

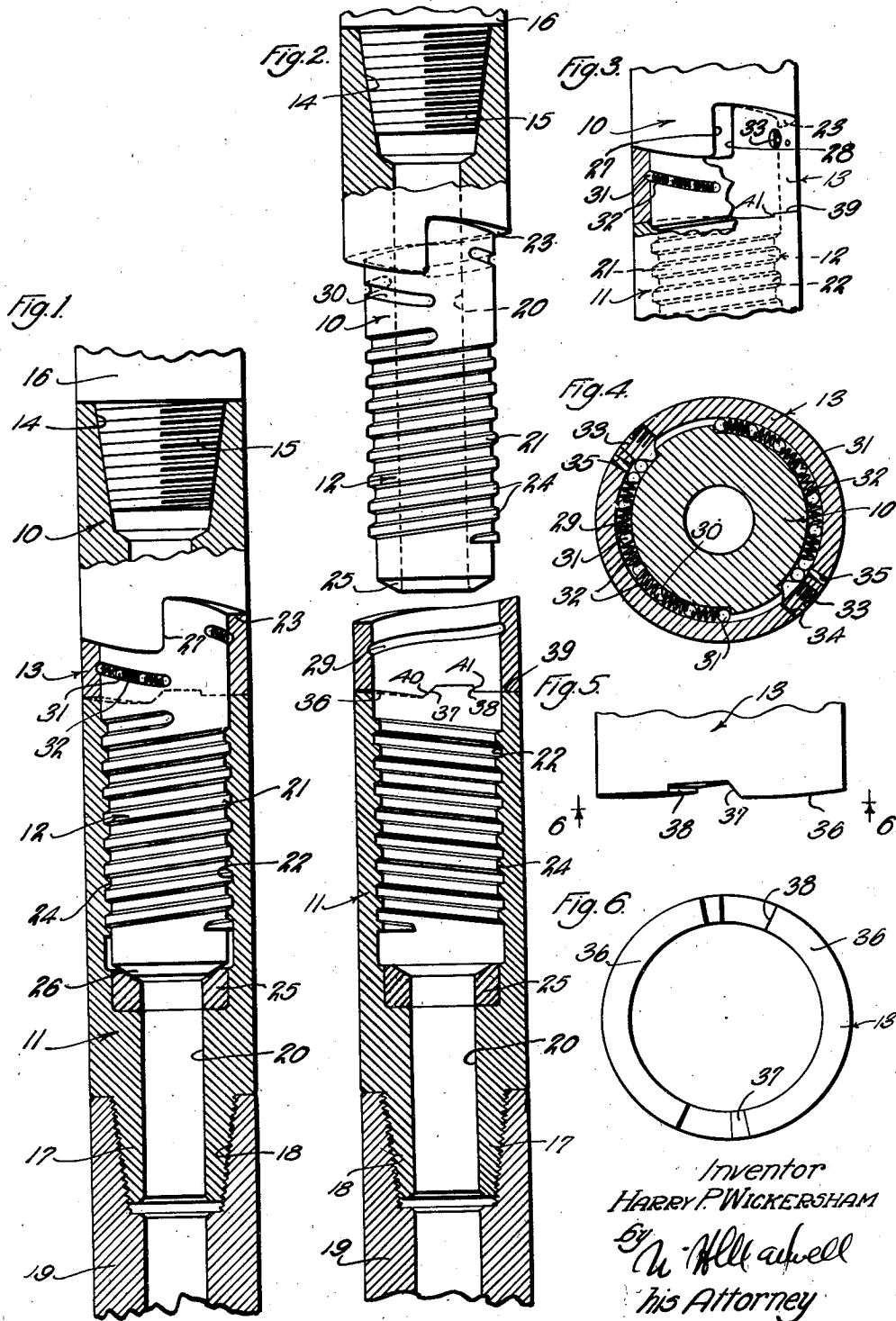
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SAFETY JOINT

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SAFETY JOINT

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This invention relates to a connection or joint for connecting two members and relates more particularly to a releasable safety joint adapted to connect two parts of a string of drill pipe, or the like. It is a general object of the invention to provide a safety joint for use in a string of drill pipe, or the like, that may be easily and quickly released.

During the course of drilling wells with the rotary method and while carrying on fishing operations the tool carried at the lower end of the operating string often becomes stuck so that the operating string and tool cannot be withdrawn from the well. It is common practice to insert a device known as a "safety joint" in an operating string to be released when the drilling tool or fishing tool carried by the string becomes stuck, so that the main upper portion of the operating string may be withdrawn from the well.

It is an object of the invention to provide a safety joint for use in a string of drill pipe, or the like, that effectively connects two parts of an operating string for rotation during normal operations and which may be released by rotation when desired.

It is another object of the invention to provide a safety joint that embodies two sections having a screw threaded connection and a sleeve mounted to engage between the sections to prevent setting or jamming of the threads of the said connection so that the connection may be readily released or disconnected when desired.

Another object of the invention is to provide a safety joint of the character mentioned in which the sleeve automatically is returned to a normal position out of engagement with one of the sections upon slight rotation of one section relative to the other when the threaded connection is being unthreaded or released.

It is a further object of the invention to provide a safety joint of the character mentioned that is simple in construction and is dependable in operation.

Other objects and features of the invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference

is had to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the joint provided by this invention showing the two sections in the fully connected position and illustrating the lower end of the upper section partially in elevation. Fig. 2 is a longitudinal detailed sectional view illustrating the two sections disconnected. Fig. 3 is a side elevation of a portion of the joint with part of the sleeve broken away. Fig. 4 is an enlarged transverse detailed sectional view taken through the registering helical grooves in the sleeve and pin of the joint. Fig. 5 is an enlarged side elevation of the lower portion of the sleeve, and Fig. 6 is a bottom plan view taken as indicated by line 6—6 on Fig. 5.

The safety joint provided by the present invention includes, generally, two sections 10 and 11 detachably connected by a screw threaded connection 12, and a sleeve 13 adapted to cooperate between the sections 10 and 11 to limit the threading together of the connection 12.

The sections 10 and 11 constitute an assembly adapted to be inserted in an operating string of drill pipe, or the like, and are adapted to be connected by the connection 12 to join two parts of an operating string. I will, for purpose of example, refer to the section 10 as the upper section and the section 11 as the lower section, it being understood that this relationship may be reversed without altering the function of the device. It is desirable to construct the sections 10 and 11 so that they may be inserted in a standard or common tool joint, that is, so that one of the sections is provided with means for connection with means for connection with the socket section of a tool joint. In the particular case illustrated a tapered screw threaded socket 14 is provided at the upper end of the upper section 10 to receive the tapered screw threaded pin 15 of a tool joint section 16, or the like. A screw threaded pin 17 may be provided at the lower end of the section 10 to thread into a socket 18 in the socket or box section 19 of a tool joint. The sections 10 and 11 are elongated cylin-

drical members and are preferably of the same external diameter. A fluid passage 20 extends longitudinally through the assembly of the sections 10 and 11.

5 The threaded connection 12 detachably connects the sections 10 and 11 so that they may be released by rotation of one section relative to the other. Throughout the present description where I use the terms "forward direction" and "rearward direction" it is to be understood that I mean in a forward
10 rotative direction relative to the normal rotation of the operating string in which the tool joint is employed and in a rearward rotative direction relative to the normal rotation of the string. The connection 12 between the sections 10 and 11 is such that the section 10 may be released from the section 11 upon relative rotation between the sections
15 in a rearward direction. In the preferred embodiment of the invention the connection 12 includes a screw threaded pin 21 projecting downwardly from the section 10 and adapted to thread into a socket 22 in the upper
20 end of the section 11. The pin 12 is of reduced diameter so that a downwardly facing shoulder 23 is provided on the section 10 at the upper end of the pin. The pin 21 and the walls of the socket 22 are provided with comparatively coarse heavy cooperating
25 threads 24. The threads 24 are pitched so that they are released or unthreaded upon rotation of one of the sections relative to the other in a rearward direction.

35 The fluid passage 20 extends longitudinally through the pin 21, and the invention provides means for sealing or packing between the lower end of the pin 21 and the bottom of the socket 22. An annular body 25 of packing
40 may be arranged in the bottom of the socket 22. A downwardly convergent extension 26 may be provided on the lower end of the pin 21 to compress and seal with the packing 25 when the sections 10 and 11 are in the
45 fully connected position.

The sleeve is mounted on the upper end portion of the pin 21 to engage between the shoulder 23 of the section 10 and the upper
50 end of the section 11 to limit the threading of the pin 21 into the socket 22. In accordance with the invention the upper end portion of the pin 21 is unthreaded or of plain cylindrical configuration to effectively carry the sleeve 13. The sleeve 13 is preferably of
55 the same external diameter as the sections 10 and 11. The shoulder 23 and the upper end of the sleeve 13 are inclined or helicoidally curved, and a longitudinally extending radial shoulder 27 is provided on the section 10,
60 which is normally spaced from a shoulder 28 on the sleeve 13. The shoulder 23 and the upper end of the sleeve 13 are spiraled or pitched in a left-hand direction and are adapted to cooperate or fit together. The
65 shoulder 27 of the section 10 faces rearward-

ly while the shoulder 28 faces forwardly so that they may abut when the sections are disconnected as will be hereinafter described.

In accordance with the invention the sleeve 13 is mounted on the pin 21 so that it is adapted to move on the pin 21 in a path parallel to the shoulder 23 and so that it is held against displacement from the pin. A helically curved groove 29 and is provided in the inner wall or interior of the sleeve 13, and the grooves 30 are provided in the pin 21 to register with the groove 29. There may be two grooves 30 provided in the pin 21. The grooves 30 are preferably comparatively long. The registering grooves 29 and 30 are provided to carry a plurality of balls 31. Helical compression springs 32 are interposed or arranged between the several balls 31 in each of the grooves 30. Set screws 33 may be threaded through openings 34 in the sleeve 13 to extend into the forward ends of the grooves 30. The several balls 31 and springs 32 may be arranged in the registering grooves 30 and 31 through the openings 34 before the set screws 33 are arranged in position. Openings 35 may be initially provided in the sleeve 13 adjacent the openings 34 to receive a suitable tool for engaging the assembly of springs and balls during their arrangement in the grooves so that a sufficient number of balls and springs may be arranged in the grooves to normally yieldingly urge the sleeve 13 to a position where its shoulder 28 engages the shoulder 27. The openings 35 may be closed or filled as desired. Upon rotation or movement of the sleeve 13 in a rearward direction relative to the pin 21, the springs 32 are compressed between the rear ends of the grooves 30 and the set screws 33.

The lower end of the sleeve 13 is adapted to engage, or abut the upper end of the section 11 and the helicoidal upper end of the sleeve 13 and the shoulder 23 are adapted to cooperate to force the lower end of the sleeve 13 into engagement with the upper end of the section 11 when the pin 21 is threaded into the socket 22 to limit the threading of the pin into the socket. In accordance with the invention the lower end of the sleeve 13 is formed with two inclined substantially helicoidal segments 36. The segments 36 are curved or spiraled in a right-hand direction or opposite to the shoulders 23 and the upper end of the sleeve 13 and terminate in substantially diametrically opposite forwardly facing shoulders 37. The shoulders 37 are beveled downwardly and rearwardly. Vertical or longitudinal rearwardly facing shoulders 38 are provided on the segment portions 36 at points spaced forwardly of the shoulders 37. The shoulders 38 are shorter than the shoulders 37. The upper end of the section 11 is provided with inclined or helicoidal portions 39 to engage the portions 36 of the sleeve and is provided with rearwardly fac-

ing beveled shoulders 40 to abut the shoulders 37 when the sections 10 and 11 are in the connected position. Short forwardly facing shoulders 41 are provided on the upper end of the section 11 to cooperate with the shoulders 38 of the sleeve.

To connect 10 and 11 the pin 21 is threaded into the socket 22, so that the parts are in the positions illustrated in Fig. 1 of the drawings. When the pin 21 has been fully threaded into the socket 22 the lower end or helicoidal portions 36 of the lower end of the sleeve 13 cooperate with the portions 39 of the upper end of the section 11 to wedge the sleeve against the shoulder 23 in a position where the shoulder 28 is spaced from the shoulder 27. The shoulder 23 and the upper end of the sleeve 13 cooperate to urge the sleeve downwardly so that the faces 36 and 39 are in engagement and the shoulders 37 and 40 are in abutment. The sleeve 13 is in this manner clamped between the sections 10 and 11 to positively limit rotation of the section 10 relative to the section 11 in a forward direction so that the sections 10 and 11 are effectively connected for rotation during normal drilling operations. During normal drilling operations, that is, when the operating string is rotated in the forward or clockwise direction, the torsional strain is transmitted from the section 10 to the sleeve 13 through the shoulder 23 and the upper end of the sleeve, and the torsional strain is transmitted from the sleeve 13 to the section 11 through the abutting shoulders 37 and 40, and the spiraled faces 38 and 39. When it is desired to release the joint, the upper section 10 is rotated in a rearward direction relative to the section 11. The parts are preferably proportioned so that the shoulders 27 and 28 are spaced apart, as illustrated throughout the drawings, so that the section 10 may be rotated rearwardly relative to the sleeve. For the purpose of example it may be assumed that the section 11 is held stationary while the section 10 is rotated in a rearward direction. The shoulders 38 and 41 engage to retain the sleeve 13 stationary relative to the section 11 at the start of rotation of the section 10 so that the springs 32 are compressed and the spiraled shoulder 23 moves upwardly out of engagement with the upper end of the sleeve. The threads 24 of the pin and socket are of comparatively heavy pitch and cause the section 10 to shift upwardly upon slight rotation of the section 10 relative to the section 11 in a rearward direction, so that the shoulders 38 and 41 are shifted out of engagement. Upon release of the shoulders 38 from the shoulders 41 the springs 32 operate to return the sleeve to its normal position or may shift the sleeve to a position where shoulders 27 and 28 are in engagement.

The shoulders 37 and 40 are related to the

pitch of the threads 24 so that they do not engage upon continued rotation of the section 10 in a rearward direction after the sleeve has returned to its normal position. The shoulders 38 and 41 are comparatively short so that slight rotation of the section 10 relative to the section 11 in a rearward direction causes the threads 24 to shift the section 10 upwardly sufficiently to disengage the shoulders 38 from the shoulders 41. After disengagement of the section 11 from the sleeve 13 the pin may be freely unthreaded from the socket 22. It is to be noted that the invention provides a safety joint wherein a sleeve is fitted between two sections to positively limit relative rotation of the sections in one direction so that they are effectively connected for rotation during normal operations and so that it is easily freed from the sections when the joint is released so that the sections may be easily disconnected.

Having described only a typical preferred form of my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A safety joint including, two sections, a screw threaded connection between the sections, and a sleeve having helicoidal parts at its opposite ends to engage correspondingly formed parts on the two sections.

2. A safety joint including, two sections, a screw threaded connection between the sections, and a sleeve having helicoidal parts at its opposite ends to engage correspondingly formed parts on the two sections, the said helicoidal parts at the opposite ends of the sleeve being spiraled in opposite directions.

3. A safety joint including, two sections, a screw threaded connection between the sections, a sleeve mounted on one section having an end with helicoidal parts to engage a shoulder on the said section, and having helicoidal parts on its opposite end to engage the other section.

4. A safety joint including, two sections, a screw threaded connection between the sections, a sleeve mounted on one section having an end with helicoidal parts to engage a shoulder on the said section, and having helicoidal parts on its opposite end to engage the other section, the helicoidal parts on the opposite ends of the sleeve being spiraled in opposite directions.

5. A safety joint including, two sections, a screw threaded releasable connection between the sections, a sleeve mounted on one section having helicoidal parts at its ends to engage correspondingly tapered parts on the sections, and means holding the sleeve against displacement from the said section.

6. A safety joint including, two sections,

a screw threaded releasable connection between the sections, a sleeve mounted on one section having helicoidal parts at its ends to engage correspondingly tapered parts on the sections, and means holding the sleeve against displacement from the said section including a ball carried in registering grooves in the sleeve and the said section.

7. A safety joint including, two sections, a screw threaded releasable connection between sections, a sleeve carried by one section to engage the other section when the sections are connected by the said connection, a helicoidal part on the first-mentioned section, a helicoidal part on the sleeve to cooperate with the helicoidal part on the section, a ball carried in registering grooves in the sleeve and the said first-mentioned section, the grooves extending parallel to the said helicoidal parts, and spring means in the grooves normally yieldingly urging the sleeve in a direction to maintain cooperative engagement of said helicoidal parts.

8. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection, and a ball carried in registering grooves in the sleeve and the first-mentioned section extending parallel to the said inclined parts.

9. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection, and cooperating inclined parts on the sleeve and the other section inclined in a direction opposite to the direction of inclination of the first-mentioned inclined parts.

10. A safety joint including, two sections, a releasable screw thread connection between the two sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection, and terminating in longitudinal shoulders, and a ball carried in registering grooves in the sleeve and the first-mentioned section extending parallel to the said inclined parts.

11. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction op-

posite to the threads of the said connection, and terminating in longitudinal shoulders, balls carried in registering grooves in the sleeve and the first-mentioned section, and springs in the grooves to normally yieldingly urge the sleeve to a position where the longitudinal shoulders are in engagement.

12. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection and terminating in longitudinal shoulders, and means for normally yieldingly urging the sleeve to a position where the shoulders are in abutment.

13. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection terminating in longitudinal shoulders, cooperating inclined parts on the sleeve and the other section inclined in a direction opposite to the direction of inclination of the first-mentioned inclined parts, oppositely facing shoulders on the said other section, and shoulders on the sleeve adapted to engage the said oppositely facing shoulders.

14. A safety joint including, two sections, a releasable screw thread connection between the sections, a sleeve carried by one section to engage the other section when the sections are connected by the connection, cooperating inclined parts on the sleeve and the first-mentioned section inclined in a direction opposite to the threads of the said connection terminating in longitudinal shoulders, cooperating inclined parts on the sleeve and the other section inclined in a direction opposite to the direction of inclination of the first-mentioned inclined parts, a shoulder on the said other section facing oppositely to the shoulder on the first-mentioned section, and a shoulder on the sleeve to engage the shoulder of the said other section.

In witness that I claim the foregoing I have hereunto subscribed my name this 26th day of August, 1930.

HARRY P. WICKERSHAM.