

[54] **DRILL PIPE COUPLINGS**

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[58] Field of Search **285/90, 91, 39, 330, 362, 377, 285/DIG. 14; 175/320**

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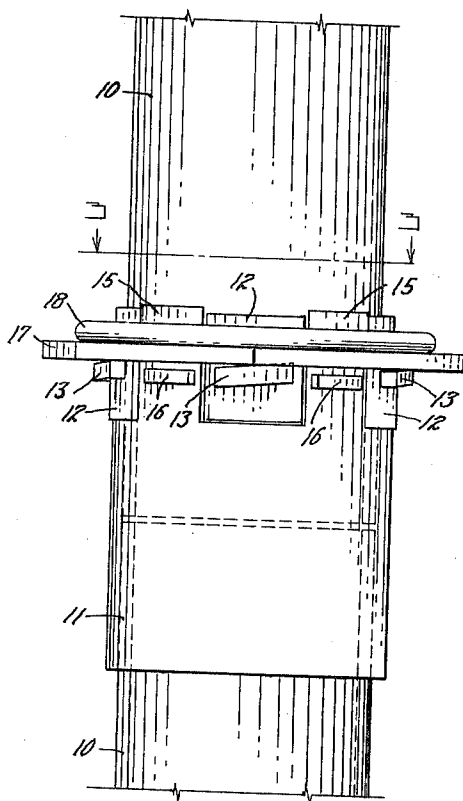
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[57] **ABSTRACT**

A coupling for safely and detachably connecting lengths of drill pipe into a rotary well drilling string including a cylindrical sleeve mounted on and surrounding the upper extremity of each length to telescopically receive the lower extremity of the next above length. Diametrically spaced pads externally mounted on and adjacent the lower extremity of each length and spaced-apart tenons formed on each sleeve so as to pass between the pads of the next above length to prevent relative rotation between the lengths. A rotatable clamping ring surrounding said tenons and provided with internal segments adapted to be brought into engagement with inclined cam bosses on said tenons to lock the latter in place between said pads.

6 Claims, 5 Drawing Figures



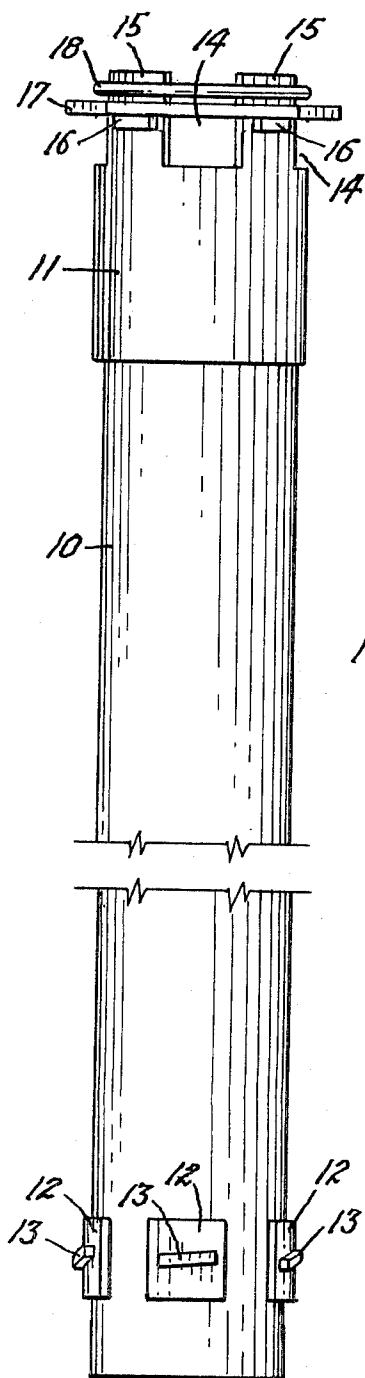
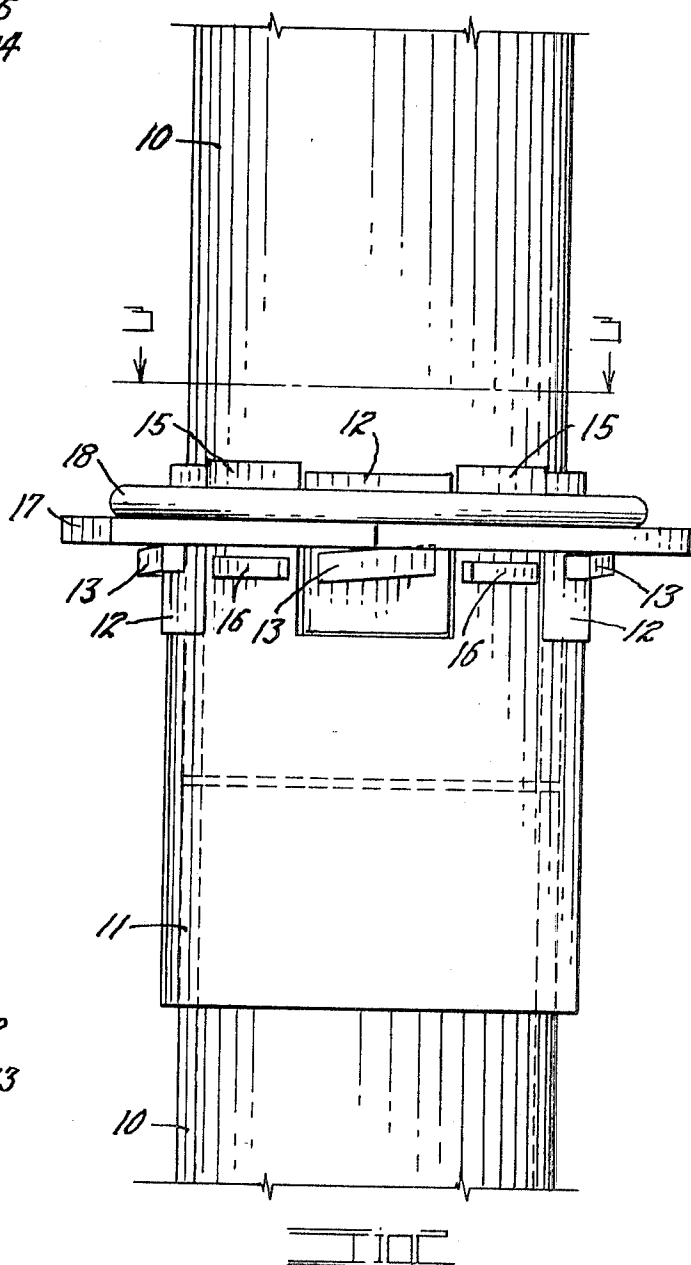
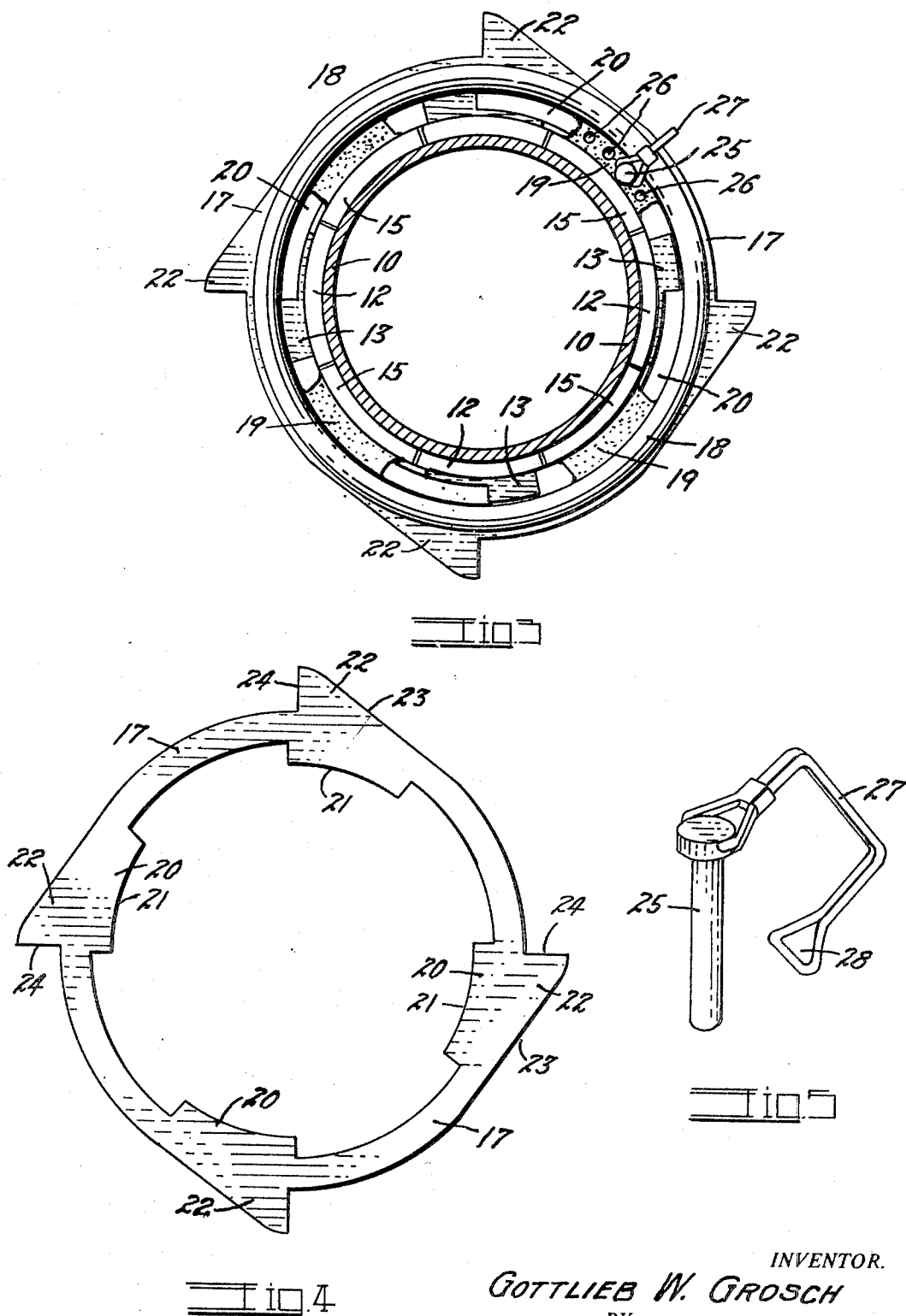


Fig. 1



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DRILL PIPE COUPLINGS

This invention relates to rotary drill pipes for use in well drilling and more particularly to a drill pipe coupling for joining the successive lengths of the drill pipe into a continuous drilling string.

Attempts have been made to join lengths by various threaded arrangements but these have not been satisfactory since the drill string is subjected to extreme torque stresses in both directions which quickly loosen the couplings when the string is turned counterclockwise, to cause expensive and well damaging fishing operations and occasionally abandonment of the well. When turned clockwise, the threads bind and "freeze" the lengths together causing difficult and expensive time consuming disassembly problems.

The principal object of this invention is to provide a comparatively simple and highly efficient drill pipe coupling in which all threads are eliminated and in which the means for conducting torsional stresses will be completely independent of the means for resisting tensional stresses so that rotation of the drill pipe will have no effect on the coupling, thus entirely eliminating accidental disconnection and "freezing."

A further object is to provide a drill string coupling which will have but one movable part, the actuation of which will simultaneously lock the pipe lengths against separation and against relative rotation.

A still further object is to provide a simplified drill string coupling which will not require the use of special tools or wrenches and which can be quickly, easily and safely applied by hand, assisted by simple hammer strokes.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is made to the accompanying drawings which form a part thereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawings:

FIG. 1, is a partially broken away side elevational view of a typical length of drill pipe with the invention applied to the extremities thereof;

FIG. 2 is a fragmentary side view of the coupling of this invention as it would appear when joining two pipe lengths together for use;

FIG. 3 is an enlarged sectional view looking downwardly on the line 3—3, FIG. 2;

FIG. 4 is a similarly enlarged detail face view of a rotary clamping ring employed in the improved coupling for clamping adjacent aligned lengths together as will be later described; and

FIG. 5 is an enlarged detail perspective view of a locking key for locking the clamping ring in clamped position.

A typical length of drill pipe is indicated at 10. To apply this invention thereto, a tubular sleeve 11 is tightly fitted over, and welded to, the upper extremity of length 10, so as to project upwardly therefrom, and a plurality of rectangular, arcuate, circumferentially spaced pads 12, each provided with a projecting inclined cam boss 13, are welded thereto adjacent to the lower extremity thereof. It is preferred to employ four of the pads 12 uniformly spaced apart.

The upper annular edge of sleeve 11 is provided with a plurality of substantially rectangular spaced-apart mortise notches 14 to form four upwardly extending, rectangular, transversally arcuate tenons 15, each having a width which, when assembled, will enable them to fit snugly between the pads 12 of the next above length of drill pipe as shown in FIG. 2.

The tenons 15 are provided with horizontal supporting ledges 16 which horizontally support a rotatable annular clamping ring 17, as shown in FIG. 1 and 2, thereon. A stationary, annular, retaining ring 18 concentrically surrounds all of the tenons immediately above the clamping ring and acts to limit vertical movement of the clamping ring 17. The retaining

ring is substantially similar in general diameter to the clamping ring 17 and is fixedly supported in radially spaced relation from the tenons 15 upon intervening webs 19 welded in the intervening space between the tenons 15 and the retaining ring as shown in FIG. 3.

Four cam-engaging segments 20, of less length than the width of the notches 14, project radially inward from the clamping ring 17. The segments 20 have arcuately concave inner edges 21 which circumferentially and slidably engage the drill pipe 10 to maintain the ring 17 concentric therewith. The clamping ring 17 is also provided with a plurality of externally projecting actuating lugs 22 to facilitate rotation of the clamping ring. The clamping ring 17, the segments 20 and the lugs 22 lie in the same plane and can be integrally formed from a relatively thick, flat metallic plate.

ASSEMBLY

It is believed that the relations of the various elements of the new coupling can be best understood from a description of its assembly. Let us assume that the uppermost length of a drill pipe string is projecting upwardly from a drill table. The lower extremity of the next length is now lowered into the sleeve 11 of the first length, with the pads 12 of the next length entering the notches 14 of the sleeve, until the pads rest upon the bottoms of the notches 14 of the sleeve 11. During the lowering, the cam-engaging segments 20 are radially aligned with the tenons 15 to provide clear downward passages for the pads 12 and the cam bosses 13.

When the pads 12 of the next length are resting on the bottoms of the notches 14 of the first length, the clamping ring is rotated counterclockwise by hand as far as possible causing the cam engaging segments to move over and climb the inclined cam bosses 13, as shown in FIGS. 2 and 3, thus locking the two lengths forcibly together.

The drilling can now be resumed and the resistance of the well walls, to the clockwise movement of the clamping ring lugs 22, constantly tends to maintain all of the cam-engaging segments 20 in the string in climbing relation with their respective inclined cam bosses 13 so as to absorb all lost motion and maintain a permanently tight coupling during the entire drilling operation.

It is desired to call particular attention to the triangular shape of the projecting actuating lugs 22. It will be noted that the leading edge of each lug, shown at 23, is tangentially inclined so it can readily pass over well-wall obstructions as the rotary drilling progresses. The trailing edge of each lug, shown at 24, is radially positioned so that it may be readily struck in a clockwise direction by a sledge to loosen the tight clamping rings from the cam bosses for quick disassembly of the string.

An additional safety device is provided to prevent accidental, unloosening, rotation of the clamping ring 17. The latter device comprises a headed locking stud 25 as shown in FIG. 5, adapted to be inserted downwardly through any desired one of a plurality of locking holes 26 which are formed in one of the retaining ring webs 19 so that it will be engaged by the adjacent cam engaging segment 20 to prevent reverse rotation of the clamping ring 17.

To prevent loss of the locking stud 25 a U-shaped resilient, double wire ball 27, having an open bolt loop 28 at its bight, is hinged mounted on the head of the stud so that it may be swung downwardly between the retaining ring 18 and the clamping ring 17, as shown in FIG. 3, and so that its bolt loop 28 can be snapped over the lower extremity of the stud, to retain the stud in place.

The clamping rings in the drill string, when tightened, will be in various circumferential positions due to variations in the applied tightening torque and to various mechanical irregularities, yet it is desired to position the locking stud as close to the final position of the adjacent segment as possible to reduce lost reverse motion. By providing a plurality of aligned stud holes 26 as illustrated, these variations in circumferential posi-

tions are accommodated since the assembler can selectively place the locking stud in the hole 26 which is closest to an adjacent segment at the time of installation.

The principal use of the invention is upon rotary drill strings. It is valuable, however, for any use requiring a rapid, strong connection between pipe lengths for any desired purpose.

While a selected form of the invention has been above described, it is understood that mechanical variations and detail substitutions can be made by one skilled in the art without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. A drill string including a coupling for connecting successive lengths of drill pipe together to form a rotary drilling string comprising:

- a. a cylindrical sleeve surrounding, fixedly secured to, and extending above the upper outer extremity of each length to telescopically receive the lower extremity of a next above length;
- b. a plurality of diametrically spaced pads mounted on and in direct contact with the outer surface of each length adjacent the lower extremity thereof;
- c. a similar plurality of mortise notches in the upper extremity of said sleeve forming intervening tenons which extend upwardly between the pads of the next above length to prevent relative rotation when successive lengths are telescopically coupled; and
- d. means for detachably locking said pads in place in said mortise notches, said means including a locking boss extending radially outward from each of said pads; and locking means supported by said tenons adapted to be moved laterally over said tenons to a position above said locking bosses to prevent upward movement of the latter.

2. A coupling as described in claim 1 in which the locking means comprises:

- a. a rotatable, annular clamping ring concentrically surrounding all of said tenons, so as to pass horizontally across all of said notches; and
- b. engaging means formed on and projecting radially inward from said clamping ring which can be rotated to a position above said locking bosses to prevent upward movement of the latter.

3. A coupling as described in claim 2 in which the locking bosses comprise:

- a. an elongated spirally inclined ridge formed on the outside face of each pad, said ridge being so positioned that the engaging means of said clamping ring will contact and slide up the spiral incline of said ridges to clamp tenons in their respective notches in consequence of rotation of said clamping ring.

4. A coupling as described in claim 3 having:

- a. an annular retaining ring fixedly mounted on and concentrically surrounding all of said tenons substantially parallel with and above said clamping ring to limit upward movement of the latter.

5. A coupling as described in claim 4 in which the fixed mounting of said retaining ring comprises:

- a. spacing webs secured to and positioned between the tenons and the retaining ring so as to position the latter radially outward from the tenons to allow vertical passage of said locking bosses during assembly and disassembly.

6. A coupling as described in claim 3 having:

- a. spaced-apart actuating lugs projecting radially from, and in the plane of, said clamping ring to facilitate rotation of the latter.

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