July 28, 1936. E. BURNS ET AL 2,049,290

DRILLING SAFETY JOINT

Filed June 17, 1935

Fig. 1

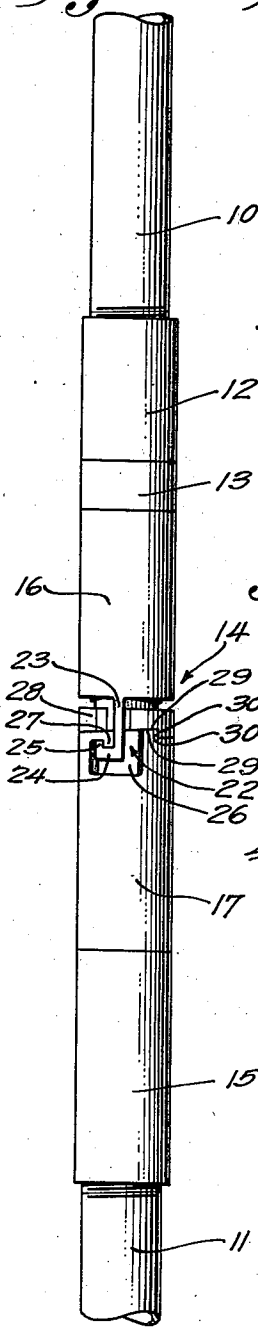


Fig. 2

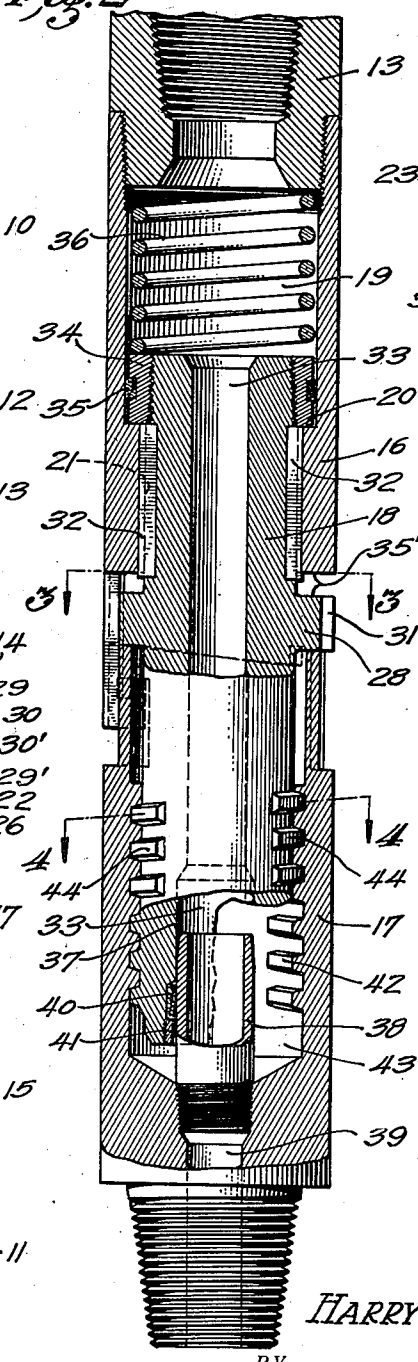


Fig. 3

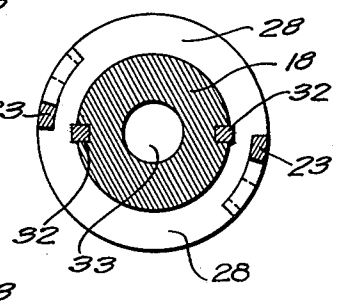
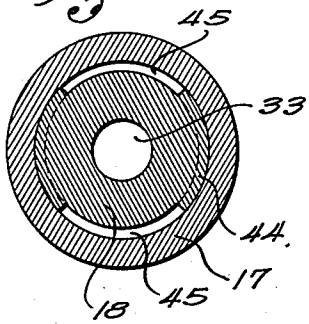


Fig. 4



INVENTORS:
ERWIN BURNS
HARRY P. WICKERSHAM

BY James M. Abbett
ATTORNEY

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DRILLING SAFETY JOINT

Erwin Burns and Harry P. Wickersham, Los Angeles, Calif., assignors of one-third to Lawrence P. Baash, Los Angeles, Calif.

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5 Claims. (Cl. 255—28)

This invention relates to well drilling tools and particularly pertains to a drilling safety joint.

In the drilling of oil wells it sometimes occurs that a lower length of drill string and the tool carried thereby may become fastened accidentally within the well. Under such conditions it is necessary to attempt to dislodge the fastened members and when this is not possible to thereafter attempt to disconnect a portion of the drill string so that the unscrewed length of drill pipe may be recovered. In the event that an attempt is made to unscrew the drill string at some joint in its length or to rotate the drill string in a counterclockwise direction the drill string will separate at the coupling which offers the least resistance to an unscrewing motion. It will be recognized that such an operation is not satisfactory since the length of drill string removed will be determined by accident rather than in a predetermined manner. It is common practice therefore to provide a jointed connection at a predetermined point in the length of the drill string which connection will hold the drill string assembled when rotating in a clockwise direction, but which will release and allow separation of the drill string at that point to take place when rotated in a counterclockwise direction. Such devices are commonly called safety joints. These structures for the most part will not permit a positive counter rotation of the drill string to be made without disconnecting the parts of the safety joint, although under some conditions this would be quite desirable. It is the object of the present invention therefore to provide a safety joint, the parts of which are normally locked against separation by rotation in either direction, and which joint may be optionally controlled by manipulation of the drill string to release its parts from positive engagement and to permit counter rotation of the upper end of the drill string to separate the locking parts of the joint.

The present invention contemplates the provsion of two tubular sections interposed in the line of a drill string, and which sections interlock with each other through an intermediate member splined to one of the sections and threaded to the other, said tubular sections having a positive locking connection holding the sections against relative rotation in either direction, and one of said tubular sections having a positive driving connection with the intermediate section in a clockwise direction.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a fragmentary view in elevation showing a section of drill string with the safety joint of the present invention interposed between lengths thereof.

Fig. 2 is an enlarged view in longitudinal section and elevation with parts broken away to disclose the operative elements of the safety joint with which the present invention is concerned.

Fig. 3 is a view in transverse section through the safety joint as seen on the line 3—3 of Fig. 2, and shows the splined connection between the interconnecting member and one of the tubular members, as well as indicates the relative position of the positive locking means.

Fig. 4 is a view in transverse section as seen on the line 4—4 of Fig. 2 and as showing the interrupted thread.

Referring more particularly to the drawing 10 indicates an upper section of drill string. 11 indicates a lower section of drill string, the upper section being provided with a coupling 12, which is connected with a sub 13 carried at the upper end of a safety joint structure generally indicated at 14. A coupling 15 connects the lower drill string section 11 and the safety joint. The safety joint 14 comprises three major elements, an upper tubular section 16, a lower tubular section 17, and an interconnecting section 18. The upper tubular section is internally threaded at its upper end to receive the sub 13. It has a main central bore 19 terminating intermediate the length of the tubular section by a shoulder 20 from which a bore 21 of reduced section continues through the upper tubular member. Extending downwardly from opposite sides of the upper tubular member 16 and projecting from the lower edge thereof are a pair of J-shaped hooks 22 which have longitudinally extending leg portions 23, a laterally extending portion 24, and an upturned hooked end 25. These members project from the bottom of the upper tubular member 16 and extend into recesses 26 which are formed in the circumferential side face of the lower tubular member 17. These recesses have an entering throat of a width in excess of the overall width of the J hooks 22, and in the upper wall of each of the recesses is a downwardly extending lug 27 around which the hooked end 25 of a hook 22 extends, and by which it is engaged. The depth of the recess 26 is such as to permit the upturned hooked end 25 of a hook 22 to be moved downwardly a sufficient distance to clear the lug 27 and to permit the hooks to be rotated in a counterclockwise direction when it is desired to release the upper tubular member and lower tubular member from their positive en-

gagement with each other. When the hooks 22 are in positive engagement with the lug 27 carried upon the lower tubular member 17 a space will occur between the contiguous ends of the two tubular members. This space is partially occupied by a collar 28 formed around the body of the interconnecting member 18 at a point intermediate its ends. The under face of the collar 28 is formed with inclined faces 29 terminating in longitudinally disposed shoulders 30 while similar faces and shoulders 29' and 30' are formed on the upper end of the lower tubular member 17. The inclination of the faces 29 and 29' are so disposed as to cause the shoulders to insure an initiatory rotation of the upper tubular member 16 and the lower tubular member 17 when a rotational movement in a clockwise direction is imparted to the upper tubular member 16. Longitudinally extending slots 31 are formed across the outer face of the collar portion 28 to accommodate the longitudinally extending portions 23 of the hooks 22. This will tend to prevent relative rotation between the upper tubular member 16 and the interconnecting member 18, although additional means are provided for this purpose which includes splines 32 which connect the upper extending portion of the member 18 with the upper tubular member 16, for positive rotation and longitudinal sliding movement. The upper end of the interconnecting member 18 is cylindrical and tubular, having a central fluid circulating passageway 33 therethrough. Carried at the upper end of the member 18 is a packing nut 34 around the body of which suitable packing material 35 is placed to form a fluid seal between the wall of the bore 19 in the upper tubular member 16 and the interconnecting member 18. By this means the upper tubular member 16 may reciprocate upon the upper end of the interconnecting member 18 a distance as represented by the space 35' between the lower face of the tubular member 16 and the upper face of the collar 28. The downward movement of the interconnecting member 18 with relation to the tubular member 16 is limited by engagement of the nut 34 with the shoulder 20 within the member 16. Normally the nut 34 is held in this seated position by the expansive action of a coil spring 36 which is interposed between the end face of the nut 34 and the end face of sub 13. The end portion of the interconnecting member 18 which occurs below the collar 28 is cylindrical and is formed with a continuation of the central fluid circulating passageway 33. The lower end of the passageway 33 is formed with an enlarged counterbore 37 which receives a wash pipe 38 threaded into the end of the lower tubular member 17 and communicating with a downwardly extending fluid passageway 39. This wash pipe fits the counterbore 37 with a sliding fit and is further packed with a packing 40 held by a packing gland 41 to prevent leakage of fluid into the safety joint and therethrough.

The lower tubular member 17 is formed with mutilated thread sections 42 which are arranged lengthwise within bore 43 of the lower tubular section 17. Complementary mutilated thread sections 44 are formed lengthwise of the outer cylindrical face of the interconnecting member 18. Spaces 45 will occur between the ends of the threaded members as shown in Fig. 4 of the drawing so that when the interconnecting member is turned a quarter of a turn the thread sections 42 and 44 will move from their meshing positions and will permit the lower tubular section and the interconnecting section to bodily move lengthwise as the parts of the safety joint are released and separated.

In operation of the present invention the safety joint is assembled as shown particularly in Figs. 1 and 2 of the drawing. Here it will be seen that normally the J-shaped hooks 22 will fit within the recesses 26 with the hooked ends 25 of the members 22 positively hooked over and engaging the lug 27 in the recesses. Thus the tubular members will be held by the members 22 and 27 in a locked position since expansion spring 36 will exert a force tending to separate the two tubular elements and keep the hooks 22 in locked relation to the lug 27. At the same time the threads 42 of the lower tubular member and the threads 44 carried by the interconnecting member will be in mesh to hold the lower tubular member 17 and the interconnecting member 18 in positive connection with each other.

In the event that the portion of the drill string occurring below the safety joint or the tools carried thereby should become fastened in the well reverse rotation may be imparted to the safety joint and the lower section of the drill string due to the fact that the J-hooks 22 positively engage the lug 27 of the recesses 26. It will be understood that during this operation at least part of the weight of the drill string is being supported from the derrick. When, however, it is desired to disconnect the J-hooks 22 from the members 27 the weight of the drill string is released from its support, or at least sufficiently released, so that it will overcome the expansive action of spring 36 and allow the member 25 of each of the hooks 22 to clear the lugs 27, after which the upper tubular member 16 and the interconnecting member 18 may be rotated in a counterclockwise direction so that the shoulders 30 and 30' will move apart, and so that when the hooked end 25 of the J-hooks 22 have moved to a position of clearance with relation to the lugs 27 the threads 42 and 44 will be out of engagement and it will be possible to directly raise the upper drill string section with the upper tubular mandrel and the interconnecting member 18.

It will thus be seen that by the structure here shown it is possible to temporarily connect sections of drill string in a manner to insure that said sections may be positively rotated in unison in clockwise and counterclockwise directions, and that by manipulation of the upper end of the drill string it will be possible to quickly release the safety joint sections and remove the upper drill string section with its associated safety joint parts.

In order to facilitate in the assembly of the members 16 and 17 and the lock hook 22 with the lug 27, it may be desirable to cut recesses 28' in the shoulder 28. These recesses will, of course, be wide enough to accommodate the hooks 22 at their widest parts.

While we have shown the preferred form of our invention, as now known to us, it will be understood that various changes might be made in the combination, construction, and arrangement of parts, by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A drilling safety joint comprising a pair of tubular members disposed in longitudinal alignment with each other, an intermediate section splined for limited longitudinal movement within one of the tubular sections and having a

threaded connection with the other of said tubular sections, yieldable means maintaining the splined portion of the intermediate section in its outermost position, and means carried at contiguous ends of the tubular sections for interlocking said sections to produce rotation of the sections in unison and whereby relative longitudinal movement of the sections against the action of the yielding means will permit the sections to be released from their interlocking engagement.

2. A drilling safety joint comprising a pair of tubular members disposed in longitudinal alignment with each other, an intermediate section splined for limited longitudinal movement within one of the tubular sections and having a threaded connection with the other of said tubular sections, yieldable means maintaining the splined portion of the intermediate section in its outermost position, and means carried at contiguous ends of the tubular sections for interlocking said sections to produce rotation of the sections in unison and whereby relative longitudinal movement of the sections against the action of the yielding means will permit the sections to be released from their interlocking engagement, and whereby subsequent counter-rotation of the two sections will cause the threaded connection between the intermediate section and the tubular section to be unscrewed and the tubular sections of the safety joint completely separated.

3. A drilling safety joint comprising a pair of tubular sections disposed in longitudinal alignment, hook-shaped locking means carried by one of said sections, complementary locking members carried by the other of said sections whereby the sections may be locked against rotation with relation to each other in either direction, and whereby longitudinal movement and subsequent rotation of the sections with relation to each other will bring the hooks and lock means into and out of their interlocking engagement.

4. A drilling safety joint comprising a pair of tubular sections disposed in longitudinal alignment, hook-shaped locking means carried by one of said sections, complementary locking members carried by the other of said sections whereby the sections may be locked against rotation with relation to each other in either direction, and whereby longitudinal movement and subsequent rotation of the sections with relation to each other will bring the hooks and lock means into and out of their interlocking engagement, and yieldable means acting to maintain said interlocking members in their engaged positions.

5. A drilling safety joint comprising a pair of tubular sections disposed in longitudinal alignment, hook-shaped locking means carried by one of said sections, complementary locking members carried by the other of said sections whereby the sections may be locked against rotation with relation to each other in either direction, and whereby longitudinal movement and subsequent rotation of the sections with relation to each other will bring the hooks and lock means into and out of their interlocking engagement, an intermediate section splined to the upper tubular section for limited longitudinal movement relative thereto and having a threaded connection with the lower tubular section, and means between the intermediate section and the lower tubular section for positively locking the sections against relative movement in a clockwise direction and for permitting the sections to be directly unscrewed by counterclockwise rotation when the hook locking means has been released.

ERWIN BURNS.
HARRY P. WICKERSHAM.