May 5, 1936. H. P. WICKERSHAM ET AL. 2,039,945

LOCKED DRILLING SAFETY JOINT

Filed July 1, 1935

Fig. 1

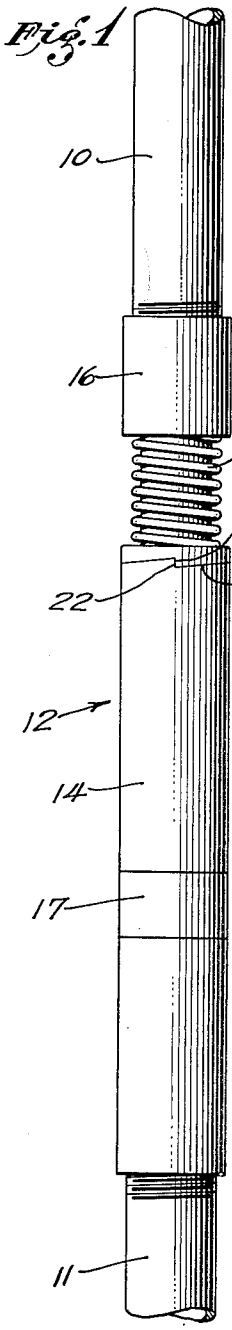



Fig. 2

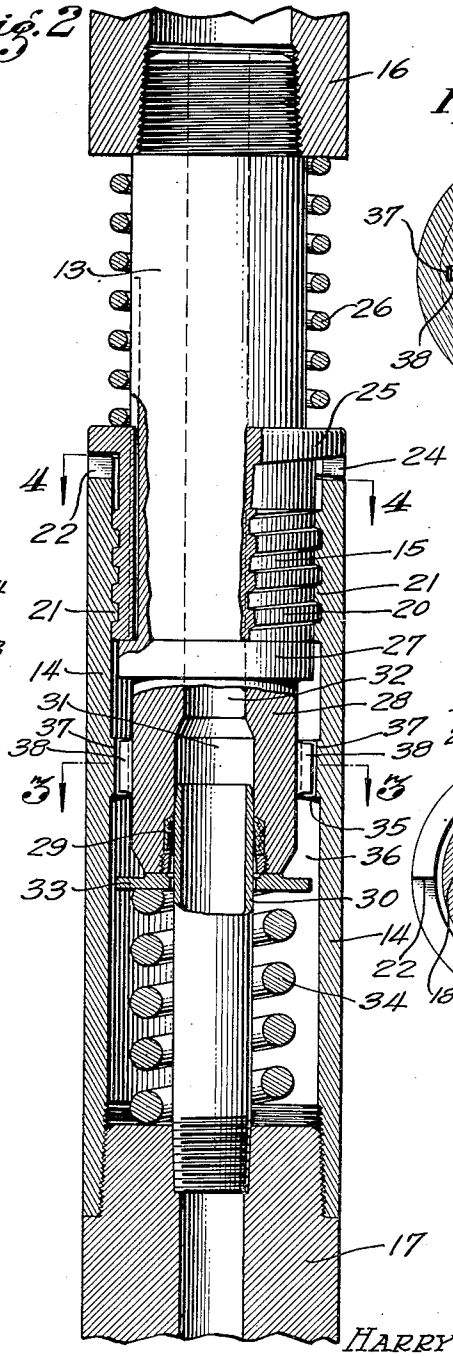



Fig. 3

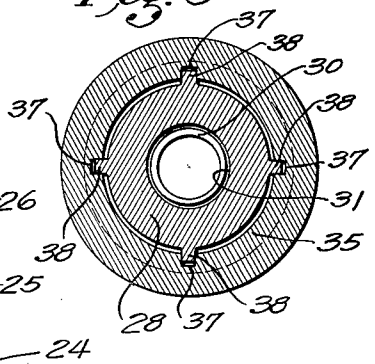
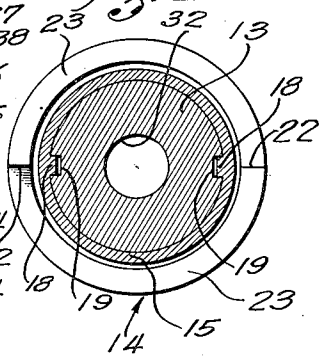



Fig. 4

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2,039,945

## LOCKED DRILLING SAFETY JOINT

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10 Claims. (Cl. 255—28)

This invention relates to well drilling tools and particularly pertains to a drilling safety joint characterized as being positively locked.

In oil well drilling safety joints are used which comprise members adapted to be interlocked and interposed at a point in the length of a drill string, and which structures make it possible for the drill string sections to be separated in case of emergency. Various types of safety joints have been provided, some of them being quite complicated in construction, and most of them acting to lock the parts of the safety joint against rotation and separation only when the drill string is rotated in a clockwise direction. In view of the fact that a safety joint is required for emergency purposes when a lower drill string section becomes fastened in the hole, it is desirable that the joint be capable of manipulation to exert tension upon the fastened portion of the drill string and to exert counterclockwise torque, as well as rotation in a clockwise direction, and it is the principal object of the present invention to provide a safety joint which is simple in construction, positive in its locking action in both directions of its rotation, and which may be readily released at the option of the operator to permit the parts of the joint to be unscrewed and separated.

The present invention contemplates the provision of a safety joint comprising a box section and a pin section which telescope one within the other, and between which is interposed interlocking means tending to prevent separation of the pin and the box, and other means to lock the three members together against relative rotation except as the safety joint is manipulated by the upper drill string section.

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

Figure 1 is a fragmentary view in elevation showing the safety joint and the drill string sections connected above and below the same.

Fig. 2 is an enlarged view in central longitudinal section with parts broken away showing the structural details 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, and shows the positive locking members.

Fig. 4 is a view in section and elevation taken along the line 4—4 of Fig. 2, to show one of the clockwise rotating locking members.

Referring more particularly to the drawing, 10 indicates an upper drill string section. 11 indicates a lower drill string section, and 12 indicates an interposed safety joint. The safety joint includes a pin 13, a box 14, and a threaded locking sleeve 15. The pin 13 is threaded at its upper end to engage a coupling 16 carried by the upper drill string section 10. The box 14 is threaded at its lower end to engage a bottom sub 17 carried by the lower drill string section 11. The pin 13 telescopes into the box 14 and may be removed therefrom. Slidably mounted upon the pin 13 is the locking sleeve 15. This sleeve is fitted with splines 18 which extend longitudinally of the inner bore of the sleeve and into keyways 19 formed in the face of the pin 13. Thus the pin 13 and the lock sleeve 15 will have positive rotational engagement at all times while being capable of relative longitudinal movement. The body portion of the sleeve 15 is formed with external threads 20 which engage threads 21 cut in the inner face of the box 14 and adjacent the upper end thereof. The upper edge face of the box 14 is formed with a plurality of longitudinally extending shoulders 22 which have inclined back faces 23. These shoulders mesh with similar shoulders 24 formed upon a flange 25 at the upper end of the lock sleeve 15. The shoulders 22 and 24, and their corresponding inclined faces, are so designed as to insure that when the pin 13 is rotated in a clockwise direction the shoulders will be engaged and the pin 13 will drive the box 14 in unison therewith. The inclined faces are of the same pitch as the threads 20 and insure that upon counter rotation of the pin 13, while the box 14 is held stationary, the shoulders will move away from each other in a direct rotational movement. These shoulders when abutting prevent the threads from tightening. The lock sleeve 15 with its shoulder 25 is yieldably held in its lowermost position by a spring 26, which circumscribes the pin 13, and is interposed between the top sub 16 and the flange 25 of the lock sleeve. Downward longitudinal movement of the lock sleeve 15 upon the pin 13 is limited by an annular shoulder 27 formed around the pin 13 at a point intermediate its length. A portion 28 of the pin 13 extends downwardly beyond the shoulder 27, and is provided with a packing gland 29 to receive the upper end of a wash pipe 30 which is free to reciprocate within a counterbore 31 formed centrally of the pin 33 as a continuation of the fluid circulation passageway 32 which is formed through the pin. The lower end of the wash pipe 30 is fixed within the bottom sub 17. A washer 33 abuts against the lower end of the pin 13 and circumscribes the wash pipe 30. A relatively heavy coil spring 34 is interposed between the shoulder 33 and the upper face of the

bottom sub 17. This spring is designed to yieldably resist downward movement of the pin 13 except when optionally brought about at the will of the operator. Formed within the box 14 at a point below the threaded section 21 is an annular flange 35 which circumscribes the inner wall of the bore 36 of the box. At points in the circumference of this flange longitudinal keyways 37 are cut. These keyways carry splines 38 which project radially from the circumferential face of the section 28 of the pin 13. The splines are maintained in mesh by the action of the springs 26 and 34 and may be moved out of their meshing position under certain conditions.

In operation of the present invention the safety joint is assembled and installed between sections of a drill string, as shown in Fig. 1 of the drawing. In this position the sleeve 15 will be screwed in place so that the longitudinal shoulders 22 and 24 will be abutting. The pin 13 will be drawn with its collar 27 against the bottom face of the lock sleeve 15 and with its splines 38 in mesh with the keyways 37 of the box 14. Under such conditions the spring 34 will be under a predetermined degree of compression. It will be seen that so long as the pin 13 rotates in a clockwise direction there will be driving engagement between the shoulders 22 and 24 on the contiguous faces of the box 14 and the upper flange 25, and that in addition a positive driving action will occur between the splines 38 and the keyways 37. When, however, a counter clockwise rotation of the pin 13 takes place the continued engagement of the splines 38 and the keyways 37 will act to drive the pin and the box in unison in a counterclockwise direction. This will also insure that the relationship of the lock sleeve 15 and the box will remain unchanged. When it is desired to separate the parts of the safety joint additional weight is imposed by the upper drill string section sufficient to overcome the expansive action of the spring 34. This will move the splines 38 downwardly and out of register with the keyways 37. When this has been accomplished the upper drill string section 10, and the pin 13 may be rotated in a counterclockwise direction, the result being that the lock sleeve 15 also will rotate in a counterclockwise direction to unscrew it from the threads 21 of the box 14. The unscrewing action will produce an upward movement of the lock sleeve 15 with relation to the box and the mandrel and against the expansive action of spring 26. The initial counter-clockwise rotation of the lock sleeve 15 will move the shoulders 22 and 24 out of engagement with each other, and since the inclined back faces of these shoulders are at the same inclination as the pitch of the thread on the sleeve, the sleeve may be directly and continuously unscrewed until it has been completely disengaged from the box 14. After this operation has been completed the splines 38 may be placed in mesh with the keyways 37 and thereafter the pin 13 may be bodily withdrawn from the box and will carry the lock sleeve 15 with it.

Attention is directed to the fact that the spring 26 has a particular function especially when it is desired to separate and reassemble the safety joint when in the well. This function is that the spring 26 always tends to hold the sleeve 15 in its lowermost position with regard to the box 14. The spring 34 must be compressed in order to engage the threads 20 and 21. The spring 34 must be strong enough to support the weight of the drill string and only collapse under sufficient additional weight to disengage splines 38. If the spring 26 was not present between the members 15 and 16 it might not be possible to reengage the parts 14 and 15 and their threads 20 and 21.

It will thus be seen that the safety joint here shown will provide a yieldable and a positive lock for the joint sections when being driven in a clockwise direction, so that the parts of the structure will not be damaged due to the strain imposed upon it, and furthermore the safety joint parts will be positively locked against counter rotation and may be released by manipulation of the drill string at the will of the operator.

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 box member carried by one drill string section, a pin member carried by another drill string section and telescoping into the box, a lock sleeve splined upon the pin for longitudinal movement with relation thereto and having threaded engagement with the box, interengaging means between the pin and the box normally acting to hold the pin and the box against rotation with relation to each other, and yieldable means for permitting disengagement of said holding means and to allow the threaded connection between the lock sleeve and the box to be disengaged by rotation of the pin and the sleeve.

2. A safety joint comprising a box member carried by one drill string section, a pin member carried by another drill string section and telescoping into the box, a lock sleeve splined upon the pin for longitudinal movement with relation thereto and having threaded engagement with the box, interengaging means between the pin and the box normally acting to hold the pin and the box against rotation with relation to each other, means for yieldably holding said lock sleeve in its lowermost position on said pin, positive engaging means between the box and the sleeve in one direction of rotation of the pin, and yieldable means acting between said pin and said positive engaging means.

3. A safety joint comprising a tubular box threaded at its upper end, a lock sleeve in engagement with said threaded portion, positive engaging means between said sleeve and said box when the sleeve is rotated in one direction, a pin splined for longitudinal movement within said sleeve, and spring means acting to maintain the positive engagement of said sleeve and the box in one direction of rotation and for yieldably resisting movement of the sleeve with relation to the pin.

4. A safety joint comprising a tubular box threaded at its upper end, a lock sleeve in engagement with said threaded portion, positive engaging means between said sleeve and said box when the sleeve is rotated in one direction, a pin splined for longitudinal movement within said sleeve, spring means acting yieldably to urge the sleeve downwardly on the pin and for yieldably resisting longitudinal movement of the sleeve with relation to the pin as the sleeve unscrews from the box

upon a reverse rotation of the pin, and positive means temporarily interlocking the pin and the box against rotation and whereby said means may be released upon relative longitudinal movement between the pin and the box.

5. A safety joint comprising a tubular box threaded at its upper end, a lock sleeve in engagement with said threaded portion, positive engaging means between said sleeve and said box when the sleeve is rotated in one direction, a pin splined for longitudinal movement within said sleeve, spring means acting yieldably to maintain the sleeve in its lowermost position on the pin, positive means temporarily interlocking the pin and the box against rotation and whereby said means may be released upon relative longitudinal movement between the pin and the box, and means acting to yieldably hold said pin and box in said positively locked position.

6. A safety joint comprising a tubular box carried by one section of drill string, a pin carried by the other section of drill string and telescoping into the box, a lock sleeve splined for longitudinal movement upon the pin, a threaded connection between the lock screw and the box, positive means temporarily interlocking the pin with the box in either direction of rotation and whereby longitudinal movement of the pin and the box with relation to each other will release said positive connection and permit the threaded connection between the lock sleeve and the box to be unscrewed.

7. A safety joint comprising a tubular box carried by one section of drill string, a pin carried by the other section of drill string and telescoping into the box, a lock sleeve splined for longitudinal movement upon the pin, a threaded connection between the lock sleeve and the box, stop means limiting the tightening movement of the threaded connection between the lock screw and the box, positive means temporarily interlocking the pin with the box in either direction of rotation and whereby longitudinal movement of the pin and the box with relation to each other will release said positive connection and permit the threaded connection between the lock sleeve and the box to be unscrewed, and yieldable means normally maintaining the positive locking means in engagement with each other.

8. A safety joint comprising a tubular box carried by one section of drill string, a pin carried by the other section of drill string and telescoping into the box, a lock sleeve splined for longitudinal movement upon the pin, a threaded connection between the lock sleeve and the box, stop means limiting the tightening movement of the threaded connection between the lock screw and the box, positive means temporarily interlocking the pin with the box in either direction of rotation and whereby longitudinal movement of the pin and the box with relation to each other will release said positive connection and permit the threaded connection between the lock sleeve and the box to be unscrewed, the pin being formed with a central fluid circulation passageway therethrough, and a wash pipe in fixed association with the box and telescoping into said central passageway of the pin.

9. A safety joint comprising a tubular box carried by one section of drill string, a pin carried by another section of drill string and telescoping into said box, means temporarily interlocking said box and pin against rotation in either direction while allowing relative longitudinal movement of said box and pin, yielding means resisting telescopic action of the box and spring in one direction to release said interlocking means, and a sleeve having threaded engagement with said box and being splined upon said pin to positively resist relative longitudinal movement of the box and pin in the opposite direction, and complementary stop means on the box and pin to limit relative rotation of said members in one direction of rotation.

10. A safety joint comprising a tubular box carried by one section of drill string, a pin carried by another section of drill string and telescoping into said box, means temporarily interlocking said box and pin against rotation in either direction while allowing relative longitudinal movement of said box and pin, yielding means resisting telescopic action of the box and spring in one direction to release said interlocking means, and a sleeve having threaded engagement with said box and being splined upon said pin to positively resist relative longitudinal movement of the box and pin in the opposite direction, and complementary stop means on the box and pin to limit relative rotation of said members in one direction of rotation, and means yieldably holding said sleeve at its lowermost position upon said pin.

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