The United States of America

The Director of the United States Patent and Trademark Office

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

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If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extensions.

John Doll

Acting Director of the United States Patent and Trademark Office

US007506699B1

(12) **United States Patent**
Harvey et al.

(10) **Patent No.: US 7,506,699 B1**
(45) **Date of Patent: Mar. 24, 2009**

(54) **DIRECTIONAL DRILLING TOOL**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(51) **Int. Cl.**
E21B 7/04 (2006.01)

(52) **U.S. Cl.** **175/61**; 175/62; 166/117.5; 166/241.5

(58) **Field of Classification Search** 166/241.5, 166/117.5; 175/61, 62, 45; 285/404, 90
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,052,309 A * 9/1962 Eastman 175/45
5,915,474 A * 6/1999 Buytaert et al. 166/50

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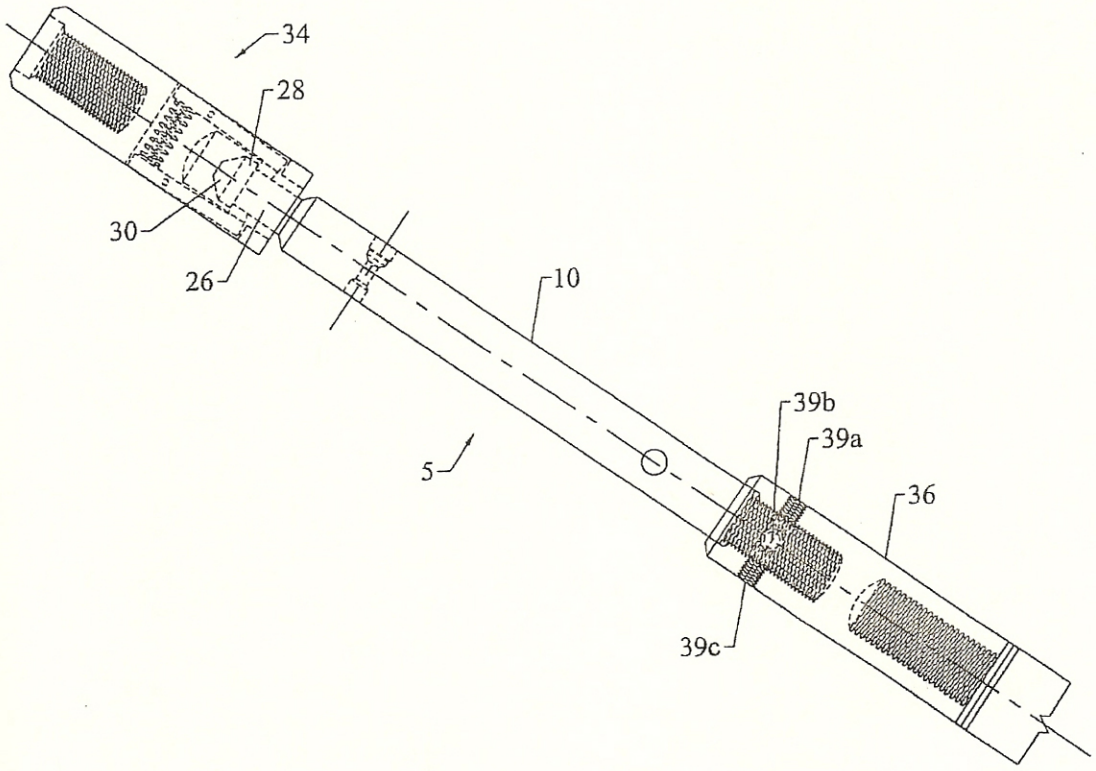
(57) **ABSTRACT**

A directional drilling tool comprising an orientation spear point having a spear axis. The orientation spear point comprises an end shaft with a threadable extension disposed along the spear axis and a support pin having a support pin axis perpendicular to and intersecting the spear axis. An orienting pin having an orienting pin axis perpendicular to the support pin axis and spear axis and intersecting the spear axis also extends through the end shaft. A latch rod with a latching edge is connected to the end shaft, and a nose is connected to the latching rod. The directional drilling tool also comprises a crossover sub comprising a first threaded section for engaging the threadable extension, and a second threaded extension for receiving a plurality of pin dimensions, an end of a tool, or a box.

18 Claims, 8 Drawing Sheets



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(12) **United States Patent**
Harvey et al.

(10) **Patent No.: US 7,506,700 B1**
(45) **Date of Patent: Mar. 24, 2009**

(54) **METHOD FOR STEERING MUD MOTORS AND RETRIEVING MEASUREMENT WHILE DRILLING DEVICES**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(58) **Field of Classification Search** 166/241.5, 166/117.5; 175/61, 62, 45; 285/404, 90
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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(57) **ABSTRACT**

A method for steering a steerable mud motor while attached to a retrievable replaceable measurement while drilling device comprising: securing a directional drilling tool to a retrievable replaceable measurement while drilling device, orienting the retrievable replaceable measurement while drilling device with a spear axis of an orientation spear point of the directional drilling tool, and lowering the orientation spear point into a non-magnetic drill collar above a mud motor. An orienting mule shoe stinger is attached to a gyroscopic device, which is then inserted over the orientation spear point, which orients the gyroscoping device along the spear axis, enabling steering of the mud motor while attached to the retrievable replaceable measurement while drilling device, while maintaining full retrievability of the retrievable replaceable measurement while drilling device from the well.

17 Claims, 10 Drawing Sheets