United States Patent

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[72] Inventor **Fletcher Redwine**
Irving, Tex.

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[73] Assignee **United States Steel Corporation**

[54] **DRILL-COLLAR CONSTRUCTION**
2 Claims, 1 Drawing Fig.

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[51] **Int. Cl.** **F16l 15/00,** E21b 17/02
[50] **Field of Search** ..... 285/329, 422, 114 (Cursory), 115 (Cursory), 390 (Cursory); 175/320; 29/(Inquired); 285/333, 334, 173

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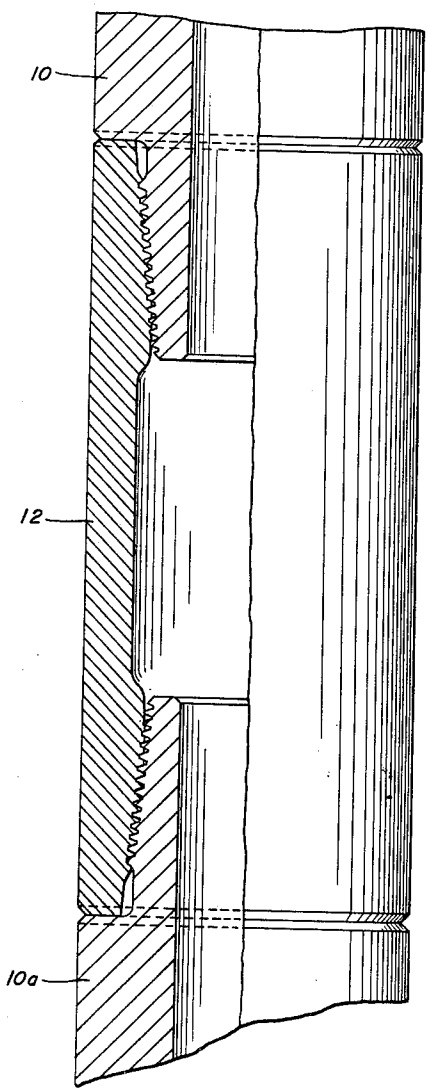
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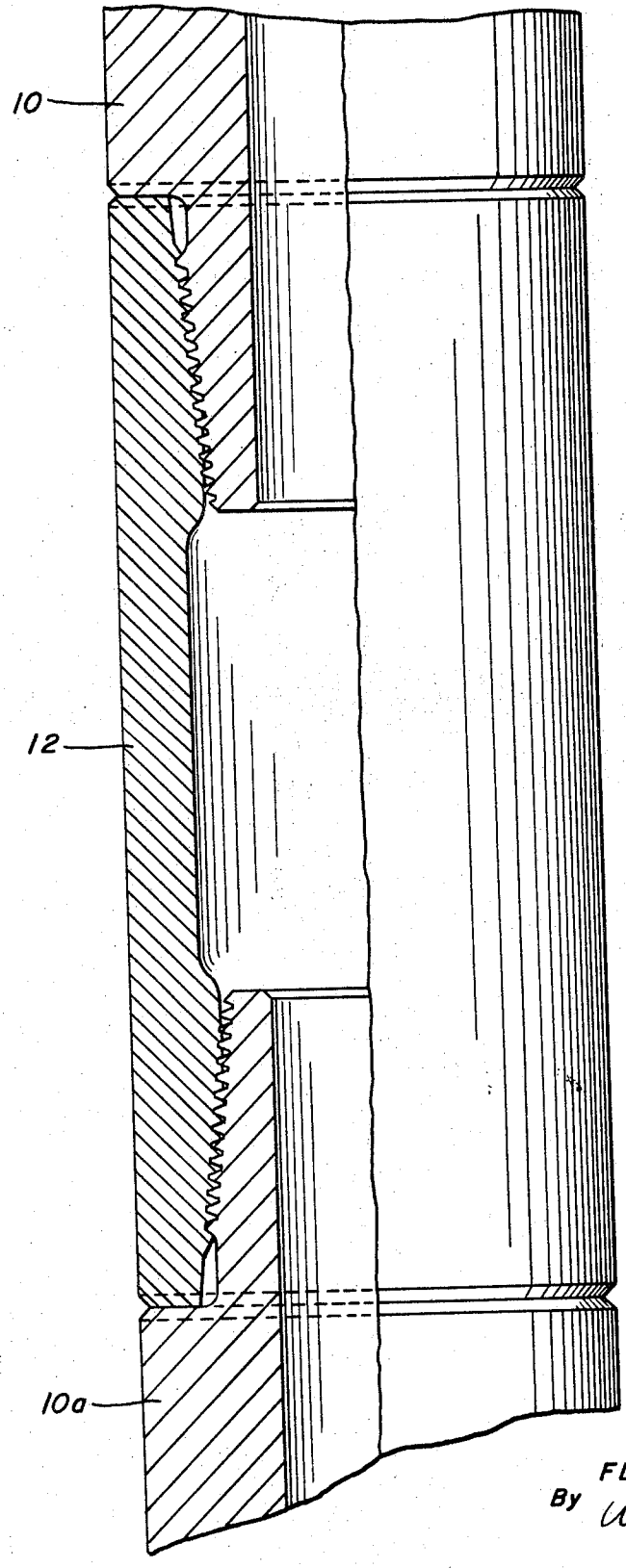
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Primary Examiner—Thomas F. Callaghan
Attorney—Walter P. Wood

ABSTRACT: A drill-collar construction for use in rotary drilling of wells. The individual collars are joined end-to-end with connectors which have greater fatigue resistance than the steel of the drill collars. The preferred metal for the connectors is titanium or a titanium-base alloy.





INVENTOR.
FLETCHER REDWINE
By Walter P. Wood
Attorney

DRILL-COLLAR CONSTRUCTION

This invention relates to an improved drill-collar construction for use in rotary drilling of wells.

When a well is drilled with conventional rotary equipment, the drill bit is attached to the lower end of a string of drill pipes, down which drilling fluid circulates. The portion of the drill string immediately above the bit is made up of a series of "drill collars", which are heavy-walled pipe sections, each usually about 30 feet long, joined end-to-end. The purpose of drill collars is to supply the necessary weight to the bit to enable it to penetrate the earth formation. The harder the formation, the more weight required and the larger the number of drill collars needed. The drill collars are in compression, but the rest of the drill string should be in tension. The point of neutral stress should be located in the drill collars near the upper end of the series. Although drill collars are relatively inflexible, uneven drilling feed, changes in the earth formation, slanted formations, etc., as well as shifts in the neutral stress location, cause them to flex to some extent. Such flexing takes place mostly at joints between individual drill collars. Most drill collar failures are the result of fatigue at these joints.

An object of my invention is to provide an improved drill-collar construction which forestalls fatigue failures at joints between individual collars.

A more specific object is to provide an improved drill-collar construction in which the individual collars are joined to one another through connectors of material highly resistant to fatigue, for example titanium or a titanium-base alloy.

In the drawing:

The single FIGURE is a longitudinal vertical section of a pair of drill collars and a connector in accordance with my invention.

The drawing shows portions of two drill collars **10** and **10***a* of series and a connector **12** which joins the two collars end-to-end. Similar connectors are used between other collars of the series, not shown. The collars may be externally threaded and the connector internally threaded as illustrated (pin-and-pin), or the collars may be internally threaded and the connector externally threaded (box-and-box), or opposite ends of the connectors may be threaded externally and internally (combination). Commonly each collar is about 30 feet long, and each connector about 12 to 18 inches. The collars usually are of an alloy steel heat treated to provide a tensile strength of about 125,000 p.s.i., and a modulus of elasticity of about 29 million to 30 million p.s.i. Such collars have a wet fatigue strength in drilling mud of about 13,000 p.s.i.

In accordance with my invention, I form the connector **12** of a metal which has a tensile strength comparable to the steel of the drill collars **10** and **10***a*, but a substantially lower modulus of elasticity and greater fatigue resistance. My preferred metal for this purpose is titanium. I intend the term "titanium" to include various titanium-base alloys, such as that which contains 6 percent aluminum, 4 percent vanadium, and the balance titanium, or those which contain small percentages of other known alloying elements including tin, zirconium, molybdenum, iron, chromium, etc. Typically the metal used in the connector has a modulus of elasticity of about 16,200,000 p.s.i. and a wet fatigue strength in drilling mud of 95,000 p.s.i.

With my invention, any flexing in the series of drill collars takes place in the connectors, rather than in the drill collars themselves. Since these connectors have much greater fatigue resistance, fatigue failures are forestalled. Corrosion may take place in fatigue cracks. My invention provides prevents such corrosion, both by preventing fatigue cracks from forming and by use of a metal which is highly resistant to corrosion. Thus, my invention effectively prolongs the life of drill collars.

I claim:

1. In a drill string for use in rotary drilling of a well, a series of drill collars and short-length connectors threadedly engaged with the ends of said collars and joining them end-to-end, said collars being formed of an alloy steel which has a relatively high modulus of elasticity and low fatigue strength, said connectors being formed of titanium which has a lower modulus of elasticity and a higher fatigue strength, whereby flexing in the series of drill collars takes place in said connectors rather than in the collars themselves.

2. A series of drill collars as defined in claim **1** in which the collars themselves have a modulus of elasticity of about 29 million to 30 million p.s.i. and a wet fatigue strength in drilling mud of about 13,000 p.s.i., and said connectors have a modulus of elasticity of about 16,200,000 p.s.i. and a wet fatigue strength in drilling mud of about 95,000 p.s.i.