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H. P. WICKERSHAM ET AL

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LOCKED SAFETY JOINT

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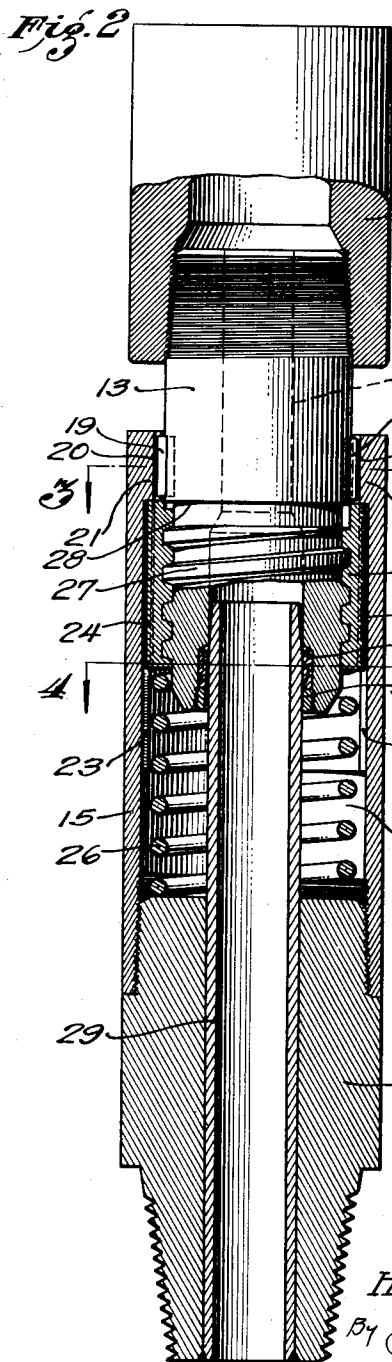
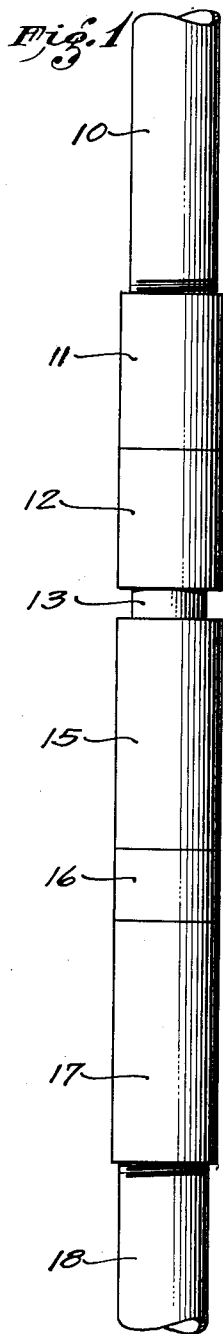


Fig. 3

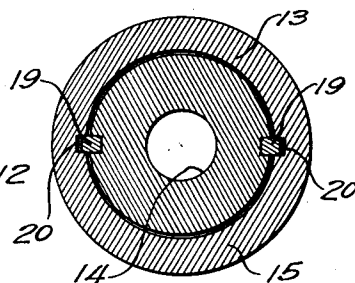


Fig. 4

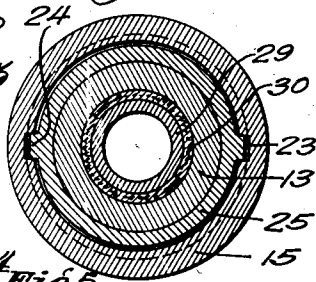
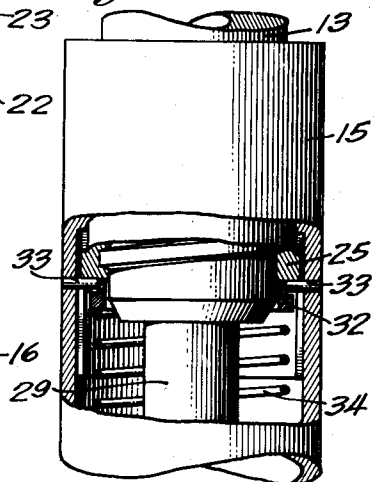


Fig. 5



INVENTORS:

HARRY P WICKERSHAM
HARLEY J CRAIG

By *James M. Abbott*
ATTORNEY

UNITED STATES PATENT OFFICE

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LOCKED SAFETY JOINT

Harry P. Wickersham and Harley J. Craig,
Los Angeles, Calif.

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10 Claims. (Cl. 255—28)

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

In the drilling of oil wells it is the usual practice to provide emergency means to insure that in the event the drill string and the tool carried thereby for any reason become fastened in the hole being drilled it will be possible to cause actuation of the emergency means to release the portion of the drill string below said means by counter rotation of the drill string so that the portion of the drill string above the point of release may be readily removed. In devices of this type, commonly known as safety joints, the construction usually contemplates that when the drill string and the joint are rotated in a clockwise direction the joint will remain fastened, and that when it is rotated in a counterclockwise direction the parts of the joint may be released and separated. In some instances it is highly desirable to maintain the safety joint in a locked condition, even upon counter rotation until it is desired to bring about a release, since such counter rotation might facilitate the loosening or dislodging of the fastened portion of the drill string and its tool, and it is the principal object of the present invention to provide a safety joint for use in well drilling operations which joint is positively locked against separation by rotation in clockwise or counterclockwise direction until its release is desired by the operator who may then manipulate the drill string to cause the parts of the safety joint to assume positions with relation to each other which will allow them to separate upon counterrotation of the upper drill string section.

The present invention contemplates the provision of a mandrel element carried on one section of the drill string, and a tubular element carried on the other section of the drill string, said elements being connected by an intermediate internally threaded sleeve carried upon the mandrel and splined to the tubular member.

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

Figure 1 is a fragmentary view in section and elevation showing the safety joint attached to the drill string section.

Fig. 2 is an enlarged view in section and elevation showing the operative elements of the safety joint.

Fig. 3 is a view in transverse section through the safety joint as seen on the line 3—3 of Fig. 2 showing the locking splines.

Fig. 4 is a view in transverse section through

the safety joint as seen on the line 4—4 of Fig. 2, showing the engagement of the locking sleeve with the tubular member.

Fig. 5 is a fragmentary view in section and elevation showing another form of the present invention adapted to be released by a shear pin.

Referring more particularly to the drawing 10 indicates an upper drill string section fitted with a coupling 11 and a top sub 12. Threaded into the top sub 12 is a cylindrical mandrel 13 which is formed with a fluid passageway 14 through its center, the mandrel projecting into the tubular member 15 of the safety joint. The tubular member 15 is connected with a lower sub 16 which in turn is suitably fitted with a coupling 17 and a lower drill stem section 18. It is desirable that the mandrel 13 and the sleeve 15 be normally held against rotation with relation to each other in clockwise and counterclockwise directions. This is brought about in the present case by locking splines 19 which project from sides of the mandrel 13 and mesh normally with keyways 20 cut in the inner circumferential face of the tubular member 15. The length of the splines 19 agree substantially with the width of an internal shoulder 21 longitudinally through which the keyways 20 are cut. Below the shoulder 21 within the tubular member 15 is an enlarged bore 22. This bore is formed with longitudinally extending keyways 23 into which keys 24 carried by a lock sleeve 25 slide. The lock sleeve 25 is free to reciprocate within the bore 22 of the tubular member 15. It is held, however, in its uppermost position against the under face of the annular shoulder 21 by an expansion spring 26 which is disposed between the lower end face of the locking sleeve 25 and the upper face of sub 16. The length of the keyways 23 are such as to permit longitudinal shifting motion of the locking sleeve 25 within the tubular member 15, as will be hereinafter described. The amount of this shifting motion will be limited by the space which occurs between the end face of the tubular member 15 and the end face of the sub 12. The locking sleeve is internally threaded and receives the threaded length 27 of the mandrel 13. This mandrel is formed with a shoulder 28 above its threaded portion so that downward screwing of the mandrel into the locking sleeve will be limited. The mandrel 13 carries a wash pipe 29 which fits within a central passageway 14 of the mandrel and is packed by a suitable packing 30 and a packing gland 31. The lower end of the mandrel is welded into the lower sub 16 and its upper

end reciprocates through the packing and into the passageway 14 as relative motion takes place between the wash pipe and the mandrel.

Referring more particularly to Fig. 5 of the drawing, it will be seen the mandrel 13, the tubular member 15, and the lock sleeve 25 are the same as previously described, with the exception, however, that at the lower end of the lock sleeve 25 a washer 32 is carried. This washer is here shown as of angle section. Interposed between the flange portion of the washer 32 and the end of the lock sleeve 25 is a series of radially extending shear pins 33 which are held by the wall of the tubular member 15 through which they extend, and the inner ends of which stand in an obstructing position with relation to the lock sleeve 25 until sufficient force has been applied upon the lock sleeve 25 by the mandrel 13 to shear the pins, and allow disengagement of the splines 19 from their keyways 20 to take place. A relatively light spring 34 is used in the structure shown in Fig. 5 instead of the heavy spring 26 previously described. This light spring tends to hold the washer 32 in position.

In operation of the present invention the safety joint is assembled as shown in Fig. 2 of the drawing, and as lowered into the hole the spring 26 will maintain the tubular member 15 in its lowermost position with relation to the mandrel 13 and will also maintain the splines 19 in mesh with the keyways 20. In the event that the portion of the drill string 18 is in any manner caught in the hole the entire drill string may be rotated in a clockwise or counterclockwise direction and tension may be imposed upon the drill string tending to dislodge it. If this is not possible the tension is released from the drill string and a sufficient amount of the drill string weight is imposed upon the mandrel 13 to move the mandrel downwardly with relation to the relatively stationary tubular section 15. This downward movement is in opposition to the expansion of the spring 26 and continues until the upper ends of the splines 19 have cleared the lower face of the shoulder 21. Simultaneously with this downward movement the lock sleeve 25 will slide downwardly within the tubular member 15, it being held against rotation by the action of the splines 23 and the keyways 24. After the locking splines 19 have moved to a point lower than the shoulder 21 and are therefore disengaged from their respective keyways a counter-rotation of the upper drill string section 10 may be made. This will cause the screw 27 of the mandrel 13 to become unthreaded from the threaded portion of the locking sleeve 25. The sleeve 25 will be forced longitudinally within the tubular member 15 and along the keyways 24 against the increasing tension of the spring 26. When these parts have become completely disengaged the splines 19 are moved to register with the keyways 20 and the upper drill string section is lifted. This will draw the splines 19 longitudinally through the keyways 20 and will permit the mandrel 13 to be completely retracted from the tubular member 15.

In the form of the invention shown in Fig. 5 the downward movement of the mandrel will act to force the lock sleeve 25 downwardly and will therefore shear the pins 33 after which counter-rotation of the mandrel will produce an unscrewing action between the threaded portion 27 of the mandrel and the internal threads of the lock sleeve 25.

In both of these devices it will be seen that the mandrels will be positively locked with relation

to the tubular sections 15 until optionally released, and that the safety joint embodying these features is simple in construction, being composed of a minimum number of moving parts adapted to be directly and optionally controlled to maintain the safety joint in a locked condition, or to permit it to become unlocked and its parts separated by a direct and continuous rotation.

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 safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping into the sleeve, a lock sleeve slidably mounted within the tubular sleeve and splined thereto for limited longitudinal movement, and a threaded connection between the mandrel and the lock sleeve whereby the parts of the joint may be held in assembled relation to each other.

2. A safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping into the sleeve, a lock sleeve slidably mounted within the tubular sleeve and splined thereto for limited longitudinal movement, a threaded connection between the mandrel and the lock sleeve whereby the parts of the joint may be held in assembled relation to each other, and means for temporarily and positively locking the mandrel and the tubular sleeve against rotation.

3. A safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping into the sleeve, a lock sleeve slidably mounted within the tubular sleeve and splined thereto for limited longitudinal movement, a threaded connection between the mandrel and the lock sleeve whereby the parts of the joint may be held in assembled relation to each other, means for temporarily and positively locking the mandrel and the tubular sleeve against rotation, and means temporarily holding said positively locking means in their locked position.

4. A safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping into the sleeve, a lock sleeve slidably mounted within the tubular sleeve and splined thereto for limited longitudinal movement, a threaded connection between the mandrel and the lock sleeve whereby the parts of the joint may be held in assembled relation to each other, means for temporarily and positively locking the mandrel and the tubular sleeve against rotation, and means temporarily holding said positively locking means in their locked position, said means including a spring acting between the tubular sleeve and the lock sleeve.

5. A safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping thereinto, a lock sleeve mounted within the tubular sleeve and splined thereto for longitudinal sliding movement, yieldable means holding said lock sleeve in its outermost position with relation to said tubular sleeve and permitting the lock sleeve to be unscrewed from the

mandrel as the mandrel is rotated in a counter-direction.

5 6. A safety joint comprising a tubular sleeve carried by one section of drill string, a mandrel carried by another section of drill string and telescoping thereinto, a lock sleeve mounted within the tubular sleeve and splined thereto for longitudinal sliding movement, yieldable means holding said lock sleeve in its outermost position with relation to said tubular sleeve and permitting the lock sleeve to be unscrewed from the mandrel as the mandrel is rotated in a counterdirection, and releasable means positively interlocking the mandrel with the tubular sleeve to insure rotation of the mandrel and the sleeve in unison.

15 7. A safety joint comprising a tubular sleeve carried upon one section of a drill string, a lock sleeve disposed within the tubular sleeve and splined for longitudinal movement therein, a shoulder limiting the movement in one direction, a spring resisting movement in the other direction, a mandrel carried by another section of drill string and threaded into said lock sleeve, whereby the mandrel and lock sleeve may reciprocate in unison within the tubular sleeve between the said shoulder and against the resistance of said spring.

20 8. A safety joint comprising a tubular sleeve carried upon one section of a drill string, a lock sleeve disposed within the tubular sleeve and splined for longitudinal movement therein, a shoulder limiting the movement in one direction, a spring resisting movement in the other direction, a mandrel carried by another section of drill string and threaded into said lock sleeve, whereby the mandrel and lock sleeve may reciprocate in unison within the tubular sleeve between the said shoulder and against the resistance of said spring, said spring yieldably resisting an unscrewing motion of the lock sleeve with relation to the mandrel.

9. A safety joint comprising a tubular sleeve carried upon one section of a drill string, a lock sleeve disposed within the tubular sleeve and splined for longitudinal movement therein, a shoulder limiting the movement in one direction, a spring resisting movement in the other direction, a mandrel carried by another section of drill string and threaded into said lock sleeve, whereby the mandrel and lock sleeve may reciprocate in unison within the tubular sleeve between the said shoulder and against the resistance of said spring, said spring yieldably resisting an unscrewing motion of the lock sleeve with relation to the mandrel, the splined connection between the mandrel and the tubular sleeve acting to hold the mandrel and the sleeve in a temporarily locked position with relation to each other for rotational movement in unison.

10. A safety joint comprising a tubular sleeve carried upon one section of drill string, a lock sleeve disposed within the tubular sleeve and splined for longitudinal sliding movement therein, a shoulder limiting the outward movement of the lock sleeve with relation to the tubular sleeve, a mandrel carried by another section of drill string and threaded into said lock sleeve whereby the mandrel and the lock sleeve may reciprocate in unison within the tubular sleeve, spring means yieldably resisting said reciprocation in a downward direction, and yieldably resisting an unscrewing motion of the lock sleeve with relation to the mandrel, and a splined connection between the mandrel and the tubular sleeve whereby the mandrel and the sleeve may be held in a temporarily locked position with relation to each other for rotational movement in unison and will be released with relation to each other when the mandrel telescopes into the tubular sleeve.

HARLEY J. CRAIG.
HARRY P. WICKERSHAM.