Dec. 31, 1968 I. LARI 3,419,289

TOOL-JOINTS FOR DRILLING STRINGS

Filed Oct. 19, 1967 Sheet 1 of 3

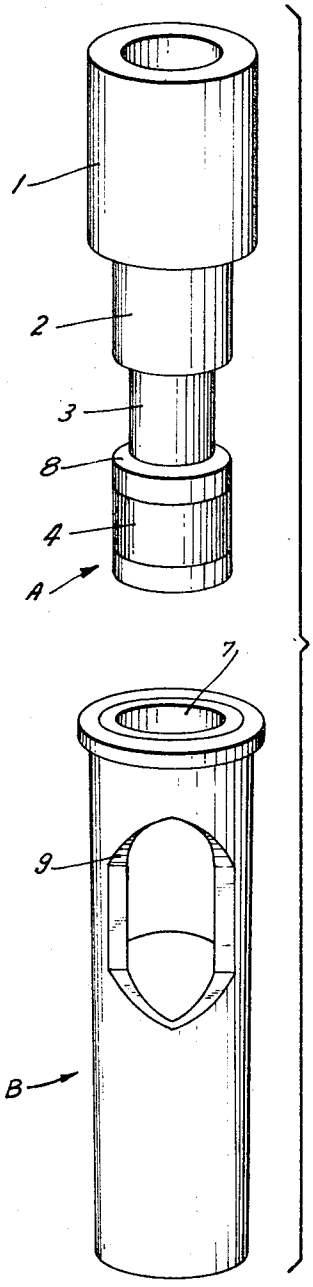

FIG. 1

FIG. 2

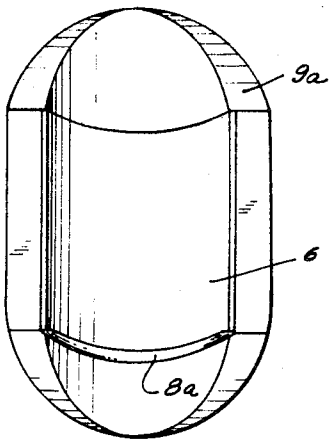

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FIG. 3

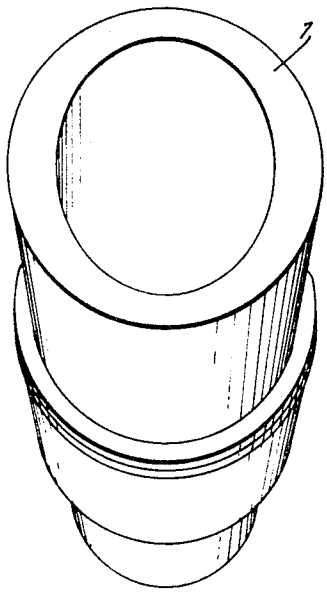

FIG. 4

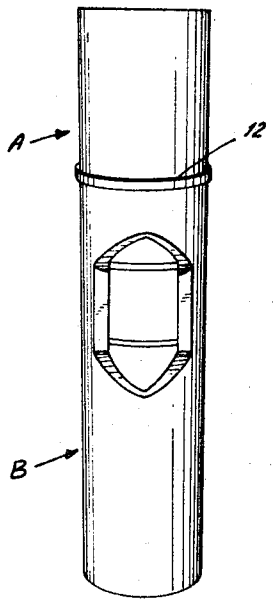

FIG. 5

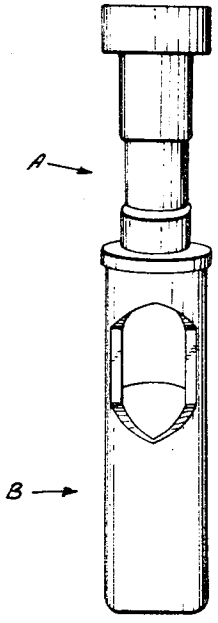

FIG. 6

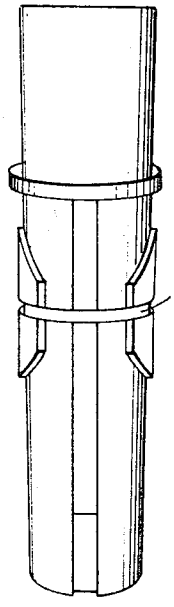

FIG. 7

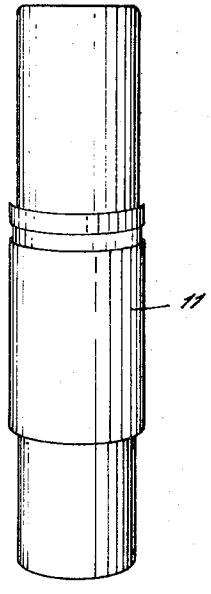

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FIG. 8B

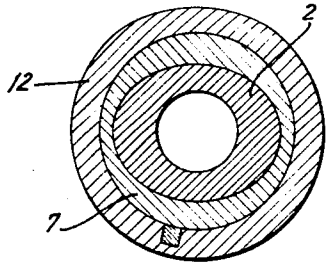


FIG. 8A

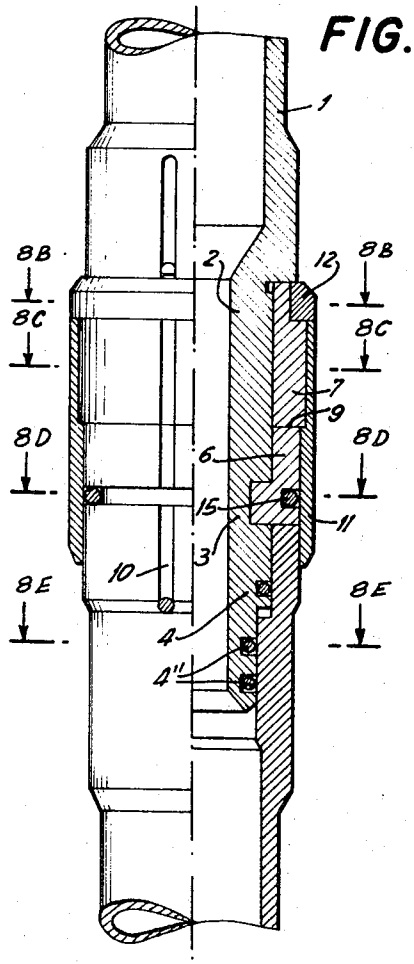


FIG. 8D

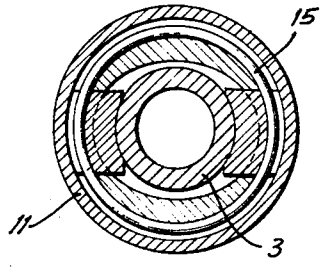


FIG. 8E

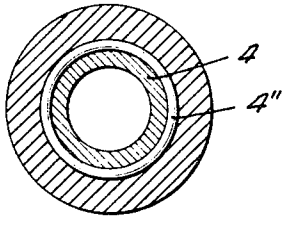
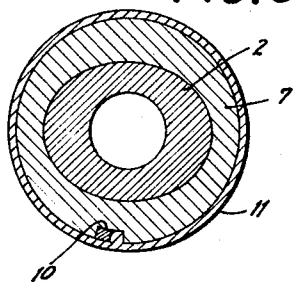


FIG. 8C



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3,419,289

TOOL-JOINTS FOR DRILLING STRINGS

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Continuation-in-part of application Ser. No. 398,643, Sept. 23, 1964. This application Oct. 19, 1967, Ser. No. 676,585
Claims priority, application Rumania, Sept. 27, 1963, 46,988
3 Claims. (Cl. 285—178)

ABSTRACT OF THE DISCLOSURE

An elliptic-cylindrical tool joint for a drilling string, which includes a pin and box. The pin member is provided with an axial bore and is provided on its outer periphery with: a first cylindrical cross-section, a second ellipsoidally shaped cross-section, contiguous to the first cross-section, a third cylindrical cross-section, contiguous to the second cross-section, and a fourth cylindrical cross-section, contiguous to the third cross section. The pin member is adapted to be inserted into a matingly shaped bore of the box member, which includes: a first ellipsoidally shaped bore portion, adapted to receive said second cross-section, a second cylindrical bore portion, contiguous to the first bore portion and third cylindrical cross-section having, respectively, a lateral opening and recess, through which blocking means are inserted and are maintained in position by suitable biasing means. This threadless joint can be easily assembled or disassembled by simply, respectively, positioning or removing the blocking means.

The present disclosure is a continuation-in-part of applicant's co-pending application Ser. No. 398,643 and now abandoned.

Background of the invention

The present invention relates to drilling string tool-joints, for example, a joint having what is called in the language of the art, a pin and box, which, unlike the conventional threaded tool-joints, are made up by using an elliptic-cylindrical system.

Tool-joints, having a pin and box, in the conventional drilling string are known to be provided with "coarse thread," and making or breaking a joint requires screwing. The threaded connections have the disadvantage that for tripping the drilling string in our cut while drilling, requires a number of complicated manual or automatic tools to make or break the connections. It generally takes about 70 seconds for a conventional drilling string tool-joint to be made up or broken. Taking this time period as a basis, the assembling time for a drill string comprising sections 27 m. in length, which are driled in a 3000 m. deep hole, will take appriximately 2 hours.

Since the automation of the make and break operations for a drilling string vertically positioned in the well-bore, requires special equipment, such as, for example, tongues as well as other tools used to screw in the tool-joints, automation of round trips is usually expensive. Automation of the round trip operations leads mainly to the reduction of the fatigue of the crew, rather than substantially cutting the tripping time proper.

In order to eliminate the drawbacks of threaded connections, where generally the major stresses are located and failures usually may occur, a new tool-joint type has been developed, which is described herein and forms the subject matter of the invention. This novel tool-joint comprises an elliptic-cylindrical connecting system. The tool-joints are connected by flash welding to the drill pipe sections proper.

It is to be noted that in the known drilling devices, the

drilling string can only rotate the bit in one direction. Laboratory tests have however shown that, depending on the dip of the formation which is being penetrated, the operation of the roller-bit will be more efficient in penetrating the rocks of the formation by means of a left-hand rotation of the bit. The rotating direction must therefore be selected according to the dip of the formation and according to the relative position of the bit opposite the formation.

According to the invention, the drill string comprises tool-joints of the elliptic-cylindrical type, the tool-joints being flash-welded to the drill pipe which enables the bit to be rotated either to the left or to the right. In this novel drill string type, the threaded connections are completely eliminated.

For illustration purposes, an example of the tool-joint of the elliptic-cylindrical type in accordance with this invention is shown diagrammatically in FIGS. 1–8.

FIG. 1 is an outside view in perspective of the tool-joint shown separately as pin and box.

FIG. 2 is an illustration in perspective of the box of the elliptic-cylindrical type of tool-joint.

FIG. 3 is an illustration in perspective of the inner elliptic shape of the tool-joint box.

FIG. 4 illustrates in perspective an aspect of the stabbing operation.

FIG. 5 illustrates in perspective an inner view of the elliptic-cylindrical connection without blocking ram.

FIG. 6 illustrates in perspective how the blocking rams are locked in place by means of a sliding sleeve.

FIG. 7 illustrates in perspective the elliptic-cylindrical tool-joint when completely assembled.

FIGS. 8A, 8B, 8C, 8D and 8E illustrate a longitudinal and several horizontal cross-sectional views through the elliptic-cylindrical tool-joint of the invention.

According to the invention, the pin A of the elliptic-cylindrical tool-joint comprises four sections. Sections **1**, **3** and **4** are of cylindrical cross-section and section **2** is of elliptic cross-section. Section **4** is fitted with a rubber sleeve A (see pin A in FIG. 1), similar to that used for the pistons of the drilling mud pumps. Alternately the section **4** can be provided with a pair of O-rings **4''** (as shown in FIG. 8A) for producing a liquid-tight joint. The pin A is provided, on the inside, with a bore of circular cross-section for circulation of the drilling mud.

The box B of the elliptic-cylindrical tool-joint has two openings for locking in the blocking rams **6** which will be further described below. The box B of the tool-joint has at the top an interior elliptic cross section **7** and an interior circular cross-section.

The elliptic-cylindrical cross-section is obtained, according to the invention, by inserting sections **2**, **3** and **4** of pin A into box B, which is provided at the top with the elliptic interior cross-section **7**.

This elliptic cross-section corresponds approximately to the exterior elliptic cross-section of section **2** of the pin A. The interior elliptic shape of box B and the elliptic shape of section **2** of pin A, provide connections between the drill-string sections which permit the drill-string to be rotated either to the left or the right. By inserting the pin A into box B, as shown in FIGS. 4 and 5, the blocking rams **6** which are held in place by an outside built-in spring **15**, are slightly pushed outwardly so that pin A enters completely into box B. Each one of the blocking rams **6** has a pair of opposite bearing surfaces **8***a*, **9***a* which act, respectively, upon the surfaces **8** and **9** of the pin A and box B. The areas of these bearing surfaces are 2–3 times larger than the cross-sectional areas of the corresponding drill pipes. The blocking rams **6** acting upon surfaces **8** and **9**, achieve a connection capable of supporting axial loads. With the blocking rams **6** in place, the channel **10** which extends longitudinally along the outer

periphery of box B and pin A, allows the sliding sleeve **11** to be automatically locked in position on ring **12** by means of an inner wedge member which fits into the channel **10**. The connection is thus complete. Variable torque and rotational forces of the bit can thus be transmitted through the elliptic section **2** of pin A and the mating elliptic sections of box B, and the tensile axial stresses are transmitted through surfaces **8** and **9**. In this way the external actions of the torque and axial stresses are separately transmitted by approximately separated elements.

Dismantling of the connection is performed in the reversed order, than the assembling thereof. By pulling out the inner locking wedge member of the sliding sleeve **11**, the latter can travel by its own weight down to the lower shoulder (not illustrated), thereby exposing the blocking rams **6**.

The blocking rams **6** can then be automatically removed by means of the magnetic field of a special device; they can also be removed manually by means of two holes provided in their body (not illustrated).

The elliptic-cylindrical tool-joints in accordance with this invention offer the following advantages:

They eliminate the threaded connections of the drilling strings of comparable prior art devices, where stresses usually concentrate, which have resulted in frequent failures of the threaded parts.

They make it possible to apply through the drill-string left-hand or right-hand rotation of the bit while drilling, depending upon the relative position of the bit to the rock and the formation dip, thereby increasing the penetration efficiency.

They eliminate the need for using a great number of types of gauges for checking coarse threads of the tool-joints.

Complicated tools and devices necessary for making up and breaking out the tool-joints can be eliminated from the drilling well equipment.

They facilitate the assembling of the drill-string and reduce the time necessary for these operations.

No complicated automated equipment for the make and break operations is necessary, since the connection of this invention provides a tool-joint which does not require any specific screwing operations.

Drilling programs based upon predetermined successive left-hand and right-hand rotation of the same bit, can be used with a drill-string, in accordance with this invention, which insures uniform wear of the bit elements.

The elliptic-cylindrical connection of the invention can also be used in sucker rod strings for pumping wells.

The use of the elliptic-cylindrical tool-joint of this invention permits rapid connection of the cementing truck lines to the pipes in the bore-hole while performing a cementing job.

While I have thus described herein and illustrated in the accompanying drawings what may be considered a typical and particularly useful embodiment of my said invention, I wish it to be understood that I do not limit myself to the details and dimensions described or illustrated; for obvious modifications will occur to a person skilled in the art.

What I claim as my invention and desire to secure by Letters Patent is:

1. A drill-pipe joint of the character described, comprising a pin member A being provided with an axial bore and having; a first cylindrical cross-section (**1**), a second ellipsoidally shaped cross-section (**2**) contiguous to said first cross-section, a third cylindrical cross-section (**3**) contiguous to said second cross-section, and a fourth cylindrical cross-section (**4**) contiguous to said third cross-section; and a box member B being provided with an axial bore and having: a first bore portion (**7**) having an ellipsoidally shaped cross-section matingly shaped with respect to said second cross-section of pin member A so that the latter may be inserted into box member B, so that the wall surface of said second cross-section engages the wall surface of said first bore portion, a second cylindrical bore portion contiguous to said first bore portion adapted to matingly receive said fourth cylindrical cross-section, said first portion having at least one lateral opening and said third cylindrical cross-section having at least one recess adapted to be positioned opposite said opening; and blocking means adapted to be inserted through said opening and adapted to engage said recess and the edges of said opening; whereby torsional stresses can be transmitted through said drill pipe by means of said matingly engaging first portion and second cross-section, and axial stresses can be transmitted through said drill pipe by means of said blocking means, said recess and said edges of said opening.

2. The drill pipe joint as set forth in claim **1**, including biasing means engaging said blocking means so as to maintain them in engagement with said recess.

3. The drill pipe joint as set forth in claim **1**, including a cylindrical sleeve mounted over said blocking means and said biasing means.

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U.S. Cl. X.R.

285—315, 317, 347