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(11) **EP 1 597 454 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
05.07.2006 Bulletin 2006/27

(21) Application number: **04712263.5**

(22) Date of filing: **18.02.2004**

(51) Int Cl.:
E21B 17/042^(2006.01)

(86) International application number:
PCT/SE2004/000210

(87) International publication number:
WO 2004/074624 (02.09.2004 Gazette 2004/36)

(54) **TOOL**
WERKZEUG
OUTIL

(84) Designated Contracting States:
IE

(30) Priority: **24.02.2003 SE 0300498**

(43) Date of publication of application:
23.11.2005 Bulletin 2005/47

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Description

Background of the Invention

[0001] The present invention relates to a male portion for percussive drilling according to the preamble of the appended independent claim.

[0002] Upon drilling with a drill string connected to a top hammer, a gap is formed between co-operating shoulders of the tubes or rods included in the drill string after each shock wave. Water is collected on the surface of the shoulder between each shock wave so that each impact provides a jet stream of water away from the impact surface. The part of the jet stream that then travels radially inwards will give rise to damage on associated male portion, see Figs. 1A and 1B, and finally the male portion will break so that the drilling cannot be continued.

[0003] In US-A-6,334,493, a male portion is shown where a threaded portion has been provided with a metallic material, which is more precious than the steel in the male portion. Thereby, it is intended to solve the problem of corrosion fatigue in the threads by coating at least the parts of the thread of the male portion that co-operate with other parts of the threaded joint.

Objects of the Invention

[0004] An object of the present invention is to substantially decrease the damage on a male portion for percussive rock drilling.

[0005] Another object of the present invention is to substantially improve the resistance to erosion corrosion in sections having a reduced cross-section in a male portion for percussive rock drilling.

Brief Description of the Drawings

[0006] These and other objects have been attained by a male portion that has received the features according to the characterizing clause of the appended independent claim, reference being made to the drawings. Fig. 1A shows a conventional male portion after erosion corrosion. Fig. 1B shows a cross-section of a threaded joint having the conventional male portion. Fig. 2A shows a threaded joint having a male portion according to the present invention in longitudinal cross-section. Fig. 2B shows an enlarged cross-section of the male portion according to the present invention. Fig. 2C shows a cross-section of the male portion according to the present invention.

Detailed Description of the Invention

[0007] The threaded joint shown in Figs. 2A and 2B for percussive drilling comprises a sleeve-shaped portion or a female portion 11 having a cylindrical female thread or cylindrical internal thread 12 in co-operation with a pin or male portion 13 according to the present invention

provided with a cylindrical male thread or cylindrical external thread 14. The male portion 13 and the female portion 11 constitute integrated parts of identical drill elements or drill tubes 10A, 10B. The shown thread is a so-called trapezoidal thread but other thread shapes may be possible, e.g. a rope thread. Furthermore, the male portion has a through flush channel 15, through which a flush medium, usually air or water, is led. The threads 12, 14 comprise thread flanks and thread roots arranged between the flanks.

[0008] The male thread 14 is terminated, in the direction of the other end of the tube, in a clearance surface 16. The clearance surface 16 connects via a concave portion 17 to a shoulder 18, which is substantially perpendicular to the centre line CL of the threaded joint. The shoulder 18 connects in turn to the envelope surface of the tube 10A. The concave portion 17 is preferably softly rounded, such as via a radius.

[0009] The female portion 11 has an end surface 19 arranged on the free end thereof, which is substantially perpendicular to the centre line CL of the threaded joint. When the joint is tightened according to Fig. 2A, the end surface 19 and the shoulder 18 abuts against each other. During drilling, the water that is deposited on the surfaces 18 and 19 will provide a jet stream of water in a direction shown by the arrow in Fig. 1B. The part of the jet stream that travels radially inwards has an angle of action of about 90° and when it meets the surface in the concave portion, a protective layer of oxide on the surface is broken. The exposed pure metal surface then oxidizes (corrodes) again before the oxide thereof again is torn away. This course of events gives rise to accelerated so-called erosion corrosion.

[0010] The joint is also shown in US-A-4,968,068, which patent hereby is incorporated in the present description, where there are shoulder and/or bottom abutment between the tubes 10A, 10B.

[0011] According to the present invention, the concave portion 17 of the male portion is provided with a coating consisting of at least one surface-modifying, erosion-protecting layer 20. The layer is continuous in the direction of circumference. The layer follows the curvature in the portion 17. The maximum thickness of layer is 0,002-5 mm, preferably 0,02-2 mm. A plane P, which coincides with the shoulder 18, substantially touches or intersects the layer 20. The layer 20 is more resistant to erosion corrosion than the supporting or subjacent steel. Examples of such erosion corrosion-resistant materials are nickel, chromium, copper, tin, cobalt and titanium as well as alloys of these, preferably erosion-resistant steels or Co or Ni base alloys. Additional layers may be made in order to increase the binding between coating and steel. The material in the layer 20 has at least 50 mV higher electrode potential than the steel, preferably at least 100 mV, most preferably at least 250 mV higher electrode potential than the steel.

[0012] A number of different surface-coating methods may be used in order to apply the layer, e.g. chemical or

electrolytic plating, thermal spraying or tool-tipping, preferably tool-tipping by means of laser.

[0013] Thus, the invention relates to a male portion for percussive drilling having a concave portion, which is coated with a protective layer in order to substantially improve the resistance to erosion of a low-alloy steel body.

Claims

1. A male portion for percussive drilling comprising an external thread (14), the male portion (13) constituting an integrated part of a drill element (10A), the male portion having a through flush channel (15) for a flush medium, the external thread (14) comprising thread flanks adapted for percussive drilling, the thread being terminated in a clearance surface (16), the clearance surface (16) connecting via a concave portion (17) to a shoulder (18), the shoulder being intended to transfer shock waves, **characterized in that** at least one part of the concave portion (17) of the male portion is provided with a coating consisting of at least one erosion corrosion-protecting layer (20).
2. The male portion according to claim 1, **characterized in that** the layer is continuous in the circumferential direction of the male portion.
3. The male portion according to claim 1 or 2, **characterized in that** the maximum thickness of layer is 0,002-5 mm, preferably 0,02-2 mm.
4. The male portion according to any one of the preceding claims, **characterized in that** the layer (20) is more wear-resisting than the supporting or subjacent steel.
5. The male portion according to any one of the preceding claims, **characterized in that** some of the following surface coating methods has been used in order to apply the layer (20): chemical or electrolytic plating, thermal spraying, or tool-tipping, preferably by means of laser.
6. The male portion according to any one of the preceding claims, **characterized in that** the layer (20) is made from nickel, chromium, copper, tin, cobalt and titanium as well as alloys of the same, preferably erosion-resistant steel or Co or Ni base alloys.
7. The male portion according to any one of the preceding claims, **characterized in that** additional layers are arranged in order to increase the binding between the layer (20) and the subjacent steel.
8. The male portion according to any one of the pre-

ceding claims, **characterized in that** a plane (P), which coincides with the shoulder (18), substantially touches or intersects the layer (20).

9. The male portion according to any one of the preceding claims, **characterized in that** the material in the layer (20) has at least 50 mV higher electrode potential than the steel, preferably at least 100 mV, most preferably at least 250 mV higher electrode potential than the steel.

Patentansprüche

1. Außengewindeabschnitt zum Schlagbohren, umfassend ein Außengewinde (14), wobei der Außengewindeabschnitt (13) einen integralen Bestandteil eines Bohrelements (10A) bildet, welcher Außengewindeabschnitt einen Durchgangsspülkanal (15) für ein Spülmittel aufweist, wobei das Außengewinde (14) Gewindeflanken umfasst, die zum Schlagbohren geeignet sind, wobei das Gewinde in einer Freifläche (16) endet, wobei die Freifläche (16) über einen konkaven Abschnitt (17) mit einer Schulter (18) verbunden ist, welche Schulter dafür vorgesehen ist, Stoßwellen zu übertragen, **dadurch gekennzeichnet, dass** zumindest ein Teil des konkaven Abschnitts (17) des Außengewindeabschnitts mit einer Beschichtung versehen ist, die aus zumindest einer Erosions-Korrosionsschutzschicht (20) besteht.
2. Außengewindeabschnitt nach Anspruch 1, **dadurch gekennzeichnet, dass** die Schicht in Umfangsrichtung des Außengewindeabschnitts durchgehend ist.
3. Außengewindeabschnitt nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Maximaldicke der Schicht 0,002 - 5 mm, vorzugsweise 0,02 - 2 mm, beträgt.
4. Außengewindeabschnitt nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Schicht (20) verschleißbeständiger als der Träger- oder darunter liegende Stahl ist.
5. Außengewindeabschnitt nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** einige der folgenden Oberflächenbeschichtungsverfahren angewendet wurden, um die Schicht (20) aufzubringen: Chemisches oder elektrolytisches Plattieren, thermisches Spritzen oder Tool-tipping, vorzugsweise mittels eines Lasers.
6. Außengewindeabschnitt nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Schicht (20) aus Nickel, Chrom, Kupfer, Zinn, Kobalt und Titan sowie aus Legierungen dieser, vorzugsweise aus erosionsbeständigen Legie-

rungen auf Stahl- oder Co- oder Ni-Basis, hergestellt ist.

7. Außengewindeabschnitt nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** zusätzliche Schichten angeordnet sind, um die Bindung zwischen der Schicht (20) und dem darunter liegenden Stahl zu verbessern. 5
8. Außengewindeabschnitt nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** eine Ebene (P), die mit der Schulter (18) übereinstimmt, die Schicht (20) im Wesentlichen berührt oder schneidet. 10
9. Außengewindeabschnitt nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, dass** das Material in der Schicht (20) ein um zumindest 50 mV höheres Elektrodenpotential als Stahl, vorzugsweise ein um zumindest 100 mV, noch bevorzugter ein um zumindest 250 mV höheres Elektrodenpotential als Stahl aufweist. 15 20

Revendications

1. Partie mâle pour un perçage par percussion comprenant un filetage externe (14), la partie mâle (13) constituant une partie intégrée d'un élément de perçage (10A), la partie mâle ayant un canal de chasse (15) pour un milieu de chasse, le filetage externe (14) comprenant des flancs de filet agencés pour un perçage par percussion, le filetage se terminant dans une surface de dégagement (16), la surface de dégagement (16) étant reliée, via une partie concave (17), à un épaulement (18), l'épaulement étant prévu pour transférer des ondes de choc, **caractérisée par le fait que** qu'au moins une partie de la partie concave (17) de la partie mâle comporte un revêtement consistant en couche protectrice contre l'érosion et la corrosion. 30 35 40
2. Partie mâle selon la revendication 1, **caractérisée par le fait que** la couche est continue dans la direction circonférentielle de la partie mâle 45
3. Partie mâle selon l'une des revendications 1 et 2, **caractérisée par le fait que** l'épaisseur maximale de couche est de 0,002 à 5 mm, de préférence de 0,02 à 2 mm. 50
4. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait que** la couche (20) est plus résistante à l'usure que l'acier de support ou sous-jacent. 55
5. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait que** l'un

des procédés de revêtement de surface suivants a été utilisé afin d'appliquer la couche (20) : plaquage chimique ou électrolytique, brumisation thermique, ou apport par outil, de préférence par laser.

6. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait que** la couche (20) est faite de nickel, chrome, cuivre, étain, cobalt et titane ainsi que d'alliages de ceux-ci, de préférence des alliages résistant à l'érosion à base d'acier ou de cobalt ou de nickel.
7. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait que** sont disposées des couches supplémentaires afin d'accroître la liaison entre la couche (20) et l'acier sous-jacent.
8. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait qu'un** plan (P), coïncidant avec l'épaulement (18), touche sensiblement ou coupe la couche (20).
9. Partie mâle selon l'une quelconque des revendications précédentes, **caractérisée par le fait que** le matériau de la couche (20) a au moins 50 mV de plus de potentiel d'électrode que l'acier, de préférence au moins 100 mV, de façon plus préférée au moins 250 mV de potentiel d'électrode que l'acier.

Fig. 1A

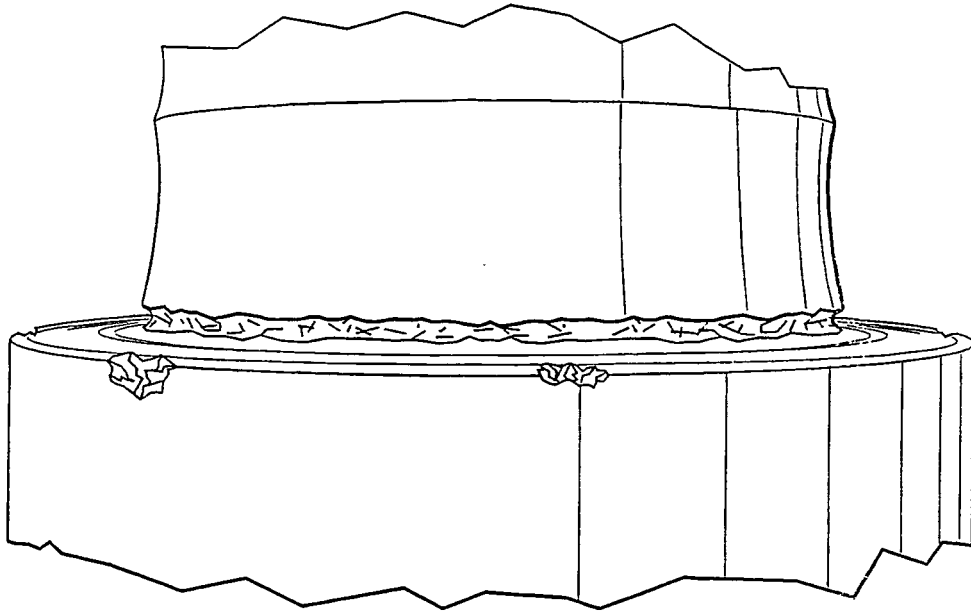


Fig. 1B

