May 25, 1943. S. SPECKERT 2,320,107

ALIGNING CONNECTION FOR DRILL COLLARS

Filed July 14, 1941

Fig. 1.

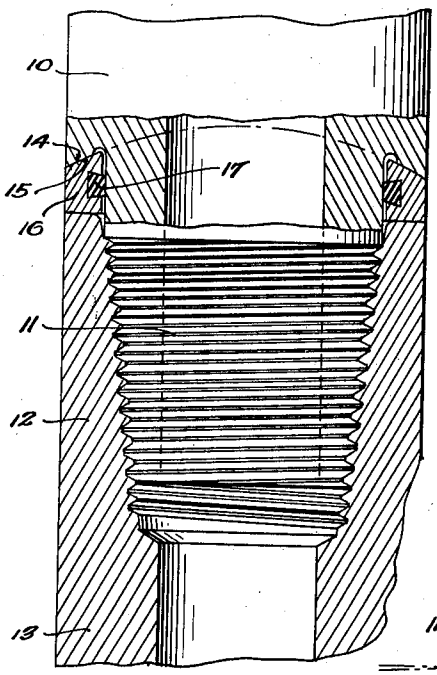


Fig. 2.

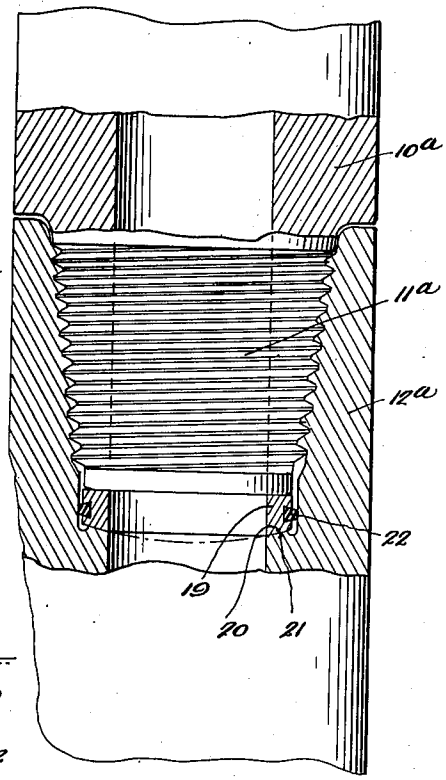


Fig. 6.

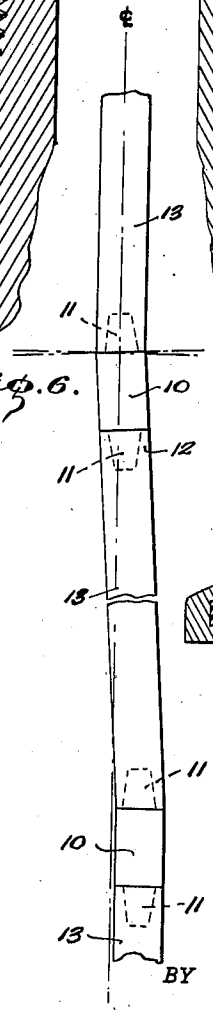


Fig. 3.

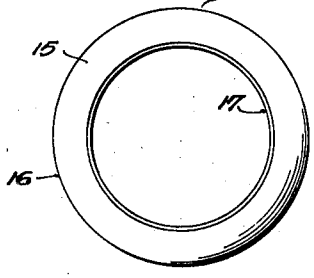


Fig. 4.

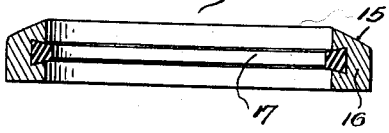


Fig. 5.

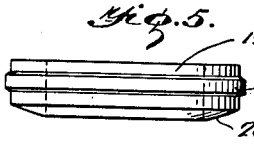
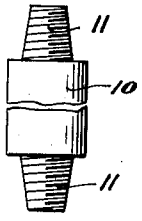


Fig. 7.



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ALIGNING CONNECTION FOR DRILL COLLARS

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11 Claims. (Cl. 285—146)

The present invention relates particularly to an aligning connection primarily intended for the sub-connected drill collars found to be necessary in modern, high speed, deep hole drilling in order to add weight to the lower or bit end of the drill string, and in this way minimize the possibility of eccentric motion of the bit, for maintaining a straight hole and eliminating the hazard of twist-off.

In accordance with the best modern practise, drill collars are utilized in an assembly of desired length, usually of considerable length, sometimes reaching two hundred and fifty to three hundred feet, each collar running as high as fifty feet in length. As those collars must be carefully manufactured of specially treated material and skilled workmanship, they are costly and for this reason are ordinarily formed with female threads at both ends for connection in an assembly by means of double pin substitutes, the latter of which are commonly known as subs.

The above follows from the fact, well known in drilling practise, that the pins or male threaded parts of drill string connections constitute the weakest links of the string. Hence they are commonly eliminated from expensive drill collars and left to be carried by the relatively inexpensive subs connecting the collars, so that a cracked pin necessitates only replacement of a sub. This happens quite frequently, although theoretically at least, the pin is amply strong for the task it performs, as long as the drill collar assembly is such that its center line coincides with the center line of the hole.

In practise, however, it is found that inaccuracies in the manufacture of the less carefully formed subs, results in the deflection of one or more drill collars so that the drill collar assembly deviates from a truly straight line. This, in turn, throws severe strain upon the sub pins, since the hanging drill collars tend toward a straight line. The frequent result is a cracked pin or pins, and when this happens it often permits alignment of the drill collar assembly and the latter then remains effective over lengthy periods of use unless the assembly parts or the joint washes out. Even if the cracked pin survives, it is obvious that it remains at all times as a potential danger of a parted string or a washed out connection.

There is, for the foregoing reasons, considerable importance, from a practical standpoint, in any means which will, in the case of drill collars out of true alignment, permit them to truly align with one another, without cracking the pin or pins of one or more collar connecting subs.

It is therefore the primary object of the present invention to incorporate in a connection, involving the female threads or box ends of drill collars, and the male threads or pins of the collar connecting subs, a means which will permit the pins to slightly angularly adjust themselves under strain, so as to compensate for non-alignment of the drill collars and allow of their alignment without cracking of the pins.

It is a further object of the invention to provide an aligning connection for sub-connected drill collars by which to accomplish the elimination of the above defects in a simple, scientific manner which is mechanically correct.

With the above in mind, the invention in its structural form at present preferred, is fully illustrated in the accompanying drawing, which forms a part of this specification, and in which:

Figure 1 is a view, partly in elevation and partly in vertical section, showing the proposed connection between one end of a double pin, collar connecting sub and an adjacent drill collar, with the yielding means of the present invention on the pin of the sub.

Figure 2 is a similar view showing the yielding means within the box end of the drill collar.

Figure 3 is a detail top plan view of the ball ring of Figure 1.

Figure 4 is a detail vertical sectional view taken diametrically through Figure 3.

Figure 5 is a detail side view of the ball ring of Figure 2.

Figure 6 is an elevation of a portion of a sub-connected drill collar assembly, showing deflection of a drill collar by reason of a faulty sub connection, and

Figure 7 is a detail side view of a double pin sub such as commonly used as a drill collar connection.

Referring now to the above described figures of the drawing, and particularly to Figure 7, there is shown a double pin sub 10, the male threads of which are on pins 11 projecting endwise from its opposite ends so as to engage the female threads or box ends 12 of drill collars 13 in the manner shown in said figure for the formation of a drill collar assembly capable of adding the desired weight to the lower end of a drill string adjacent to the bit.

Each of the collars 13, of which any number may be used in the assembly, depending upon the desired length of the latter, and the lengths of the drill collars, is of heavy construction, and is

the product of careful manufacture with the idea of eliminating any irregularities, inside or out, which would create any tendency toward eccentric movement of the bit end of the drill string.

Furthermore, since the drill collars 13 are, for the foregoing reasons, in the nature of expensive equipment, they are preferably formed with female threads or box ends 12 at both ends thereof. In this way the box ends 12 eliminate any weakness as to the drill collars, leaving them for connection by double pin subs 10, so that in case a pin is cracked it will mean replacement of only a materially less expensive sub.

In practise, the subs 10 are not so carefully manufactured as to uniformly avoid faults, and one of these faults is that not infrequently drill collars are deflected out of true axial alignment, with the result that the drill collar assembly, as seen in Figure 6, will, when rotated, develop eccentricity of movement and great strain will consequently be thrown upon the sub pins 11 at the upper and lower ends of the deflected drill collar. In many instances this strain results in cracking one or both of the pins 11, and unless the assembly parts as a result of pin breakage, or a connection washes out, the assembly will often straighten itself out due to the relief afforded by the cracking of a pin or pins, and continue to function satisfactorily, although with constant danger.

To avoid the cracking of a sub pin or pins as a relief of the strain, and at the same time permit a safe relief of the strain, being the primary object and purpose of this invention, there is shown in Figure 1, by way of example, the lower portion of one of the subs 10, having its coarsely threaded depending pin 11 entering the upwardly opening, and similarly threaded, box end 12 of the next lowermost drill collar 13 of a drill collar assembly. With respect to this assembly, and more particularly each drill collar 13 thereof, it will be noted that the sub 10 as seen in Figure 7 is substantially less in length and therefore more rigid and unyielding.

The sub 10 is cut away, as shown, at the base of its pin 11, to form an annular channel or recess, one wall of which, approximately normal to the axis of the sub, is seen provided with a cancave surface 14 mating with the adjacent convex top face 15 of a ball ring 16 which substantially interfits the annular recess or channel of the sub.

The ball ring 16 is formed with a lower flat face for engagement with the end surface of the collar box 12 when the drill collar assembly is made up, and its outside diameter is preferably such as to coincide with that of the sub 10. The inside diameter of the ball ring 16 is preferably such as to surround the base of the pin 11 of the sub 10 in slightly spaced relation thereto, creating an allowance for limited angular shifting of the threadedly connected parts so as to relieve the pin 11 of fracturing strains.

Since it is important to hold the ball ring 16 on the pin 11 in making and breaking the connection of drill collars and subs, going in and coming out of the hole, the inner surface of the ring preferably carries a deformable, frictional, pin gripping means, as for example, an inwardly protruding resilient pin gripping band 17. This band may be suitably anchored in connection with the ring to form a part thereof, as by providing the same of dovetailed form, seated in a similarly shaped inner annular groove of the ring, the band thus being effective to prevent the ball ring from falling into the hole, without affecting the normal function of the ball ring in use.

The above described placement of the ball ring being thus plainly set forth in its disposition around the base of the sub pin, as in Figure 1, and its general form clearly appearing in Figures 3 and 4, it remains but to observe that not only may this construction be utilized at both ends of the sub, but it may be used at one or both ends of the sub if the latter be either a double pin, pin to box, or a double box sub, since in Figure 2 it is plainly shown that substantially the same desirable results of the ball ring on the pin of the sub may be achieved by seating the ball ring in the base of the box.

In Figure 2, the sub 10^a is seen with its pin 11^a and the base of the box 12^a is shown as formed with an annular space or channel for the ring 19, so that the extremity of the pin 11^a seats against the flat upper face of the said ring. The ring 19, which is substantially smaller in diameter than the pin carried ring 16, has its external surface annularly spaced from the internal surface of the box 12^a, and has its lower face convex as at 20 to seat downwardly upon a mating concave internal surface 21 of the box, so that the ring will have a sufficient allowance for angular shifting movement in the box to prevent fracturing strain on the pin 11^a.

Also, in the form of Figure 2, the ring 19 will have its resilient retaining band 22 on its external surface to frictionally engage the internal surface of the box and thus avoid danger of displacement of the ring after it is once inserted in position. It is, of course, old and well known in the art that connections between drill collars in a drill collar assembly employ taper threaded pins and boxes, and that it has been common practise to so form the engaging threads of such connections as to permit play or relative movement between the threadedly engaged surfaces. This has commonly been done even though it is known that where the threads are perfectly matched in the first instance when the drill collar assembly is made up, the weight of the collars and bit, and the strain of initial use in a rapidly rotating drill string, quickly pulls and distorts the threads to such an extent that the play above referred to is invariably the result. It is, therefore, common knowledge in the art that play does exist in such threaded connections of drill collar assemblies after actual use thereof, if not before such use.

The present invention, it is to be understood, assumes the existence of the play above mentioned between the threadedly engaged surfaces of the joints, and it will be noted that the ball joint ring proposed by the present invention is not only positioned so that it permits of relative angular movement between the same along its ball surface, and the pin or box member carrying the ring, but it is also free for permissible lateral movement along its opposite surface with respect to the other member. In other words the ball joint ring, in order to be effective for the purposes of the present invention, has merely abutting contact with both the pin and the box, and is permitted movement relative to both pin and box, so that its function is automatically accomplished when the collar assembly is in actual use.

In practical use it is preferable that the ball ring, either ring 16 or ring 19, be formed of hardened metal to endure repeated making and breaking of the collar assembly in round trip-

ping, and avoid the disadvantage of galling, and it will be understood that while I have shown and described the invention as applied to drill collars and their connections, where its use is highly desirable on account of the described manner in which such connections are affected in practise, it will be appreciated that the ordinary tool joint between drill pipe stands is so affected to a lesser degree, and that the invention may be applied thereto for the same purpose, and to the same end, as that above outlined.

Having thus fully described the invention, what is claimed is:

1. A drill collar assembly, comprising drill collars connected in end to end relation, and a rigid ball joint member laterally shiftable in the connections between said collars and automatically laterally adjustable under tension in use, for insuring hanging axial alignment of collars connected in non-alignment in the collar assembly.

2. A drill collar assembly, comprising drill collars, subs between and connecting the collars in end to end relation, and a rigid ball joint member laterally shiftably positioned in the connections between the subs and drill collars and automatically laterally adjustable under hanging tension in use, insuring hanging alignment of the assembly and relief of angular strain on the connections.

3. In an aligning connection as set forth, a taper pin, a box in which said pin is threaded, said pin and box having abutment portions, and a rigid ball joint member laterally shiftably interposed between said abutment portions, and in abutting relation only with said portions, upon which the pin and box are relatively angularly shiftable to avoid fracturing strain on the pin.

4. In an aligning connection as set forth, a taper pin and a box having engaging tool joint threads, and endwise abutment portions, and a rigid ball joint member laterally shiftable between said abutment portions, and movable relative to both portions, upon which the pin is movable to a limited extent angularly relative to the box.

5. In an aligning connection as set forth, a taper pin, a box in which said pin is threaded, the pin and box having opposing abutment portions, and a ball rigid joint ring interposed between said abutment portions, and laterally shiftable relative to both portions upon which the pin and box are relatively angularly shiftable.

6. In an aligning connection as set forth, a taper pin, a box in which said pin is threaded, the pin and box having abutment portions in opposition longitudinally thereof, and a rigid joint ring laterally shiftably disposed between said abutment portions and movable with respect to both portions, the said ring and at least one of the abutment portions having engaging concavo-convex mating surfaces.

7. In an aligning connection as set forth, a taper pin, a box in which said pin is threaded, and a hardened metal ball ring freely disposed between, and in relatively laterally movable cooperation with, adjacent portions of both the pin and box, permitting their limited relative angular movements.

8. In an aligning connection as set forth, a box, a pin threaded in said box and having an annular shoulder at its base opposing the box end, and provided with a concave abutment face, and a ring frictionally supported on the base portion of the pin in spaced relation annularly thereof for lateral movement relative thereto, having one face abutting the box end in laterally shiftable relation, and an opposite convex face engaging the concave face of the pin shoulder.

9. In an aligning connection as set forth, a pin, a box in which said pin is threaded, having an internal shoulder opposing the end of the pin and presenting a concave abutment face, and a ring frictionally supported in the box in spaced relation annularly thereof, having one face abutting the pin end in laterally shiftable relation, and having an opposite conve face seated on the concave face of the box shoulder.

10. In an aligning connection as set forth, a pair of threadedly connected members consisting of a pin and a box, said members having opposing abutment portions, and a hardened ball ring interposed between said abutment portions, said ring being in laterally shiftable abutting contact with one of said members and supported on, and spaced annularly from, the other of said members, and said latter member and the ring having relatively engaging concavo-convex faces.

11. In an aligning connection as set forth, a pair of threadedly connected members consisting of a pin and a box having opposing abutment portions, a hardened metal ball ring interposed between said abutment portions in annularly spaced relation to one of said members, said latter member and the ring having relatively engaging concavo-convex faces, and a flexible, elastic band carried by said ring and protruding laterally therefrom into frictional engagement with the last mentioned member to prevent displacement of said ring when the members are disconnected.

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