

June 3, 1941.

J. B. SHEMELEY

2,244,124

JOINT FOR DRILLING EQUIPMENT

Filed Feb. 10, 1940

3 Sheets-Sheet 1

Fig. 1

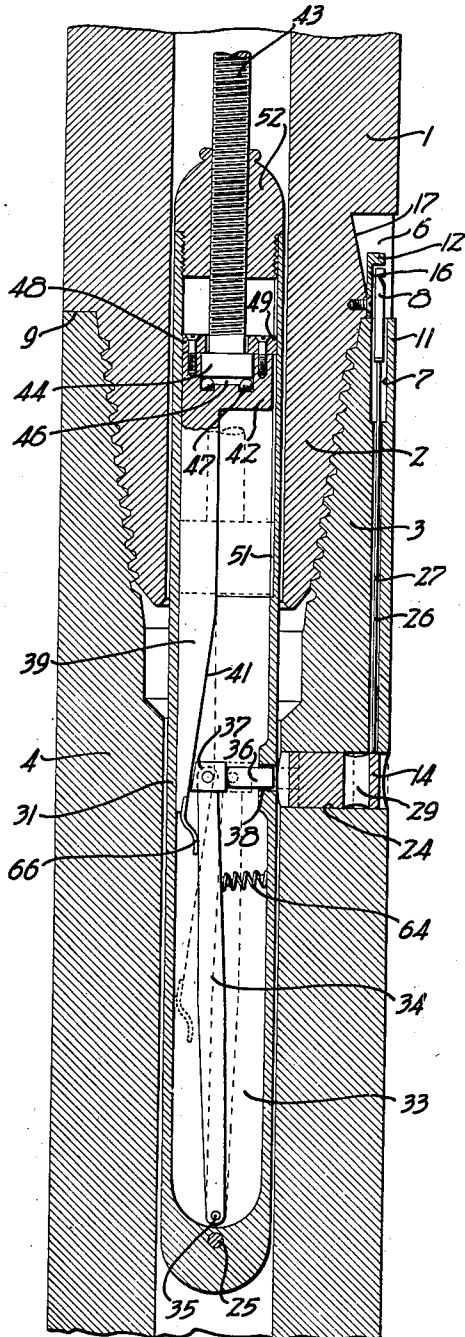
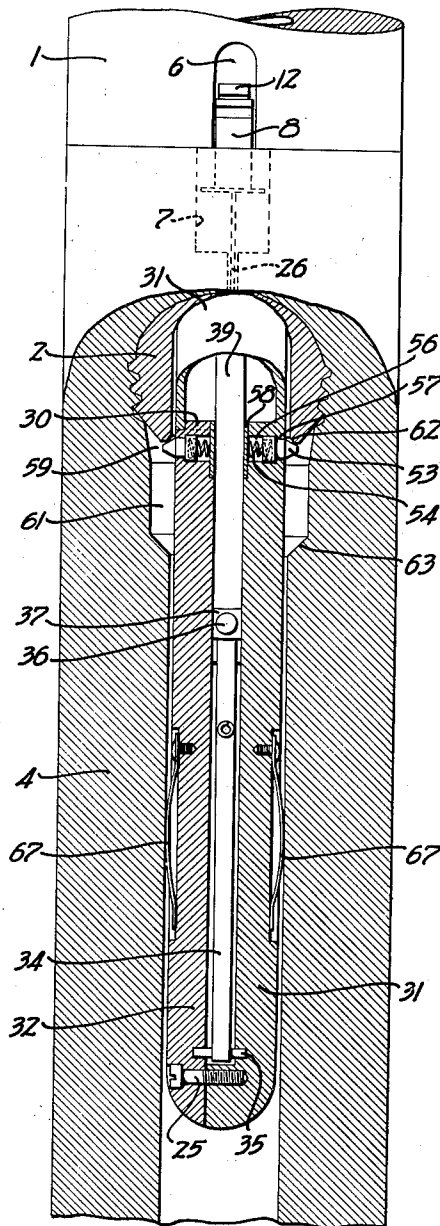


Fig. 2



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Fig. 3

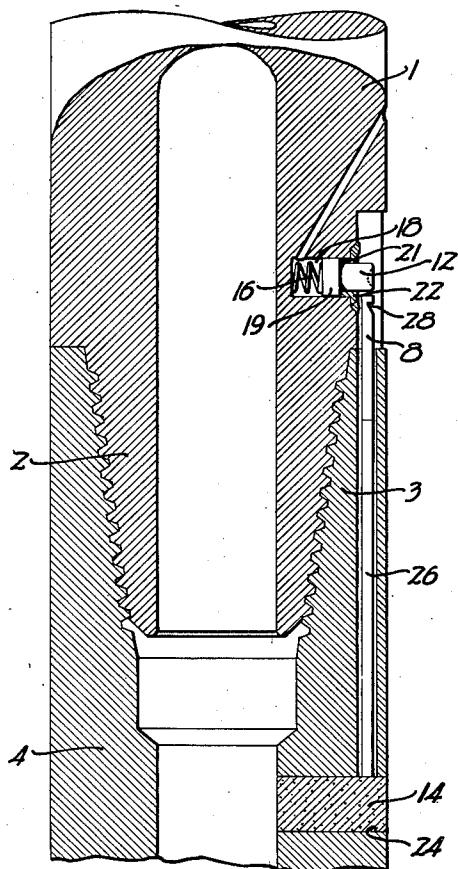


Fig. 4

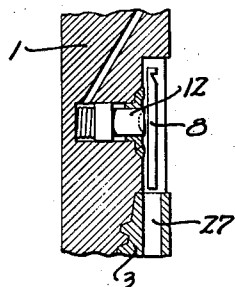
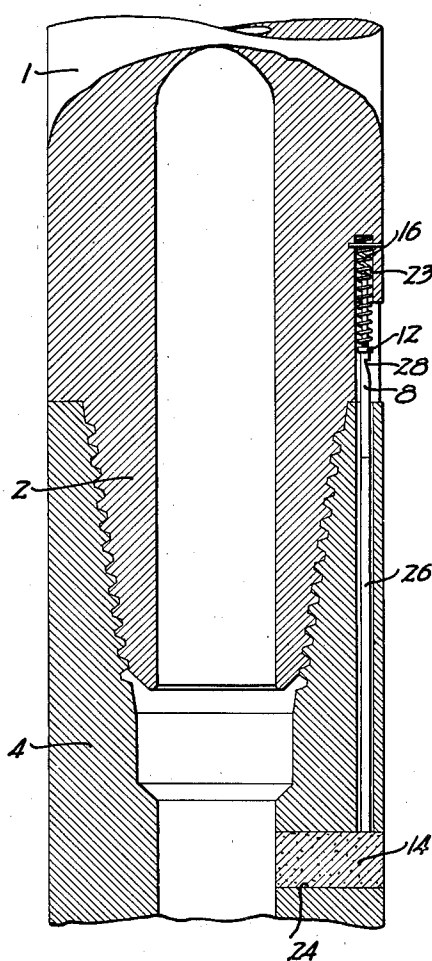


Fig. 5

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3 Sheets-Sheet 3

Fig. 6

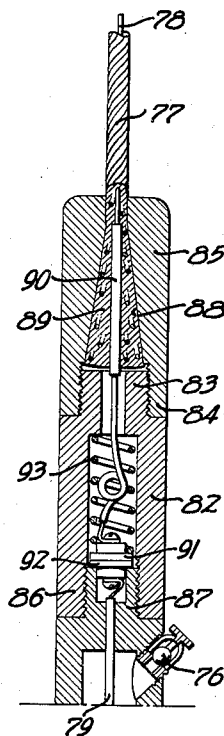
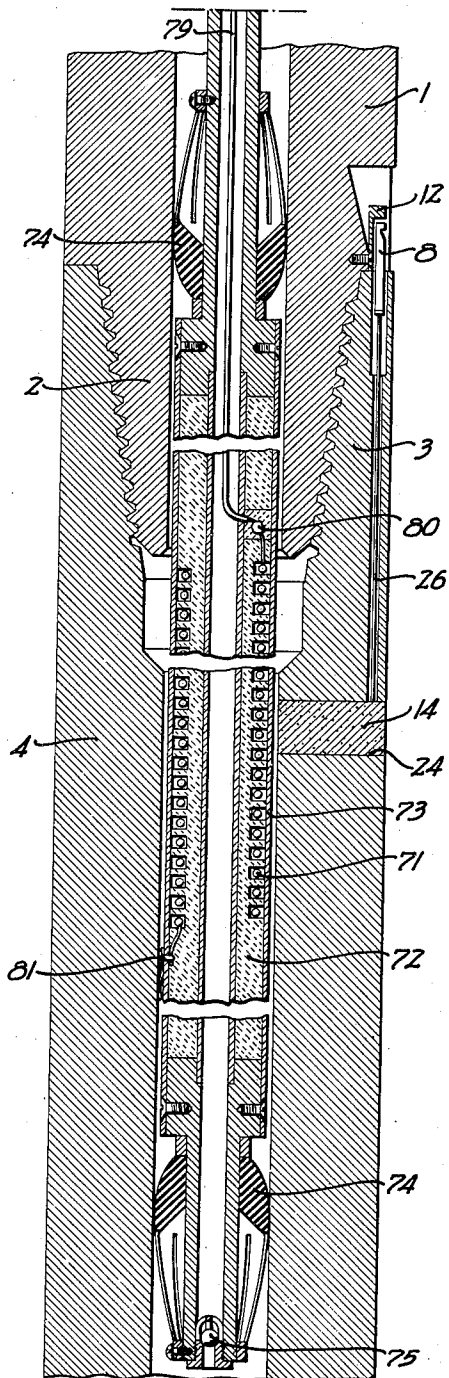


Fig. 7

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2,244,124

JOINT FOR DRILLING EQUIPMENT

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Application February 10, 1940, Serial No. 318,291

10 Claims. (Cl. 255—28)

My invention relates to screw joints for well drilling equipment, and particularly to a device for locking the members of a joint against relative rotation, and for unlocking said members when desired.

In drilling wells it is common practice to join various units of the drilling equipment by means of interengaging tapered threaded portions provided upon the adjacent ends of adjacent pieces of equipment. Unless the joint members are properly screwed together, the operation of the equipment frequently causes the joint to work loose, and the lower section to become disconnected from the string of equipment extending downwardly from the top of the well. In such cases, the lost section can be recovered only by "fishing" for it, by means of tools lowered from the top of the well. Such "fishing" jobs are usually tedious and costly, both in the matter of actual expense, and because of the delay in the drilling operations.

In attempting to obviate such loosening of the joints, the workmen sometimes screw the parts together so tightly that the socket member, or box, is subjected to excessive strain. In service, such a joint tends to crack and loosen, and causes loss of the tools and equipment below such joint. A costly "fishing" job then becomes necessary.

It is among the objects of my invention to provide a joint which will prevent the inadvertent unscrewing of a joint while in service, and thereby obviate the expense and loss of time required to recover lost equipment.

Another object is to provide a joint which may be readily connected and locked in operative relation; and which will mark the correct relation of the joint members when properly tightened, so as to prevent breakage due to overtightening the joint.

A further object is to provide a joint locking means which may be readily unlocked when desired.

Another object is to provide a locking device, and means for releasing the lock, by which the joint may be unlocked if desired while the joint is within the well.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is to be understood that I do not limit myself to this disclosure of species of my invention, as I may adopt variant embodiments thereof within the scope of the claims.

In the drawings:

Figure 1 is a fragmental vertical sectional view of a joint showing the locking and releasing means of my invention applied thereto.

5 Figure 2 is a vertical section, partly in elevation, of the device of Figure 1, the section being taken at right angles to the position shown in Figure 1.

Figure 3 is a fragmental sectional view showing a modified form of the lock mechanism.

Figure 4 is a fragmental view showing another modified form of the invention.

Figure 5 is a fragmental detail showing the manner in which the key is introduced or removed in the embodiment shown in Figure 3.

15 Figure 6 is a view similar to Figure 1 illustrating a modified form of locking and releasing means.

Figure 7 is a fragmental sectional view of the top coupling for the releasing means shown in Figure 6.

In terms of broad inclusion, the joint of my invention comprises a pair of joint members having interengaging threaded portions for connecting and disconnecting adjacent units of drilling equipment. The joint portions are provided with key-ways for receiving a key for locking the joint members against relative rotation, the key being normally held in locking position, and being releasable for movement to disengage one of the joint members when it is desired to uncouple the members.

My invention also contemplates the provision of releasing means operable from the top of a well for releasing the key, and unlocking the joint while it is in the well. Such means preferably includes a stop, normally holding the key against movement to a releasing position, and mechanism, either mechanical or electrical, for displacing the stop when desired.

In terms of greater detail, the joint of my invention comprises a joint member 1 having a reduced threaded extension 2 arranged to be screwed into a threaded socket 3 in the end of a companion joint member 4. The extension 2 and socket 3 are preferably of the conventional tapered form such as provided on substantially all standard drilling tools and equipment, for connecting one piece of apparatus to another.

The member 1 is provided with a key-way 6, and the member 4 is provided with a key-way 7, so positioned that when the members 1 and 4 are screwed together to the proper degree of tightness, the key-way 7 will be longitudinally aligned with the key-way 6. The key-way 6 is

of a length sufficient to receive the full length of a key 8 slidably mounted therein for movement into and out of engagement with the aligned key-way 7. Preferably, the outer face of the key is spaced slightly inwardly from the periphery of the member 1; and the thickness of the key is less than the depth of the shoulder 9 at the upper end of the threaded extension 2 so that the key may be fully contained inside the periphery of the body of the member 1 without intercepting any of the threads upon the extension.

The key-way 7 is preferably formed in the end of member 4, with a shell 11 closing the outer side of the key-way. The depth of the key-way 7 is sufficient to receive the full length of the key 8. The key-way 7 is preferably made somewhat wider than the key 8 so as to allow the joint members to be turned relative to each other sufficiently to take up wear upon the threads without destroying the alinement of the key-ways.

The key 8 is normally held in a locking position by means of upper and lower stops 12 and 14 respectively.

The upper stop 12 is preferably actuated by a spring 16, arranged to hold the stop in a position overhanging the upper end of the key 8, the spring being yieldable to permit sufficient displacement of the stop to allow the key to be moved entirely into the key-way 6. The stop 12 and spring 16 may be constructed and arranged in various ways. For example, Figure 1 illustrates an embodiment wherein the stop 12 is carried upon the free end of a spring arm 16 secured within the back of the key-way 6 which is recessed, as at 17, to permit the arm and stop 12 to be sprung inwardly sufficiently to clear the key-way and permit movement of the key 8 therealong.

Figure 3 illustrates a modification wherein the stop 12 is slidably mounted within a radial bore 18, and is movable inwardly of the bore against the pressure of a coil spring 16 within the back of the bore. In this arrangement the stop 12 is provided with a shoulder 19 arranged to engage a shoulder 21 carried by a collar 22 secured at the outer end of the bore 18.

Figure 4 illustrates another satisfactory form of the stop 12 and spring 16. In this case, the stop 12 is mounted in axial alinement with the key 8, and is movable into a recess 23 at the upper end of the key-way 6. The spring 16 seats within the recess 23 and normally presses the stop downwardly against the top of the key 8.

The lower stop 14 is preferably a plug mounted in a radial bore 24, extending through the wall of the joint member, directly below the key-way 7. The key 8 is supported by a rod 26, slidably mounted in a bore 27 connecting the lower end of the key-way 7 and the bore 24. The rod 26 is of a length such that when the lower end rests upon the stop 14, the key 8 will be supported in engagement with the key-ways of both joint members.

To assemble and lock the joint, the two joint members are screwed together, the key-ways 6 and 7 being so positioned that they will be alined when the proper degree of tightness has been reached, thereby providing a guard against excessive tightening of the joint. The stop 12 is then displaced against the pressure of the spring 16 sufficiently to permit a key 8 to be inserted bodily into the key-way 6. The key is then moved along the key-way 6 and into engage-

ment with the key-way 7, until it seats against the pin 26, which has previously been inserted in the bore 27. The stop 12 is then released, and serves to hold the key in its locking position.

When the joint is above the top of the well, the key may readily be moved to unlock the joint members by depressing the stop 12, and moving the key 8 back into the key-way 6, and out of the key-way 7. A notch or opening 28 is preferably provided so that the key may be engaged and moved by a suitable tool.

Frequently it is necessary or desirable to uncouple adjacent pieces of drilling equipment while they are in the well. To permit such uncoupling, the stop 14 is so constructed and arranged as to permit displacement thereof by mechanism lowered through the string of equipment from the top of the well.

Figure 1 of the drawings illustrates one satisfactory means for so displacing the stop 14. In this embodiment, the stop 14 is preferably a metal plug of a length slightly less than the thickness of the wall of the joint member 4. The stop is mounted fairly tightly in the bore 24, and is positioned with its inner end spaced from the inner side of the wall of the joint member so as to leave the inner end of the bore open. An opening 29 is provided in the plug near its outer end, parallel to but inwardly spaced from the pin 26, so that the end of the pin is normally supported upon the end of the plug. The pin 26 is arranged to drop into the opening 29, when the plug is moved a short distance outwardly.

For displacing the stop plug 14 to release the pin 26 and key 8, I prefer to employ a mechanism comprising a body member 31 arranged to be lowered through the hollow center of the string of drilling equipment by means of a sucker rod or other suitable lowering connection. The body 31 is preferably of a split construction having a recess 33 between the sections. In the embodiment illustrated in the drawings, the recess 33 is covered by a plate 32 forming one of the split portions of the body, the plate 32 having a shoulder 39 seating within the main body member. A screw 25 is provided for securing the body portions together at their lower ends.

A lever 34 is pivotally mounted within the recess 33 by means of a pin 35. A punch pin 36 is carried by a wedge block 37 mounted upon the free upper end of the lever 34, the pin being movable through an opening 38 in the wall of the body 31.

A wedge 39 is slidably mounted within the upper part of the recess 33, with an inclined face 41 arranged to engage the back of the wedge block 37. The wedge 39 is carried by a head 42 rotatably secured to a threaded stem 43 adapted to be connected to the sucker rod or other lowering connection, not shown.

The stem 43 and head 42 may be satisfactorily connected by providing an enlarged portion 44, upon the end of the stem 43 to seat within a recess 46 in the head. A thrust bearing 47 is preferably provided in the bottom of the recess 46. A plate 48 is secured upon the top of the head, and is arranged to engage the shoulder at the top of the enlarged portion 44 for retaining the enlarged portion within the head. A tongue 49 carried by the head 42 engages a groove 51 in the wall of the body 31 to prevent rotation of the head within the body.

The stem 43 is threaded through a cap 52 secured to the top of the body 31, for advancing or receding the head 42 and wedge 39 as the

stem is rotated. The lower end of the cap 52 provides an abutment limiting upward movement of the head 42.

A plurality of feeler tumblers 53 are mounted in the walls of the body 31. The tumblers are provided with tapered ends arranged to project outwardly from the walls of the body 31, due to the pressure of suitable springs 54. In Figure 2 I have illustrated one satisfactory type of tumbler wherein the tumblers are slidably mounted in recesses 56, with shoulders 57 for limiting outward movement of the tumblers. The tumblers are introduced through the backs of the recesses before the body portions 31 and 32 are assembled. The springs 54 are retained by plates 58 secured over the inner ends of the recesses 56 in any convenient manner. Other suitable types of feeler tumbler may of course be substituted if desired.

The tumblers 53 are arranged to be substantially fully retracted into the body 31 as the body is lowered through the hollow center of a piece of drilling equipment, and to spring outwardly into the clearance space 59 provided between the threaded extension 2 and the bottom of the socket 3 of each joint. Preferably the member 4 is provided with a recess 61 extending beyond the depth of the ordinary socket 3 to provide a substantial space for receiving the tumblers as they pass each joint. Beveled areas 62 and 63 are provided upon the end of the extension 2 and the bottom of the recess 61 respectively for pressing the tumblers back into the recesses 56 as they pass the joint in either direction. The tumblers 53 are so positioned that when they engage the lower end of a threaded extension 2, the punch pin 36 will be positioned with its axis in the same plane with the axis of the stop plug 14 of the joint.

A spring 64 is mounted within the recess for exerting a pressure upon the lever 34 tending to move the punch pin inwardly into the body 31. A spring 66 upon the lower end of the wedge 39 is arranged to displace the wedge block 37 and punch pin 36 outwardly against the pressure of the spring 64, when the spring 66 is moved against the back of the wedge block. The spring 66 is arranged to exert a resilient pressure against the block such that the pin 36 may be pressed outwardly past the surface of the body 31 for locating the stop plug 14 of a joint.

When it is desired to unlock a joint while the joint is in a well, the body 31 is lowered through the string of drilling equipment until it reaches the desired joint. The approximate position of the joint is known from the length and number of units of equipment which have been connected into the string between the joint and the top of the well; and by lowering the body 31 a corresponding distance, it will occupy a position within the joint. The body 31 may also be positioned at the desired position, vertically of the string, by means of the feeler tumblers 53. Thus, as the tumblers spring outwardly as they pass the end of the extension 2, they produce a click which is perceptible at the top of the well. Since the number of joints in the string of equipment is known, the body 31 may be positioned at the desired joint by counting the number of clicks made by the tumblers as they pass the joints, instead of measuring the length of the sucker rod used for lowering the body.

The body 31 is lowered until the feelers project into the recess 61 of the desired joint, and

the body is then raised until the feelers seat against the lower end of the extension 2 of the joint. In that position, the axis of the punch pin 36 will be disposed in the same horizontal plane as the axis of the stop plug 14 of the joint.

The punch pin 36 is axially aligned with the stop plug 14 in the following manner. The wedge 39 is initially set so that the punch pin 36 will be held inside the body 31 by the spring 64. When the desired joint is reached, the stem 43 is rotated in a counterclockwise direction to move the head 42 upwardly to its extreme position. This is accomplished from the surface of the well by rotating the sucker rod connection by which the body 31 has been lowered into the well. Springs 67 are mounted upon the body 31 to engage the inner surface of the joint with sufficient pressure to prevent turning of the entire body 31 with the stem 43.

As the head 42 reaches its uppermost position, the spring 66 is moved to a position where it bears against the back of the wedge block 37. Since in that position, the head 42 engages the cap 52, further rotation of the stem 43 causes the body 31 to be rotated with the stem against the frictional resistance of the springs 67 which bear against the joint member 4. As the body 31 is so turned, the punch pin 36 is pressed against the inner surface of the joint member 4 until it reaches a position in alinement with the stop plug 14, at which time it is forced outwardly by the spring 66 into engagement with the end of the bore 24. Further rotation of the body 31 is prevented by such engagement of the punch pin 36 and bore 24, and the punch is thereby held in alinement with the stop plug.

The stem 43 is then rotated in a clockwise direction to force the head 42 and wedge 39 downwardly within the body 31. The face 41 is forced against the back of the wedge block 37 with pressure sufficient to displace the stop plug 14 within the bore 24, until the opening 29 is moved into alinement with the key supporting pin 26. This allows the pin 26 to drop into the bore, and the key 8 to move downwardly along the key-way 7 out of engagement with the joint member 1, thereby unlocking the joint. The wedge 39 is then retracted sufficiently to permit the punch pin 36 to be moved back into the body 31 by the spring 64, thereby permitting the stop displacing means to be withdrawn from the well.

Figure 6 illustrates another satisfactory means for releasing the key 8 while the joint is within the well. In this embodiment, the stop plug 14 is made of a material of low melting point such as wax, soft solder, or other material which is fusible at a relatively low temperature. The plug is arranged to be melted to release the pin 26 and key 8 by means of a heating unit lowerable into proximity thereto.

For that purpose, I prefer a heating unit comprising a resistance coil 71 wound upon a hollow core 72 of porcelain or other suitable insulating material, and incased within a shell 73. The coil 71 is preferably several feet in length, say five to ten feet, so that it need not be positioned more accurately than is possible by paying out a measured length of cable or sucker rod corresponding to the length of the string of drilling equipment extending from the top of the well to the joint to be released.

The heater unit is preferably provided with suitable swabs 74, preferably of rubber, at the upper and lower ends for displacing water from

the string of equipment along the length occupied by the heater unit. Check valves 75 and 76 are preferably provided at the bottom and top of the hollow core 72 so that water may be displaced upwardly therethrough as the heater is lowered along the string of equipment. The swabs 74 serve to substantially exclude water from around the heater, thereby facilitating the heating of the joint and stop plug 14.

The heater unit may be lowered by means of a cable 77 or by a hollow sucker rod or other suitable connection. Electric current is supplied to the coil 71 by an insulated conductor 78 extending downwardly through the cable, and an extension 79 of the conductor connected to one terminal of the coil, as at 80. The other end of the coil may be grounded, as at 81, or a second conductor may be provided through the core 72, if desired. The terminal 80 is preferably sealed in by means of applying sealing wax or other suitable plastic or moldable material after the conductor is attached to the terminal, and before the shell 73 is applied thereover.

The heater unit may be connected directly to the cable 77, if desired. However, I prefer to connect the heater to the cable by means of a coupling member 82. The coupling 82 is hollow, and is provided with a threaded extension 83 at one end for engaging a threaded recess 84 in the end of a socket member 85. The opposite end of the coupling 82 is provided with a threaded recess 86 for engaging a threaded extension 87 upon the heater unit. The socket member 85 may be effectively secured to the cable by spreading the strands of the cable within a tapered recess 88, and then filling the recess with babbitt 89, or other suitable filling material.

The conductor 78 is extended through the member 85, a jacket 90, of copper or other suitable material, being provided for shielding the conductor and its insulation from the babbitt, as it is introduced into the recess. The end of the conductor 78 is connected to a terminal 91 arranged to be held seated upon a terminal 92 by means of a spring 93. The terminal 92 seats against the end of the core extension 87, and is connected to the conductor extension 79. The end portion of the conductor 78 is left slack, so as to permit the coupling 82 to be screwed onto the heater unit without unduly twisting the conductor.

To release the locking key 8 of a joint, the heater is lowered to a position with the coil 71 within the joint. The heater coil 71 is then energized. Heat from the coil is transmitted to the joint, and to the fusible stop plug 14 therein. As the plug melts, the pin 26 drops to the bottom of the bore 24 in which the plug 14 is set, and the key 8 is thereby released to its unlocking position.

While the joint locking means of my invention has been disclosed only in connection with joints of the character commonly provided on hollow drilling tools, it may of course be applied in similar manner to drill pipe joints. For that purpose, the joints should be of the type upset externally, as well as internally, in order to provide sufficient stock to receive the key and keyways without unduly weakening the joints.

The locking means may be applied to substantially all types of drilling tools, such as bits, stems, sinker bars, jars, rope sockets, bailers, sand pumps, liner setters, casing and pipe cutters, impression blocks, swivels, reamers, fishing tools, and similar equipment. As each unit is added to

the string its joint is locked by a key, and is held against rotation relative to other units of the string.

Upon removing the string from the well, the units are unlocked and uncoupled successively as they are raised to the surface. In event it is desired to remove only a portion of the string, the units may be uncoupled at the desired joint by releasing the key of that joint and unscrewing the joint.

I claim:

1. A joint for well drilling equipment comprising a pair of members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the members are screwed tightly together, a key movable along the keyway from an unlocking position entirely within the key-way of one member to a second unlocking position entirely within the key-way of the other member, and a tumbler upon one of the joint members for normally blocking movement of the key along the key-way in one direction, the tumbler being movable to release the key for movement to an unlocking position.

2. A joint for well drilling equipment comprising a pair of members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the members are screwed tightly together, a key movable along the keyway from an unlocking position entirely within the key-way of one member to a second unlocking position entirely within the key-way of the other member, and a spring actuated tumbler upon one of the joint members for normally blocking movement of the key along the key-way in one direction, the tumbler being movable to release the key for movement to an unlocking position.

3. A joint for well drilling equipment comprising a pair of members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the members are screwed tightly together, a key movable along the keyway from an unlocking position entirely within the key-way of one member to a second unlocking position entirely within the key-way of the other member, and separately displaceable stops positioned at opposite ends of the key for normally holding said key in locking position.

4. A joint for well drilling equipment comprising a pair of members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the members are screwed tightly together, a key movable along the keyway from an unlocking position entirely within the keyway of one member to a second unlocking position entirely within the key-way of the other member, a tumbler upon one joint member normally blocking movement of the key longitudinally in one direction from its locking position, and a stop upon the other joint member normally blocking movement of the key longitudinally in the other direction.

5. A joint for well drilling equipment comprising a pair of members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the members are screwed tightly together, a key movable along the keyway from an unlocking position entirely within the keyway of one member to a second unlocking position entirely within the key-way of the other

member, a tumbler upon one joint member normally blocking movement of the key longitudinally in one direction from its locking position, a stop upon the other joint member normally blocking movement of the key longitudinally in the other direction, and means for effecting displacement of the stop while the joint is within a well.

6. A joint for hollow rotary well drilling equipment comprising upper and lower joint members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the joint members are screwed together, a key movable along the key-way from an unlocking position within the key-way of one member to a locking position in engagement with the key-ways of both members, a stop normally limiting downward movement of the key along the key-way of the lower joint member, and key releasing means insertable through the hollow equipment from the top of the well for effecting displacement of the stop.

7. A joint for hollow rotary well drilling equipment comprising upper and lower joint members provided with interengaging threaded portions, key-ways upon the members arranged to be positioned in longitudinal alinement when the joint members are screwed together, a key movable along the key-way from an unlocking position within the key-way of one member to a locking position in engagement with the key-ways of both members, a stop normally limiting downward movement of the key along the key-way of the lower joint member, and key releasing means insertable through the hollow equipment from the top of the well for effecting displacement of

the stop, said means comprising a plunger, means for alining the plunger with the stop, and means operable from the top of the well for actuating the plunger to displace the stop.

8. A key releasing means for tubular joints provided with a locking key and a stop normally preventing movement of the key to an unlocking position, comprising a plunger movable into the joint, means for alining the plunger with the inner end of the stop, a wedge engaging the plunger, and a feed screw associated with the wedge for advancing the wedge against the plunger to displace the stop.

9. A key releasing means for tubular joints of well drilling equipment having a locking key and a displaceable stop normally preventing movement of the key to an unlocking position, comprising a body arranged to be lowered through the drilling equipment, a plunger movable transversely of the body into engagement with the stop, means for alining the plunger with the stop, and means upon the body in association with the plunger for actuating the plunger to move the stop to a key releasing position.

10. A key releasing means for tubular joints of well drilling equipment having a locking key and a displaceable stop normally preventing movement of the key to an unlocking position, comprising a body arranged to be lowered through the drilling equipment, a plunger movable transversely of the body into engagement with the stop, means for alining the plunger with the stop, a nut slidably movable within the body, a wedge carried by the nut for actuating the plunger, and a feed screw operable from the top of the well for actuating the nut and wedge.

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