preventer comprising a body having a bore therethrough and opposed aligned guideways extending outward from said bore, a ram in each of said guideways, means for reciprocating said rams in said guideways to retract from said bore and to move into said bore, each of said rams having a ram body having a packer receiving slot across its front surface facing said bore and dual arcuate recesses extending through the front face of said ram body in a direction parallel to the axis of said bore, seal means for sealing between the top and sides of said ram body and the walls of the guideway in which it is positioned, and a packer of resilient material positioned in said receiving slot having its sides in engagement with said seal means to complete the side sealing against the walls of its guideway, said packer having dual arcuate front recesses aligned with the recesses of said ram body, characterised by a plurality of tube supporting means lining a substantial portion of the recesses of said packer and a plurality of independently movable inserts embedded in said packer to support the resilient material in sealing position against a tubing string and its encapsulated control lines.

According to another aspect of the present invention there is provided a blowout preventer packer for use with a blowout preventer comprising a packer body of resilient material having dual arcuate recesses on its front face, and characterised by tubing support means embedded in said packer body, and a plurality of independently movable reinforcing inserts embedded in said packer body.

Prior to closing the rams of the improved blowout preventer of the present invention, the dual tubing strings should be properly oriented so they will be correctly engaged by the rams. One method of accomplishing this is to use the aligning apparatus disclosed in U.S. Patent No. 4,215,747 installed above the blowout preventer of the present invention.

The invention will be described now by way of example only with particular reference to the accompanying drawings. In the drawings:

FIGURE 1 is an elevation view with portions in section to show the open rams within the body.

FIGURE 2 is a sectional view taken along 2-2 in FIGURE 1.

FIGURE 3 is a perspective view of one of the improved rams of the present invention.

FIGURE 4 is a sectional plan view of the blowout preventer shown schematically to illustrate the closing on tubing strings.

FIGURE 5 is a partial view similar to FIGURE 4 showing the position of the ram closed but with the encapsulated control line in a different position.

FIGURE 6 is a front view of the improved packer of the present invention.

FIGURE 7 is a sectional view of the packer taken along line 7-7 in FIGURE 6.

Improved blowout preventer 10, as shown, includes body 12 having vertical bore 14 extending therethrough and opposed aligned guideways 16 extending outward from bore 14. Rams 18 are

movably positioned within guideways 16 and are moved therein by suitable pressure responsive means 20, such as pistons. As shown in FIGURES 2 and 3 rams 18 each include body 22 which includes suitable means 24 for connecting to pressure responsive means 20, top seal 26 positioned in groove 28 extending across the top of body 22 and into sealing engagement with the sides of packer 30 at the sides of body 22. The inner or front face of body 22 includes two semicircular vertically extending recesses 32 and transverse slot 34 opening to bore 14. Mud slot 36 extends along the lower portion of body 22 to provide communication from bore 14 below rams 18 to the rear or outer face of body 22.

As can be seen in FIGURE 3, packer 30 is positioned in transverse slot 34 of ram body 22 and each packer 30 has two semicircular vertically extending recesses 38 for closing on dual production strings 40 (FIGURES 4 and 5) extending through bore 14. Each packer 30 includes resilient packing 42 having upper gripping section 44 and lower sealing section 46. Lower sealing section 46 includes a plurality of upper metal inserts 48 and lower metal inserts 50 embedded in resilient packing 42. As best seen in FIGURES 4 through 7, each insert 48 and 50 is a strip positioned parallel to the axis of its ram. Additionally, specially end inserts 52 are embedded in packing 42 at each side of the recesses 38. Inserts 52 include upper and lower flanges 53 with integral neck 54 extending between flanges 53. Inserts 48, 50 and 52 provide a reinforcement for resilient packing 42. Upper gripping section 44 includes a plurality of slip segments 56 embedded in packing 42 in surrounding relationship to recesses 38. Each of slip segments 56 has a plurality of upwardly facing teeth 57 (FIGURE 7) facing inwardly toward the center of their recesses 38. Support segments 58 are positioned at the inner edges of gripping section 44 in supporting relationship to slips 56 to assist in maintaining slips 56 in their desired relationship in position to come into gripping engagement with the production string in its recess. Upper plates 60 are positioned on the upper surface of packing 42 at each side of gripping section 44. Lower plates 62 are positioned on the lower surface of packing 42 at each side of sealing section 46 as clearly shown in FIGURES 3 and 6.

The specific structure of each slip 56 and inserts 48 and 50 is shown in FIGURE 7. From this it can be seen clearly that they are embedded in resilient packing 42 with the material of packing 42 between inserts 48 and 50 and also positioned in recess 64 in the rear surface of slips 56. Pins 65 secured to packer 30 are used to secure packer 30 to its ram 18 in a manner known in the art and disclosed in U.S. Patent No. 3,817,326 and others.

In FIGURE 4, a view of rams 18 of blowout preventer 10 is illustrated closed on dual production strings 40. Each of strings 40 includes its own attached encapsulated control line 66. In one of recesses 32, control line 66 is positioned on the side of string 40 facing the center of the ram which is engaging string 40. In this position, encapsulated control line 66 is compressed radially and extends circumferentially so that it is engaged by the center two slips and the other two slips move into direct gripping engagement with string 40. The two slips on one side and four slips in the other recess 32 engaging the other string 40 is sufficient engagement to fully support the weight of both strings. The other string 40 is shown with its control line 66 positioned at the side so that when engaged, as shown, it is compressed from the side so that it is slightly smaller in the circumferential direction with respect to string 40 and is slightly larger in the radial direction. Both strings 40 are supported and packer 30 seals against them.

FIGURE 7 illustrates another possible position of control line 66 with respect to upper gripping section 44. In this position control line 66 is engaged by the two slips on the side of the recess and is partially compressed radially and the portion of the encapsulation at the side of the side slip 56a is slightly expanded radially and circumferentially. In all positions which control lines 66 may assume the pipe strings 40 are properly supported and rams 18 are set against and seal around strings 40 and encapsulated control lines 66.

Claims

1. A blowout preventer comprising a body (12) having a bore (14) therethrough and opposed aligned guideways (16) extending outward from said bore, a ram (18) in each of said guideways, means (20) for reciprocating said rams in said guideways to retract from said bore and to move into said bore, each of said rams having a ram body (22) having a packer receiving slot (34) across its front surface facing said bore and dual arcuate recesses (32) extending through the front face of said ram body in a direction parallel to the axis of said bore (14), seal means (26) for sealing between the top and sides of said ram body and the walls of the guideway in which it is positioned, and a packer (30) of resilient material positioned in said receiving slot (34) having its sides in engagement with said seal means to complete the side sealing against the walls of its guideway, said packer having dual arcuate front recesses (38) aligned with the recesses (32) of said ram body, characterised by a plurality of tube supporting means (44) lining a

movably positioned within guideways 16 and are moved therein by suitable pressure responsive means 20, such as pistons. As shown in FIGURES 2 and 3 rams 18 each include body 22 which includes suitable means 24 for connecting to pressure responsive means 20, top seal 26 positioned in groove 28 extending across the top of body 22 and into sealing engagement with the sides of packer 30 at the sides of body 22. The inner or front face of body 22 includes two semicircular vertically extending recesses 32 and transverse slot 34 opening to bore 14. Mud slot 36 extends along the lower portion of body 22 to provide communication from bore 14 below rams 18 to the rear or outer face of body 22.

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The specific structure of each slip 56 and inserts 48 and 50 is shown in FIGURE 7. From this it can be seen clearly that they are embedded in resilient packing 42 with the material of packing 42 between inserts 48 and 50 and also positioned in recess 64 in the rear surface of slips 56. Pins 65 secured to packer 30 are used to secure packer 30 to its ram 18 in a manner known in the art and disclosed in U.S. Patent No. 3,817,326 and others.

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Claims

1. A blowout preventer comprising a body (12) having a bore (14) therethrough and opposed aligned guideways (16) extending outward from said bore, a ram (18) in each of said guideways, means (20) for reciprocating said rams in said guideways to retract from said bore and to move into said bore, each of said rams having a ram body (22) having a packer receiving slot (34) across its front surface facing said bore and dual arcuate recesses (32) extending through the front face of said ram body in a direction parallel to the axis of said bore (14), seal means (26) for sealing between the top and sides of said ram body and the walls of the guideway in which it is positioned, and a packer (30) of resilient material positioned in said receiving slot (34) having its sides in engagement with said seal means to complete the side sealing against the walls of its guideway, said packer having dual arcuate front recesses (38) aligned with the recesses (32) of said ram body, characterised by a plurality of tube supporting means (44) lining a

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substantial portion of the recesses of said packer and a plurality of independently movable inserts (48, 50) embedded in said packer (30) to support the resilient material in sealing position against a tubing string and its encapsulated control lines.

2. A blowout preventer according to claim 1, wherein said tube supporting means (44) includes a plurality of gripping slips (56) embedded in said packer (20) and being movable radially of their recess to move into tight gripping engagement with a tubing string extending through said recess.

3. A blowout preventer according to claim 1 or claim 2, wherein said inserts (48, 50) include a plurality of strip shaped inserts (48) embedded in said packer immediately below said gripping slips parallel to the axis of their ram.

4. A blowout preventer according to claim 3, wherein said inserts include a plurality of strip shaped inserts (50) embedded in said packer on the lower surface of said packer parallel to the axis of their ram.

5. A blowout preventer according to claim 4, including an end insert (52) embedded in said packer at each side of said arcuate recesses, said end inserts having upper and lower flanges (53), and an integral neck (54) extending between said flanges.

6. A blowout preventer packer for use with a blowout preventer according to any preceding claim comprising a packer body (30) of resilient material having dual arcuate recesses (38) on its front face, and characterised by tubing support means embedded in said packer body, and a plurality of independently movable reinforcing inserts (48, 50) embedded in said packer body.

7. A blowout preventer packer according to claim 6, wherein said tubing supporting means includes a plurality of gripping slips (56).

8. A blowout preventer packer according to claim 7, wherein said gripping slips (56) are independently movable.

9. A blowout preventer according to claim 8, wherein said gripping slips (56) are arranged to move into gripping engagement with a tubing string recess to support said string against movement in said recess.

10. A blowout preventer packer according to claim 6, wherein said inserts (48, 50) include a plurality of strips (48) positioned immediately under said tubing supporting means and extending perpendicular to the front face of said packer.

11. A blowout preventer packer according to claim 10, including a plurality of strips (50) positioned at the lower side of said packer body and parallel to said upper strips.

12. A blowout preventer packer according to any one of claims 6 to 11, wherein said body includes dual arcuate recesses (38) on its front face, and said gripping slips (56) surround each recess.

Revendications

1. Obturateur antiéruption comprenant un corps (12) traversé par un trou (14) et comportant des guides opposés (16) alignés l'un sur l'autre et disposés à l'extérieur dudit trou, une mâchoire (18) dans chacun desdits guides, des moyens (20) pour imposer un mouvement alternatif auxdites mâchoires dans lesdits guides pour les mettre en retrait dudit trou et les déplacer dans ledit trou, chacune desdites mâchoires comprenant un corps (22) ayant une rainure (34) de logement d'une garniture d'étanchéité qui est disposée en travers de sa surface antérieure qui fait face audit trou, ainsi que des cavités courbes jumelées (32) qui passent dans la surface antérieure dudit corps de mâchoire dans une direction parallèle à l'axe dudit trou (14), des moyens d'étanchéité (26) pour assurer l'étanchéité entre le sommet et les côtés dudit corps de mâchoire et les parois du guide dans lequel il est placé, et une garniture d'étanchéité (30) en matériau élastique placée dans ladite rainure de logement (34) et ayant ses côtés en application contre lesdits moyens d'étanchéité pour compléter l'étanchéité latérale contre les parois de son guide, ladite garniture d'étanchéité comportant des cavités antérieures courbes jumelées (38) qui sont alignées sur les cavités (32) dudit corps de mâchoire, caractérisé par de multiples moyens de support de tube (44) revêtant une partie importante des cavités de ladite garniture d'étanchéité et de multiples pièces encastrées (48, 50) mobiles indépendamment, noyées dans ladite garniture d'étanchéité (30) pour supporter le matériau élastique en position d'étanchéité contre une colonne de tubes et ses lignes enrobées de commande.

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2. Obturateur antiéruption selon la revendication 1, dans lequel lesdits moyens (44) de support de tube comprennent de multiples sabots de serrage (56) noyés dans ladite garniture d'étanchéité (20) et mobiles radialement par rapport à leur cavité pour entrer en prise étroite de serrage contre une colonne de tubes disposée dans ladite cavité.

3. Obturateur antiéruption selon la revendication 1 ou 2, dans lequel lesdites pièces encastrées (48, 50) comprennent de multiples pièces encastrées (48) en forme de rubans noyés dans ladite garniture d'étanchéité immédiatement au-dessous desdits sabots de serrage, parallèlement à l'axe de leur mâchoire.

4. Obturateur antiéruption selon la revendication 3, dans lequel lesdites pièces encastrées comprennent de multiples pièces encastrées (50) en forme de rubans noyés dans ladite garniture d'étanchéité sur la surface inférieure de ladite garniture d'étanchéité, parallèlement à l'axe de leur mâchoire.

5. Obturateur antiéruption selon la revendication 4, comprenant une pièce encastrée d'extrémité (52) noyée dans ladite garniture d'étanchéité de chaque côté desdites cavités courbes, lesdites pièces encastrées d'extrémité ayant des rebords supérieur et inférieur (53) et un col (54) qui est monobloc avec ces rebords et qui est disposé entre ceux-ci.

6. Garniture d'étanchéité d'obturateur antiéruption destinée à être utilisée avec un obturateur antiéruption selon l'une quelconque des revendication précédentes et comprenant un corps (30) de matériau élastique présentant des cavités courbes jumelées (38) sur sa surface antérieure et caractérisée par des moyens de support de tube noyés dans ledit corps de garniture d'étanchéité et de multiples pièces encastrées de renfort (48, 50) mobiles indépendamment et noyées dans ledit corps de garniture d'étanchéité.

7. Garniture d'étanchéité d'obturateur antiéruption selon la revendication 6, dans laquelle lesdits moyens de support de tube comprennent de multiples sabots de serrage (56).

8. Garniture d'étanchéité d'obturateur antiéruption selon la revendication 7, dans laquelle lesdits sabots de serrage (56) sont mobiles indépendamment.

9. Obturateur antiéruption selon la revendication 8, dans lequel lesdits sabots de serrage (56) sont disposés de manière à se déplacer pour se mettre en position de serrage dans une cavité de colonne de tubes pour supporter ladite colonne en l'empêchant de se déplacer dans ladite cavité.

10. Garniture d'étanchéité d'obturateur antiéruption selon la revendication 6, dans laquelle lesdites pièces encastrées (48, 50) comprennent de multiples rubans (48) placés immédiatement sous lesdits moyens de support de tubes et orientés perpendiculairement à la surface antérieure de ladite garniture d'étanchéité.

11. Garniture d'étanchéité d'obturateur antiéruption selon la revendication 10, comprenant de multiples rubans (50) placés sur le côté inférieur dudit corps de garniture d'étanchéité et parallèlement auxdits rubans supérieurs.

12. Garniture d'étanchéité d'obturateur antiéruption selon l'une quelconque des revendications 6 à 11, dans laquelle ledit corps comprend des cavités courbes jumelées (38) sur sa surface antérieure et lesdits sabots de serrage (56) entourent chacune des cavités.

Patentansprüche

1. Eine Bohrlochsperrvorrichtung mit einem Hauptteil (12), welches eine hindurchgehende Bohrung (14) und entgegengesetzte ausgerichtete Führungswege (16), die sich nach außen von der Bohrung erstrecken, aufweist, einem Rammblock (18) in jedem der Führungswege, einer Einrichtung (20) zum Hin- und Herbewegen der Rammblöcke in den Führungswegen, um sie aus der Bohrung und in die Bohrung hinein zu bewegen, wobei jeder der Rammblöcke einen Rammblockkörper (22) aufweist, welcher einen ein Dichtungsstück aufnehmenden Schlitz quer über seine der Bohrung zugewandte vordere Oberfläche und Doppelbogenausnehmungen (32), die sich durch die vordere Stirnfläche des Rammblockkörpers in einer Richtung parallel zur Achse der Bohrung (14) erstrecken, aufweist, mit einer Dichtungseinrichtung (26) zum Herstellen einer Abdichtung zwischen der Oberseite und den Seiten des Rammblockkörpers und den Wänden des Führungsweges, in welchem er angeordnet ist, und mit einem Dichtungsstück (30) aus elastischem Material, das in dem Aufnahmeschlitz (34) angeordnet ist, und dessen Seiten im Eingriff mit der Dichtungseinrichtung stehen, um die Seitenabdichtung gegen die Wände ihres Führungsweges zu vervollständigen, wobei das

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Dichtungsstück Doppelbogenfrontausnehmungen (38) aufweist, welche zu den Ausnehmungen (32) des Rammblockkörpers ausgerichtet sind, **gekennzeichnet durch** eine Vielzahl von Rohrhalterungseinrichtungen (44), welche einen wesentlichen Teil der Ausnehmungen des Dichtungsstücks auskleiden, und eine Vielzahl von unabhängig bewegbaren Einsätzen (48, 50), die in das Dichtungsstück (30) eingebettet sind, um das elastische Material in Dichtungsanordnung gegen eine Rohrstrangkette und ihre eingekapselten Steuerleitungen zu halten.

2. Eine Bohrlochsperrvorrichtung nach Anspruch 1, wobei die Rohrhalterungseinrichtung (44) eine Vielzahl von Greiferteilen (56) enthält, welche in das Dichtungsstück (20) eingebettet und radial zu ihrer Ausnehmung bewegbar sind, um sich in feste Griffberührung mit einer Rohrstrangkette, die sich durch die Ausnehmung erstreckt, zu bewegen.

3. Eine Bohrlochsperrvorrichtung nach Anspruch 1 oder 2, wobei die Einsätze (48, 50) eine Vielzahl von streifenförmigen Einsätzen (48), die in das Dichtungsstück unmittelbar unterhalb der Griffteile parallel zur Achse ihres Rammblocks eingebettet sind, enthalten.

4. Eine Bohrlochsperrvorrichtung nach Anspruch 3, wobei die Einsätze eine Vielzahl von streifenförmigen Einsätzen (50), die in das Dichtungsstück auf der unteren Oberfläche des Dichtungsstücks parallel zu der Achse ihres Rammblocks eingebettet sind, enthalten.

5. Eine Bohrlochsperrvorrichtung nach Anspruch 4, welche einen Endeinsatz (50) enthält, welcher in das Dichtungsstück auf jeder Seite der bogenförmigen Ausnehmungen eingebettet ist, wobei die Endeinsätze einen oberen und unteren Flansch (53) und einen sich zwischen den Flanschen erstreckenden und damit einstückig ausgebildeten Ansatz (54) aufweisen.

6. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung zur Verwendung in einer Bohrlochsperrvorrichtung nach wenigstens einem der vorhergehenden Ansprüche, welches ein Dichtungsstückhauptteil (30) aus elastischem Material mit einer Doppelbogenausnehmung (38) an seiner vorderen Stirnfläche umfaßt und durch eine Rohrstranghalterungseinrichtung, die in das Dichtungsstückhauptteil eingebettet ist, und eine Vielzahl von unabhängig bewegbaren Verstärkungseinsätzen (48, 50), die in das Dichtungsstückhauptteil eingebettet sind, gekennzeichnet ist.

7. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach Anspruch 6, wobei die Rohrstranghalterungseinrichtung eine Vielzahl von Greiferteilen (56) enthält.

8. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach Anspruch 7, wobei die Greiferteile (56) unabhängig bewegbar sind.

9. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach Anspruch 8, wobei Greiferteile (56) dazu vorgesehen sind, sich in Greifberührung mit einer Rohrstrangkettenausnehmung zu bewegen, um die Kette gegen Bewegung in der Ausnehmung zu halten.

10. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach Anspruch 6, wobei die Einsätze (48, 50) eine Vielzahl von Streifen (48) enthalten, welche unmittelbar unterhalb der Rohrstranghalterungseinrichtung angeordnet sind und sich senkrecht zur Frontstirnfläche des Dichtungsstücks erstrecken.

11. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach Anspruch 10, welches eine Vielzahl von Streifen (50) enthält, welche an einer unteren Seite des Dichtungsstückhaupttells und parallel zu den oberen Streifen angeordnet sind.

12. Ein Dichtungsstück für eine Bohrlochsperrvorrichtung nach wenigstens einem der Ansprüche 6 bis 11, wobei das Hauptteil Doppelbogenausnehmungen (38) an seiner vorderen Stirnfläche enthält, und die Greiferteile (56) jede Ausnehmung umgeben.

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