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[45] Patented **Jan. 12, 1971**
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306,588 10/1884 Cronin 166/77.5
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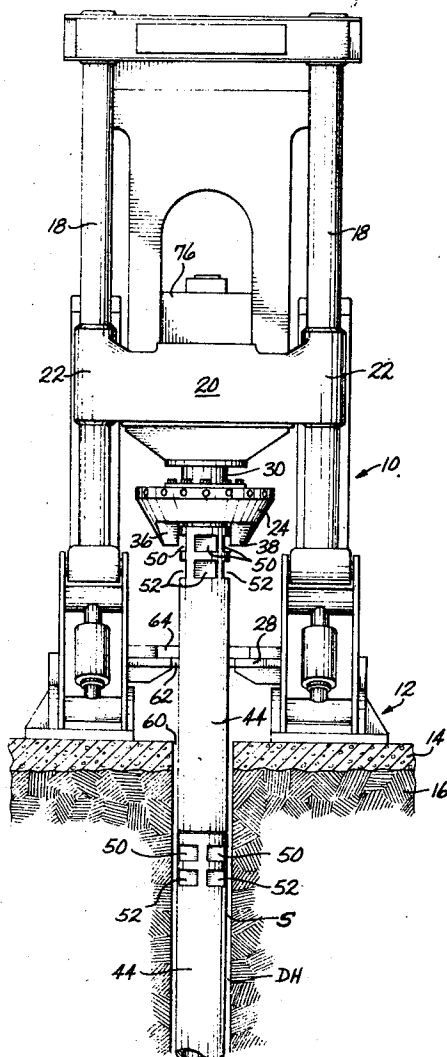
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[54] **BREAKOUT APPARATUS FOR A SECTIONAL
DRILL STEM**

5 Claims, 11 Drawing Figs.

[52] U.S. Cl. **173/164,**
175/85
[51] Int. Cl. **E21b 19/16**
[50] Field of Search 175/52, 85;
173/164; 166/77.5, 85, 315

ABSTRACT: A drill stem section having breakout wrench receiving depressions or flats formed on its outer surface substantially immediately axially inwardly of an end located threaded tool joint component. A reversible rotary drivehead including a threaded tool joint component connectable to the stem section tool joint component and a breakout wrench including a jaw wrench on the drivehead and a torque transmitting insert element insertable between the breakout wrench receiving depressions or flats on the drill stem section and the jaws of the jaw wrench. Means for holding the stem section second from the drivehead during reverse rotation of the drivehead and first stem section through the insert element.



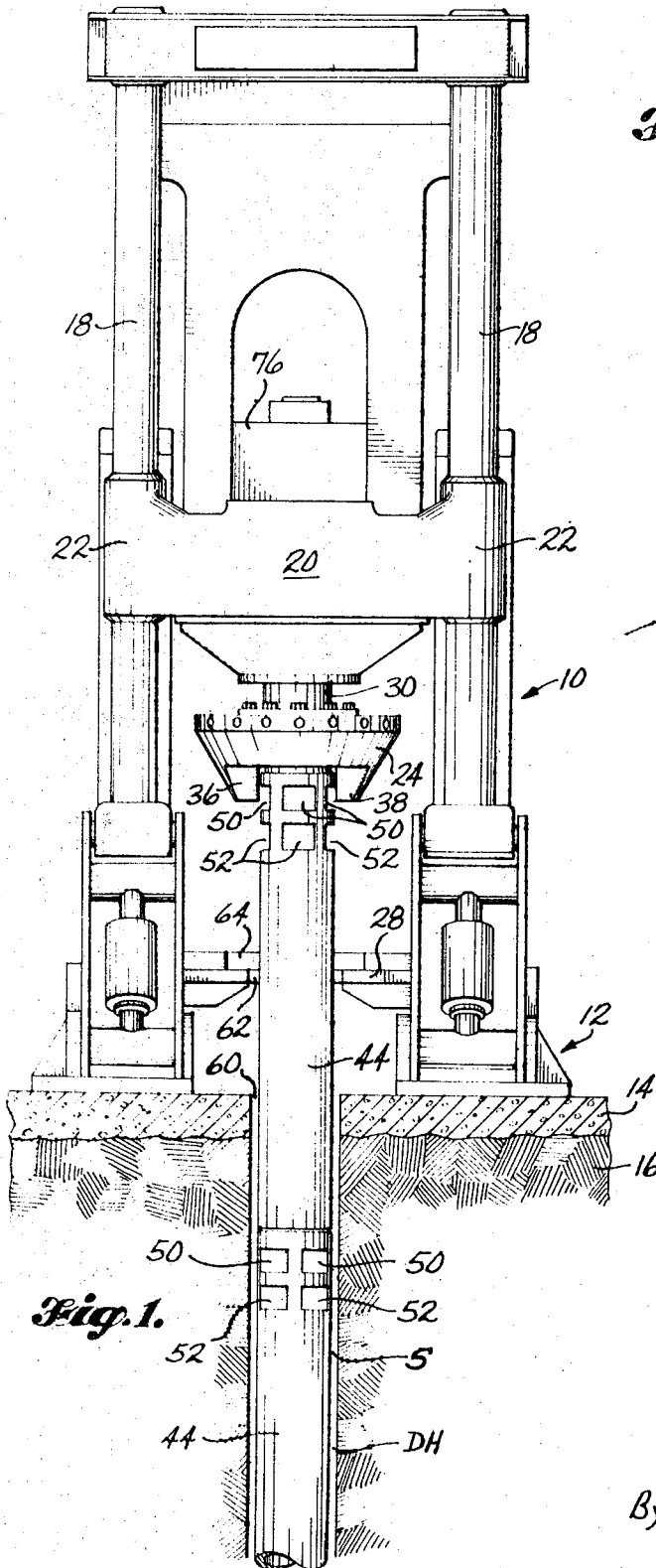
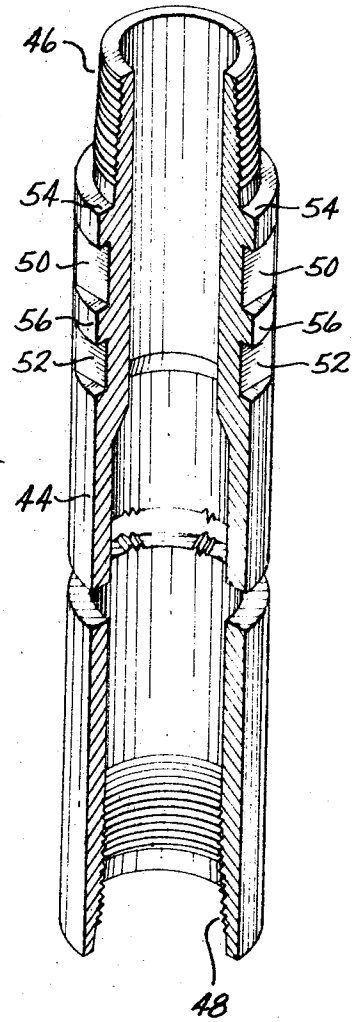
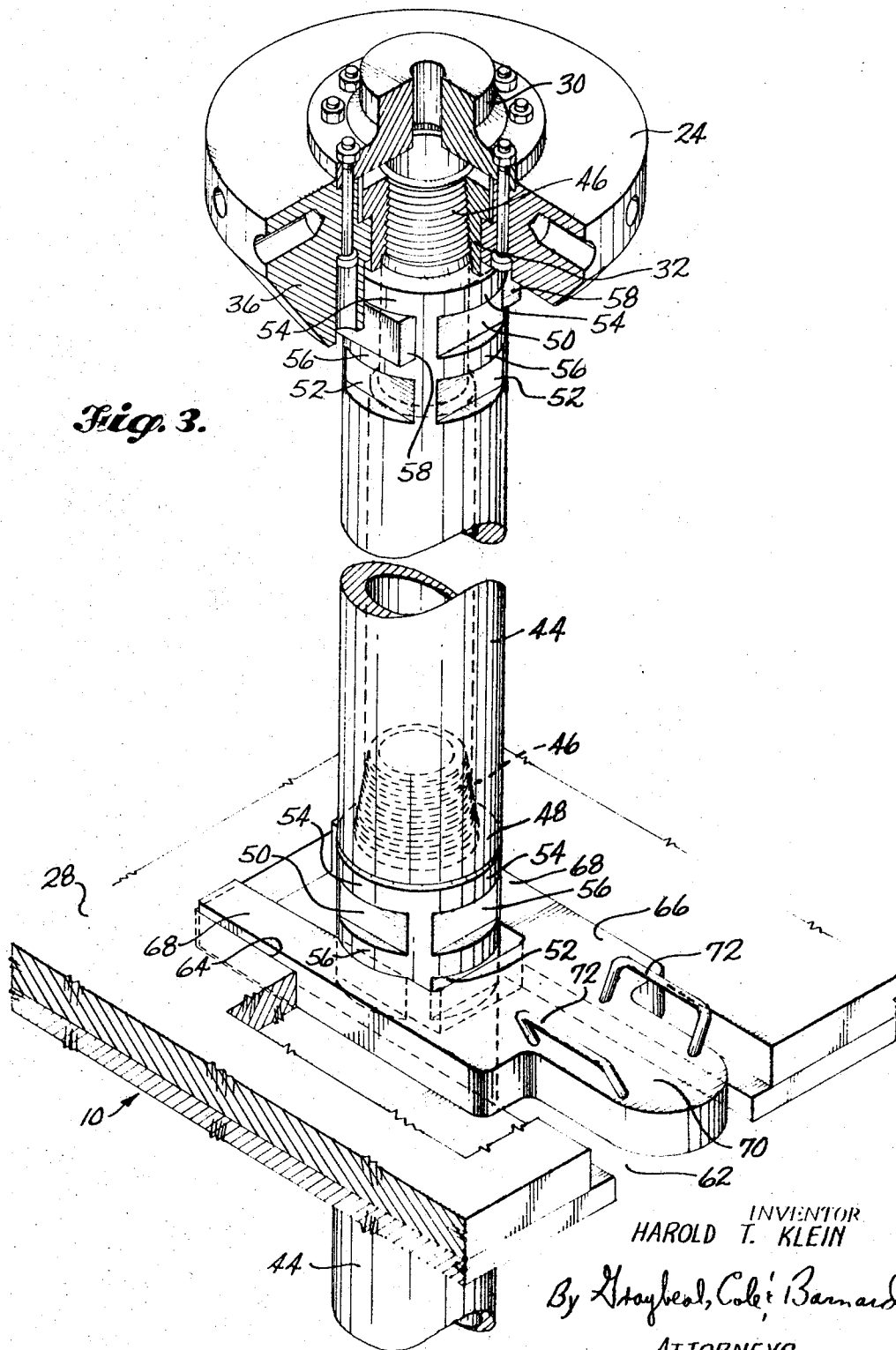


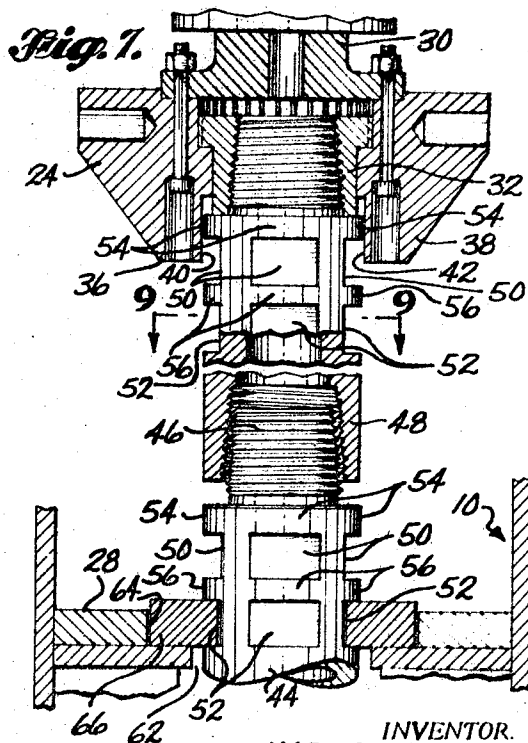
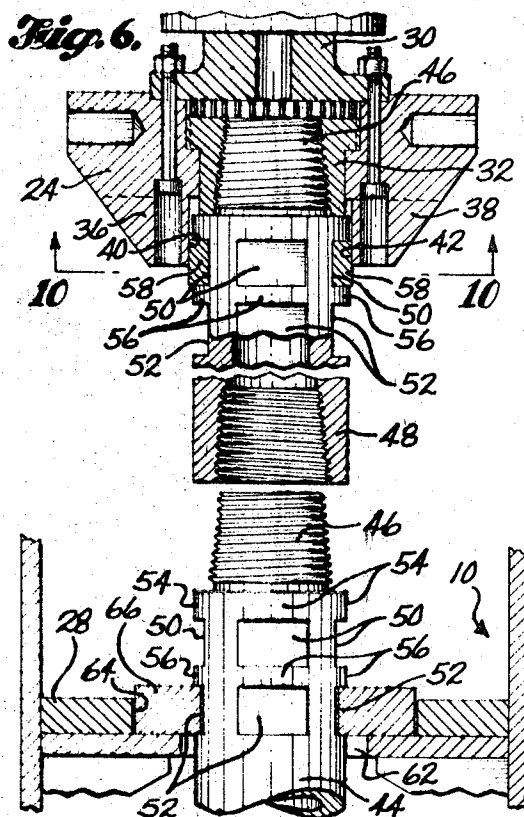
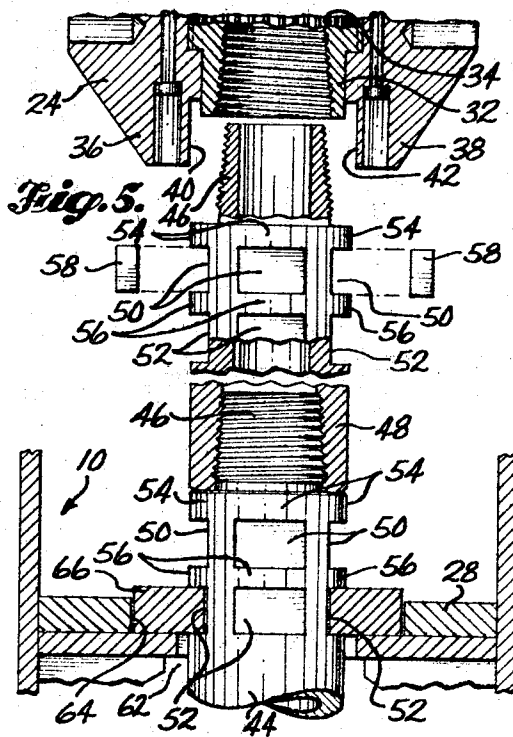
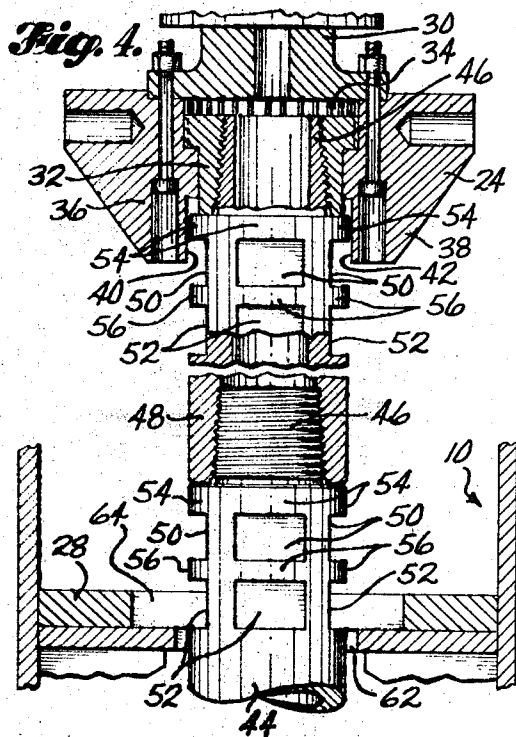
Fig. 2



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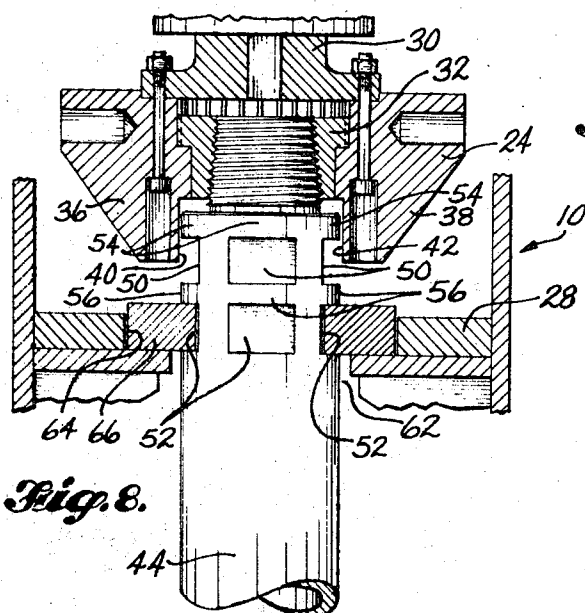


Fig. 8.

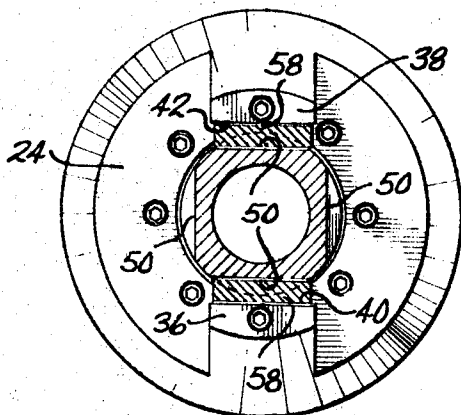


Fig. 10.

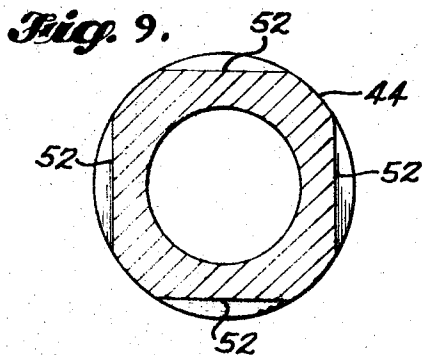
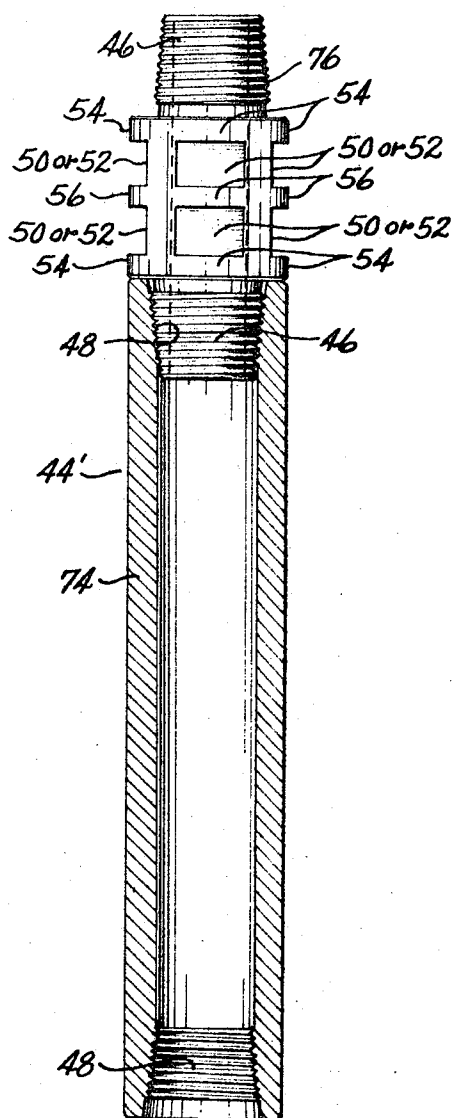


Fig. 9.

Fig. 11.



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BREAKOUT APPARATUS FOR A SECTIONAL DRILL STEM

CROSS-REFERENCES TO RELATED APPLICATIONS

This is a division of my copending application Ser. No. 658,674, filed Aug. 7, 1967, now U.S. Pat. No. 3,463,247 and entitled "Drill Stem Breakout Apparatus."

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to sectional drill stems or shafts comprising plural pipe sections joined by threaded pin and box-type tool joints. More particularly, it relates to apparatus for rotatively coupling the drill stem to the drivehead at a time when the threaded tool joint between the two is loose, so that the drivehead can be rotated in reverse to in turn rotate the drill pipe threaded to it, without unscrewing the tool joint between such drivehead and the pipe. It also relates to a breakout technique in which such apparatus is used to loosen the tightly set up threaded tool joints.

2. Description of the Prior Art

The most commonly used method of pulling the drill stem involves the use of tongs and manually applied power mechanisms to breakout tightly set up threaded tool joints. Manipulation of such tongs and power mechanisms requires hard manual work, and in addition they make the breakout operation both hazardous and time consuming.

Alexander, U.S. Pat. No. 3,239,016 proposes a breakout method and apparatus in which tongs and manually applied power mechanisms are not used. Instead, the pipe sections are specially constructed to include a squareheaded extension at the pin end of the section and a square socket of complementary shape at the box end of the section. In use, the portion of the drill stem disposed below the uppermost section is secured against both rotary and axial movement and the drivehead is reversed to cause a random loosening of either the upper or lower threaded tool joints of the upper section of drill pipe. If the lower joint loosens first, the upper section of pipe is rotated until the threads are completely decoupled. Then, the drivehead and the upper section of pipe attached thereto are raised until the squarehead of the extension is engaged in the square socket of the second section. Then, the drivehead is again reversed to cause first a loosening and then a complete decoupling of the tool joint at the upper end of the upper section. If the upper tool joint is the first to loosen, the drivehead is reversed until the threads of such joint are entirely disengaged, and then the drivehead is moved axially upwardly to place the square head of an axial extension of the drivehead inside the square socket at the upper end of the upper section of drill pipe. Then, the drive head is reversed to first loosen and then entirely disengage the threads of the lower tool joint.

Thornburg, U.S. Pat. No. 2,972,388 and Foran, U.S. Pat. No. 3,291,225 disclose drilling machines which include auxiliary wrench mechanisms actuatable to directly grip portions of the drill pipe.

SUMMARY OF THE INVENTION

The drill pipe of the present invention comprises a threaded pin at one end, a threaded box at the other end, and externally reached auxiliary torque transfer means at one end only, located axially inwardly of the tool joint component at such end.

In preferred form the auxiliary torque transfer means comprises diametrically opposed recesses or wrench flats formed on the drill pipe axially inwardly of the threaded pin. The drivehead includes a threaded box and auxiliary torque transferring means in the form of a turning wrench which extends axially outwardly beyond the box, and is positionable radially outwardly of the recesses or flats on the drill pipe when the threaded pin of the drill pipe is at least partially in the threaded box of the drivehead. Wrench "jaws," which may be in the form of removable metal bars or blocks, are snugly fittable in spaces formed between inner surface portions of the

drivehead wrench and the recesses or flats carried by the drill pipe.

According to the breakout technique of the present invention, the portion of the drill stem connected to the upper section is held against both rotational and axial movement. This may be done by anchoring it to a wrench table situated relatively close to the entrance to the drill hole, by means of a horseshoe wrench or the like engaging holding wrench surface depressions formed in side areas of the drill pipe at a location axially inwardly of, and preferably immediately adjacent to, the turning wrench receiving recesses or flats. The drivehead is then reversed to randomly loosen one or the other of the two tool joints at the opposite ends of the first section of drill pipe. If the tool joint at the drivehead end of the first section of pipe is first to loosen, then the turning wrench carried by the drivehead is coupled to the turning wrench receiving recesses or flats, and the drivehead is rotated in reverse to first loosen and then decouple the other tool joint. The first section is then removed and the drivehead is lowered or raised, depending upon the direction of drilling, in order to place its tool joint component in position to be loosely coupled to the tool joint component of the second section. A new tool joint is then loosely made up between the drivehead and the second section and the holding wrench is removed from the second section. Then the drivehead is moved axially with the axial forces being carried by the threads of the loosely made up tool joint until the holding wrench receiving surface depressions of the third section are at the holding wrench table and the second section is in position for removal.

Also according to the breakout technique of the present invention, if the tool joint at the end of the first section opposite from the drivehead is the first to be loosened, then with such joint loosely made up, so that the threads thereof can carry the weight of the portion of the drill stem still in the drill hole, the drivehead is moved toward the drill hole until the holding wrench receiving means of the first section is in a position to be engaged and held by the holding wrench at the wrench table. Then, the drivehead is rotated in reverse until the tool joint between it and the upper section has been loosened. The joint is loosened but not decoupled, so that the threads can carry the weight of the drill pipe. Then, the holding wrench is removed and the drivehead is moved axially away from the drill hole so as to return the first section to a position for removal. The holding wrench is refitted to the second section, and then the first section, which now has a loosely coupled joint at each of its ends, is easily unthreaded and removed.

Another aspect of the invention is the provision of a length or section of drill pipe that comprises a major part having identical tool joints at its two ends, and a relatively short minor part having identical tool joints at its two ends. The tool joints of one of the parts are threaded boxes and the tool joints on the other part are complementary threaded pins. Initially the minor part is threadably connected by either one of its tool joints to either one of the tool joints of the major part, so as to provide a length of drill pipe with a threaded pin at one end thereof and a threaded box at the opposite end thereof. Then, when such pin and box have become worn to a point that one or both of them should be replaced, the two parts are separated where originally joined and are rejoined by mating the worn pin with the worn box, so as to provide the length of drill pipe with a new pin and a new box at its two ends. According to the invention, the minor part comprises a pair of substantially identical wrench receiving means which are axially spaced and symmetrically arranged between the two tool joints for the minor part. In preferred form the minor part has threaded pins at its two ends and the major part has threaded boxes at its two ends.

These and other inherent objects, features, advantages and characteristics of the present invention will be apparent from the following description of typical and therefore nonlimitative embodiments of the invention, as described below in conjunction with the accompanying illustration.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing like element designations refer to like parts, and:

FIG. 1 is a small scale front elevational view of a traveling head-type drilling machine and a sectional drill stem, both of which embody features of the present invention;

FIG. 2 is an enlarged scale perspective view of one of the sections of drill pipe that make up the drill stem, shown partially in section to better illustrate the construction thereof;

FIG. 3 is a fragmentary perspective view of an upper section of drill pipe interconnected between the drive head and a second length of drill pipe, showing wrench completion blocks in position between the wrench forming extensions of the drivehead and the turning wrench receiving recesses of the upper length drill pipe, and showing the second length of drill pipe anchored to a table by a horseshoe wrench, with the drivehead being in partial section to better illustrate the construction thereof;

FIG. 4 is a view partially in section and partially in elevation of the components of FIG. 3, but minus the horseshoe wrench and showing tight engagement of the threads at both the upper and the lower tool joints;

FIG. 5 is a view similar to FIG. 4, but showing the horseshoe wrench holding the second section, the upper threaded joint decoupled, and the turning wrench completion blocks spaced radially outwardly from their recesses in the upper section of drill pipe;

FIG. 6 is a view similar to FIGS. 4 and 5, but showing a loose engagement of the threaded joint at the upper end of the upper section of drill pipe, the turning wrench completion blocks in place, and the threaded joint at the lower end of such upper length of pipe decoupled;

FIG. 7 is a view similar to FIGS. 4-6, but typifying a situation wherein on reverse rotation of the drivehead, for random breaking of the threaded joints, the lower threaded joint breaks first, and showing said lower joint decoupled;

FIG. 8 is a view similar to FIGS. 4-7, but showing the upper length of drill pipe lowered to a position adjacent the wrench table, with the horseshoe wrench engaging the holding wrench surface depressions of such upper length of drill pipe, and showing the drivehead being ready for use to loose the upper threaded joint;

FIG. 9 is a cross-sectional view taken through the upper length of drill pipe at the holding wrench receiving surface depressions, substantially along line 9-9 of FIG. 7;

FIG. 10 is a cross-sectional view taken substantially along line 10-10 of FIG. 6, and showing the cross-sectional configuration of the drill pipe in the region of the turning wrench receiving surface depressions, and showing the turning wrench completion blocks in their position of use; and

FIG. 11 is a view partially in section and partially in side elevation of a modified form of drill pipe, characterized by a minor part, or sub, of symmetrical construction which is relocatable in position from one end of a longer major part to the opposite end of the major part, to provide new tool joints at the ends of the pipe sections.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring to FIG. 1, the drilling machine 10 is shown to comprise a base portion 12 which may be firmly anchored to a concrete pad 14 which is in turn anchored to the ground 16. Base portion 12 is shown supporting guide column means 18 for a traveling drive or drill head assembly. The drivehead assembly includes a carriage 20 having guide sleeves 22 at each of its ends which surroundingly engage the guide column means 18. Hydraulic cylinder column means or the like (not shown) are provided for moving the carriage 20, and a drivehead 24 carried thereby, up-and-down along the guide column means 18. Carriage 20 also carries motor and gearing means, indicated generally at 25, for rotating the drivehead

24. The motor and gearing are adapted to rotate the drivehead 24 in either direction at the selection of the operator. Base portion 12 also supports a holding wrench table 28, the function of which will hereinafter be described in greater detail.

The drivehead 24 includes an upper neck portion 30 by which it is attached to the motor and transmission means 26. It also includes an internal collar 32 (FIGS. 3-8) which is internally threaded to provide a box-type tool joint component. The sleeve 32 is surrounded by a husky annular portion of the head 24, and is supported within said annular portion for limited axial movement by means of a plurality of circumferentially arranged, axially extending splines 34, or the like. The splines 34 hold the sleeve 32 against rotation relative to the head 24, but as previously mentioned, permit a limited amount of axial movement of the sleeve 32 within the head 24. Head 24 further includes an axial extension which in the illustrated embodiment is of two parts 36, 38 occupying diametrically opposed positions on the head 24, and each extending axially outwardly from the axial station of the sleeve 32 and the tool joint component carried thereby. As will hereinafter be described in greater detail, the two portions 36, 38 of the extension are positionable generally radially outwardly of specially constructed portions of the drill pipe. As shown by FIG. 10, in the illustrated embodiment the two portions 36, 38 of the drivehead extension are provided with diametrically opposed, flat, parallel surfaces 40, 42, which will hereinafter be termed "wrench" surfaces.

The drill stem S is of sectional construction. Each section or component is a length of pipe, and more accurately a length of "drill pipe." The drill stem S may consist of standard section 44, such as illustrated in FIGS. 1-3, for example, or special sections (not shown) such as stabilizer sections, collars, subs, etc.

According to the present invention, the standard sections 44 comprise a threaded pin 46 at one end thereof and a threaded box 48 of complementary character at the opposite end thereof. The type of threads used on the pin 46 and in the box 48 may differ somewhat in construction depending on the magnitude of the torque forces which the made up tool joints must carry during normal drilling.

As best shown by FIG. 2, the drill pipe is internally upset for a considerable distance axially inwardly of the pin 46, to provide a substantial wall thickness in that region. A first set of exterior surface depressions are formed on the drill pipe 44 at a location axially inwardly of, and substantially immediately adjacent, the pin 46. In the illustrated embodiment these surface depressions are shown in the form of a plurality of arc-to-chord cuts in the exterior wall of the upset portion. The pipe 44 is shown to include a second set of surface depressions 52 formed in the upset portion at a location spaced axially inwardly of, and substantially immediately adjacent the first set of depressions 50. In the illustrated embodiment the depressions 50, 52 are shown to be identical in construction, but this arrangement is not absolutely necessary, as will hereinafter be explained in some detail. Except at the regions of the depressions 50, 52, the drill pipe 44 has a generally round exterior shape. Radial flanges 54 are located between the pin 46 and the first set of surface depressions 50, and similar flanges 56 are located between the first set of depressions 50 and the second set of depressions 52.

According to the present invention, the first set of depressions 50, which provide the drill pipe with a noncircular cross section at their location, are a part of auxiliary torque transfer means which also includes the drivehead extension 36, 38, and which is employed during the breakout operation. The second set of depressions 52, and the radial flanges 56, constitute a part of means for restraining or anchoring the drill pipe against both rotational and axial movement.

In the illustrated embodiment the wrench surfaces 40, 42, carried by the axial extension 36, 38 of the drivehead 24, are spaced apart a distance that is greater than the outside diameter of the drill pipe in the region of the flanges 54. Thus, they offer no interference to easy passage of the pin 46 into or out

from the box formed in sleeve 32. When it is desired to turn the drill pipe by means of the wrench defined by the drivehead extension 36, 38, the flat and parallel bottom or chord surfaces of a diametrically opposed pair of the surface depressions 50 are set in parallelism with the wrench surfaces 40, 42 carried by the extension 36, 38. Then, a pair of wrench completion blocks 58 are slid sideways into the little nooks defined on the sides by the surfaces 50 or 42 and 50, and on top and bottom by the flanges 54, 56. As clearly shown by FIG. 10, these blocks 58 are sized to snugly fit within such "nooks." In the illustrated embodiment the drivehead extension 36, 38 and the wrench completion blocks 58 together form a radially adjustable wrench means, operable as an auxiliary torque transfer means between the drivehead and the drill stem S.

The wrench table 28, which is located in close proximity to the entrance 60 to the drill hole DH (FIG. 1), includes an opening or slot 62 through which the drill stem S passes. The table 28 includes a square sided (for example) box 64 adapted to snugly fit the outside dimensions of a holding wrench 66. As shown by FIG. 3, the holding wrench 66 may be of the horseshoe wrench type, composed of a pair of laterally spaced, parallel tines 68, interconnected by a stem portion 70 which may be equipped with handle means 72. The horseshoe wrench 66 is in the nature of an open ended wrench, and the open area between the tines 68 and outwardly of the stem 70 is sized to snugly receive the drill pipe at the surface depressions 52. The horseshoe wrench 66 is restrained against rotation by the square sided box 64, and it in turn holds the drill pipe and prevents it from rotating relative to the table 28. In a down drilling operation gravity prevents upward axial movement of the drill pipe, and the overlapping engagement of the radial flanges 56 with the holding wrench tines 68 prevent downward axial movement of the drill pipe.

FIG. 11 discloses a modified form of drill pipe 44' embodying features of the present invention. It comprises a major part 74 and a minor part or sub 76. In this form the major part 74 is formed to include identical threaded boxes at each of its two ends, and the minor part 76 is formed to include identical threaded pins 46 at each of its two ends. Initially the minor part 76 is threadably connected by either one of its tool joints to either one of the tool joints of the major part 74, so as to provide the drill pipe section 44' with a threaded pin at one end thereof and a threaded box of complementary character at the opposite end thereof. Then, when the threads of such pin and box have become worn to a point that one or both of them should be replaced, the two parts 74, 76 are separated where originally joined and are rejoined by mating the worn pin and the worn box. This in effect provides the drill pipe section 44' with a new pin and a new box at its two ends. This is because during the first life of the pipe section 44' the mated inner pin and inner box are always together and do not encounter the type of wear that the end located pin and box experience, through repetitious coupling and decoupling of them with other tool joint components. Besides plain wear the end place pin and box (particularly the pin) are subjected to thread damage, such as by an inadvertent bumping of them against other pieces of drill pipe, the ground, or portions of the drilling machine proper.

A single section with damaged or substantially worn tool joints can have a serious damaging effect on the entire drill stem S and must be repaired or replaced. The reversible sub 76 provides an easy and inexpensive way of repairing or rebuilding a drill pipe section, so as to prolong its useful life. Owing to this construction, it is also possible, following use of both sets of pins and boxes, to rework the ends of the major part 74 to provide it with a new box at each of its ends, and then use with it a new sub or minor part 76. This is a very economical manner of remanufacturing the drill pipe section 44', because the sub 76 is relatively economically manufactured, and it is a relatively easy operation to form new boxes at the ends of the major part 74.

The wrench receiving depressions 50, 52, and the cooperating radial flanges 54, 56 are all formed on the sub 76. In this situation it is necessary to make these parts identical, because when the sub 76 is reversed from its initial position at one end of the major part 74 to its drill pipe life-extending position at the opposite end of the part 74, the depressions which were once the turning wrench receiving recesses 50 become the holding wrench recesses 52, and the depressions which were originally the holding wrench recesses 52 become the turning wrench recesses 50. The radial flanges 54 are provided at each end of the sub 76. The radial flanges 56 are centered between the ends of the sub 76, and functions as the means for restraining the drill pipe against axial movement in the gravitational direction regardless of the end of major part 74 to which the minor part 76 is attached. As shown by FIG. 11, the sub 76 is of symmetrical construction end-to-end (the center of symmetry being a radial plane bisecting the flanges 56).

The breakout technique of the present invention will now be described.

Let it be assumed in the drilling operation depicted by FIG. 1 that the carriage 20 and the drivehead 24 carried thereby are in the process of being moved upwardly along the guide columns 18, and the drill stem S is being withdrawn from the drill hole DH. When the upper or first section 44 is wholly above the wrench table 28, and the holding wrench receiving depressions 52 of the second section 44 are in position at the wrench table 28 to receive the holding wrench 66, axial movement of the carriage 20 is stopped (FIG. 4). The holding wrench 66 is then inserted in place, within the square sided box 64, about the second pipe section at the region of the depressions 52, and below the radial flanges 56. The portion of the drill stem S below the first section 44 is then restrained or anchored against both rotational and downward axial or gravitational movement.

The drivehead 24 is then reversed, i.e. rotated in a tool joint loosening direction, for the purpose of randomly loosening one of the tool joints at the opposite ends of the upper section 44. FIG. 5 relates to the situation when the upper tool joint loosens first, and for the sake of clearer illustration shows the two upper joint components actually separated. FIG. 7 depicts the lower tool joint having loosened first, and also shows the two joint components 46, 48 separated.

Let it be assumed that the random loosening operation caused the upper joint to loosen first. The threads are preferably not totally separated, but rather are maintained loosely joined. The flat and parallel chord surfaces of a diametrically opposed pair of the depressions 50 are oriented, by rotation of the drivehead 24 relative to the upper pipe section 44, to substantially place them in parallelism with the drivehead wrench surfaces 40, 42. Then the wrench completion blocks 58 are slid into place (FIG. 10) as previously described. After this has been done the drivehead is again rotated in the thread loosening direction. The portion of the drill stem S below the upper section 44 is still restrained by the holding wrench 66, and now the wrench completion blocks 58 transmit torque from the drivehead to the upper section 44, resulting in a loosening of the threads at the lower tool joint. With the tool joints at both ends of the upper section now loosened, the upper section can be easily unscrewed and removed from the drill stem S. After this is done the drivehead 24 is lowered and coupled to the next pipe section 44 by loosely screwing together its box and the upstanding pin of the next section 44. The drivehead 24 is then raised, with the weight of the drill stem S being carried by the loosely engaged threads of the loosely made up tool joint, until such next section is in a position for removal wholly above the holding wrench table 28, and the holding wrench receiving depressions 52 of the following section are at the holding wrench station of the table 28. The wrench completion blocks 58 are again inserted between the drive head surfaces 40, 42 and the surfaces of an opposed pair of the turning wrench receiving depressions 50, and the drivehead 24 is operated as before to loosen the threaded tool joint which is now at the wrench table. This

latter stage is repeated with the subsequent sections until all sections of the drill stem S have been removed from the drill hole DH.

If during the initial reversal of the drivehead 24, to cause a random loosening of the tool joints, the lower joint was the first to loosen, then an added stage must be added to the technique in order to effect loosening of the tool joint between the upper section and the drivehead 24. This stage involves maintaining the loosened lower tool joint components coupled, so that their threads may carry the weight of the drill stem S, then removing the holding wrench 66, and then moving the drivehead 24, with drill stem S attached, downwardly until the holding wrench receiving depressions 52 of the upper section are at the holding wrench station at table 28. As shown by FIG. 8, the holding wrench 66 is then set in place and used to support the drill stem S and prevent its rotation. The drivehead 24 is then rotated in the joint loosening direction until the threaded tool joint between it and the upper pipe section 44 is loosened. When this happens the joint components are maintained loosely coupled, again so that the threads can carry the weight of the drill stem S, and then the drivehead 24 is raised to relocate the upper pipe section 44 in a proper position for removal. The holding wrench 66 is reinstalled on the second pipe section 44 and the first section 44, now having both of its tool joints loosened, is easily unscrewed from the second section and from the drivehead 24, and then removed from the drill stem S.

It is to be understood that the character of the auxiliary torque transfer means, the turning wrench receiving depressions and the holding wrench receiving depressions may vary from what is illustrated and described. For example, it may be desirable to make the axial extension of the drivehead 24 annular in shape and provide it with a radially extending bore or passageway that is alignable with a radially extending bore or passageway formed through the drill pipe in the region thereof immediately axially inwardly of the tool joint component and radially inwardly of the drivehead extension. In this situation a rod or large pin may constitute the wrench completion element and be inserted through the aligned bores. In some installations it might be desirable to use a cross pin for anchoring the drill pipe to the wrench table 28. In the illustrated embodiment the wrench completion blocks 58 in effect serve as "keys," i.e. they "key" the drivehead to the drill pipe. In other installations it may be desirable to use "keying" elements of a different shape or character. Although the drivehead 24 is shown and has been described as including a threaded box type of tool joint component, in some installations it might be desirable to provide it with a pin type of tool joint component, in which case the box ends of the pipe sections would be directed toward the drivehead, rather than the pin ends as is illustrated. Also, it is to be understood that the present invention is applicable to a drilling operation in which the drill stem S extends generally upwardly from the drilling machine.

I claim:

1. Drilling apparatus comprising:

a sectional drill stem composed of a plurality of sections joined together by threaded box and pin tool joints, each said section having a threaded pin at one of its ends and a threaded box at its opposite end;

a rotary drivehead including a threaded tool joint component connectable to the drill stem tool joint components which face the drivehead;

means for moving the drivehead axially both towards and away from the ground being drilled; and

breakout apparatus for forcibly loosening the threaded connection between a given first drill stem section connected to the drivehead and the drill stem section second from the drivehead, said apparatus comprising side located wrench element engaging means on said first stem section, adjacent the end thereof connected to the drivehead, breakout wrench jaw means on said drivehead having wrench surface means which in use at least is spaced radially outwardly from the wrench element engaging means on said first stem section, a torque transferring wrench insert element sized to snugly fill the radial space between said wrench surface of the breakout wrench jaw means and the wrench element engaging means on the first stem section, means for holding the second stem section and restraining it against both rotational and axial movement, and means for rotating said breakout wrench jaw means in a joint loosening direction, resulting in a joint loosening rotational torque being transferred from the breakout wrench jaw means to the first stem section through the torque transferring wrench insert element and a loosening of the threaded joint between the first and second stem sections.

2. Drilling apparatus according to claim 1, wherein said breakout wrench jaw means generally surrounds the tool joint component of said drivehead and said tool joint component is movable axially with the first stem section while such first stem section is being rotated in the joint loosening direction for unscrewing it from the held second stem section.

3. Drilling apparatus according to claim 1, wherein said breakout wrench jaw means generally surrounds the tool joint component of said drivehead and each is axially movable relative to the other.

4. Drilling apparatus according to claim 1, wherein the wrench element engaging means on the first stem section is a substantially flat surface, the wrench surface of the breakout wrench jaw means is also a substantially flat surface, and said insert element has a thickness dimension substantially equal to the radial distance between said surfaces and it has substantially flat inner and outer surfaces.

5. Drilling apparatus according to claim 4, wherein said breakout wrench jaw means generally surrounds the tool joint component of said drivehead and said tool joint component is movable axially with the first stem section while such first stem section is being rotated in the joint loosening direction for unscrewing it from the held second stem section.

Disclaimer

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Disclaimer filed June 21, 1973, by the assignee, *James S. Robbins and
Associates, Inc.*

Hereby disclaims the portion of the term of the patent subsequent to
Aug. 26, 1986.

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