Sept. 19, 1939. W. E. BOYD 2,173,676

CORE BARREL CONSTRUCTION

Original Filed Aug. 22, 1932

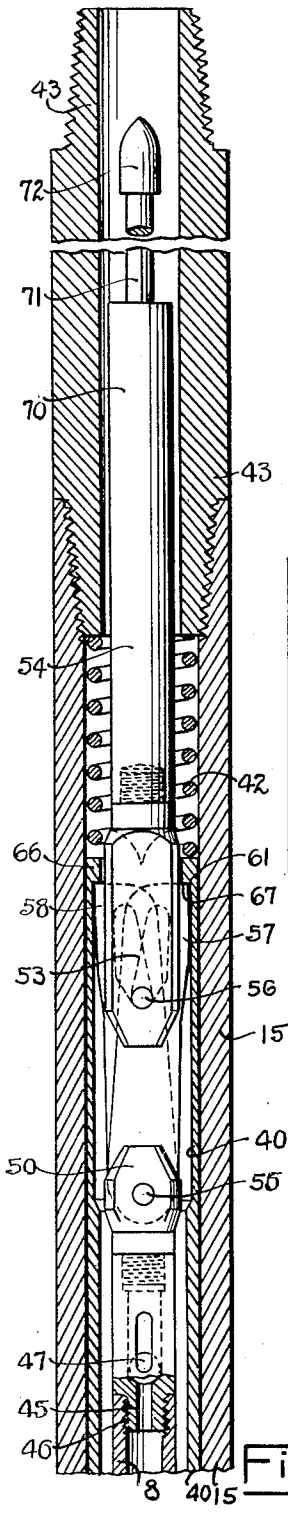


Fig. 1.

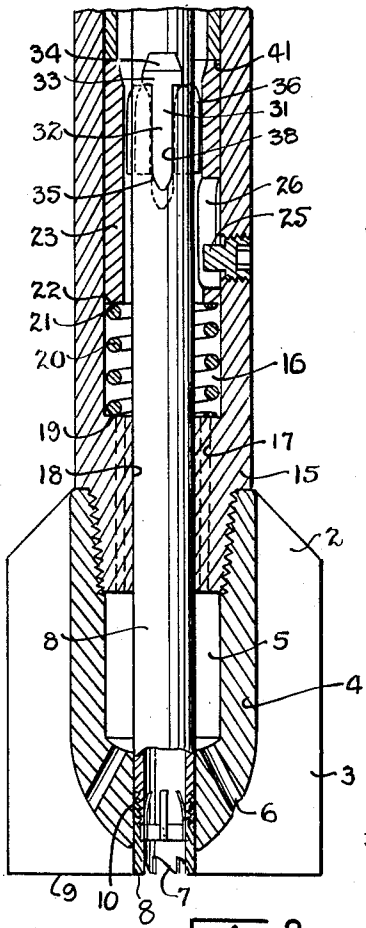


Fig. 2.

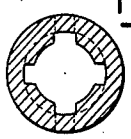


Fig. 6.

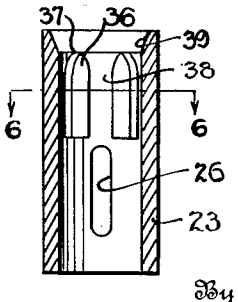


Fig. 5

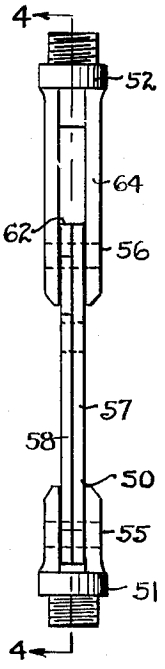


Fig. 3.

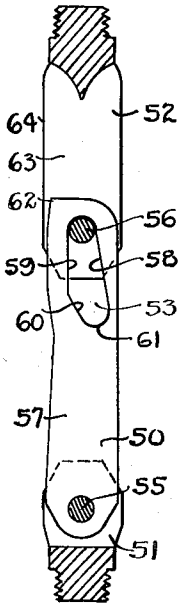


Fig. 4.

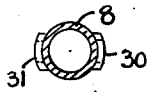


Fig. 8

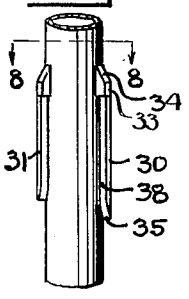


Fig. 7.

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CORE BARREL CONSTRUCTION

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Application August 22, 1932, Serial No. 629,823
Renewed June 4, 1935

19 Claims. (Cl. 255—72)

The invention relates to an improvement in core barrels, particularly of the wire line type wherein the core barrel is removable upwardly through the drill stem so that the core can be obtained without withdrawing the drill stem from the well bore.

It is one of the objects of the invention to provide a core barrel which will be resiliently mounted in the drill bit so that it may yield when occasion arises therefor.

Another object of the invention is to provide a drive bushing to receive the core barrel, and serve as a yieldable mounting therefor in the drill stem.

Another object of the invention is to provide a core barrel including a drive bushing which is yieldably mounted in the drill stem for movement either upwardly or downwardly.

Another object of the invention is to provide in combination with a drill bit and core barrel a spring to absorb the shock of the landing of the core barrel when it is dropped into the drill stem.

Another object of the invention is to provide a combination drive bushing and hold-down member for core barrels.

Still another object of the invention is to provide a simple and economical construction of the core barrel wherein a single element in the drill stem serves to both drive and hold the core barrel in position.

It is also an object of the invention to resiliently mount the core barrel so that it may move ahead of the drill bit, flush with the drill bit or work in a position retracted into the drill bit.

Another object of the invention is to provide a drive bushing and a hold-down bushing, both of which are positioned in the drill stem to hold the core barrel in core-cutting position.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawing wherein:

Fig. 1 is a vertical sectional view of the drill stem and drive bushing showing the upper portion of the core barrel mounted therein.

Fig. 2 is a continuation of Fig. 1 and showing the lower end of the drill stem, the drill bit, and the lower end of the core barrel.

Fig. 3 is an edge elevation of the latching mechanism used to hold the core barrel in position in the drive bushing.

Fig. 4 is a section taken on the line 4—4 of Fig. 3 and looking in the direction of the arrows.

Fig. 5 is a vertical section of the lower end of the drive bushing and showing the drive lugs positioned therein to receive complementary lugs on the core barrel.

Fig. 6 is a section taken on the line 6—6 of Fig. 5, and looking in the direction of the arrows.

Fig. 7 is a broken elevation of the core barrel showing the driving lugs thereon which mesh with the keys in the drive bushing.

Fig. 8 is a section taken on the line 8—8 of Fig. 7 and looking in the direction of the arrows.

By having reference to Figs. 1 and 2, an entire sectional view of the drill bit, drill stem, and portions of the core barrel will be seen.

The drill bit is indicated generally at 2 and may comprise a fish tail bit, as shown, or it may be any other form of core drill, many of which are well known. This drill embodies the blades 3 and the central body portion 4. The body portion is hollow, as at 5, to provide a passage for the flushing fluid passing down through the drill stem and the drill bit. The discharge ports 6 lead from the central passage 5 in a downwardly and outwardly inclined direction so that the flushing fluid will be directed away from the cutting edge 7 of the core barrel 8. In this manner it has been found that the core barrel need not extend ahead of the cutting face 9 of the drill bit and that satisfactory cores can be obtained even in soft formations without forcing the core barrel to extend ahead of the drill bit. The core barrel extends through the body portion 5 by way of the central bore 10, which is preferably of a rather close fit with the core barrel so that there will not be any material amount of flushing fluid pass through the central opening around the core barrel.

Connected to the drill bit 2 is the drill collar or lower end of the drill stem 15. This element may be of any desired length depending upon the length of the core barrel to be employed. The general practice in the field is to extend the length of this drill collar and to make the same as rigid as possible, which aids in obtaining a straight hole because of the rigidity of this mem- of relatively heavy material and of any desired length. The drill collar here illustrated is provided with a central opening, 16, which is arranged to receive the core barrel and its associated parts. The lower end of this passage terminates in the discharge ports 17, which permit the flow of flushing fluid into the drill bit passage 5. The core barrel extends through the opening 18 in the central lower end of the drill collar 15. A shoulder 19 is provided as defining the end of the passage 17 and the end of the passage 18. Seated upon this shoulder 19 will be found the shock ab-

sorbing spring or resilient member 20 which is positioned in the passage 16 and has its upper end 21 abutting against the lower end 22 of the drive bushing 23.

The drive bushing 23 is mounted in the passage 16 of the drill collar and is arranged for vertical sliding movement with respect to the drill collar, but it compelled to rotate with the drill collar by means of the pin 25 and the slot 26. The pin is carried by the drill collar and the slot 26 is formed in the drive bushing 23.

While the term "drill bit" is generally applied to the bit head, and the next section termed the "drill collar", it is intended in this description that the term "drill bit" or "drill" may include the bit head as well as the drill collar.

Fig. 5 shows the drive bushing as a short sleeve which is independent of the hold-down bushing or hold-down member, which will be presently described.

The spring 20 is particularly provided to absorb the shock of landing of the core barrel in its drilling position. The core barrel, it is to be understood, strikes the drive bushing with considerable force when it lands in position because it has fallen by gravity through the column of flushing fluid inside of the drill stem.

The core barrel 8 is provided with the drive lugs 30 and 31, and there may be two or more of these lugs as desired. The lug 30 is preferably somewhat longer than the lug 31 so that it will strike the drive bushing before the lug 31 and tend to rotate the core barrel so that it will pass into its operative position. The lug 31 is seen in side elevation in Fig. 7 and in front elevation in Fig. 2 and preferably comprises a straight vertical portion 32 and the head or stop portion 33. The head 33 is shown as tapered inwardly on its upper end as at 34 so that it will not serve as an obstruction when the core barrel is being withdrawn upwardly through the drill stem. The lower ends of the lugs 30 and 31 are tapered as at 35, so that the core barrel will pass into the core cutting position in the drive bushing 23.

The internal construction and arrangement of the drive bushing 23 is best seen in Fig. 5 and includes the driving keys 36, which are tapered at 37 in order to guide the drive lugs 30 and 31 into the keyways 38 between the keys 36. The lugs and keys are shown in their operative or working position in Fig. 2 with the straight portion 32 of the lugs in the keyways 38. The upper end of the bushing 23 is tapered at 39 so that the core cutter or lower end of the core barrel will be guided into the drive bushing. The head 33 on the drive lugs is of greater width than the body 32 so that it will land upon the upper ends 37 of the keys 36 and limit the downward movement of the core barrel with respect to the drive bushing. Upward movement, however, of the core barrel with respect to the drive bushing is not limited in any manner by the lugs and keys. It should be remembered that the drive bushing 23 can move downwardly from the position shown in Fig. 2 because of the spring 20 and the slot and pin connection with the drill collar 15.

Attention is directed to the fact that there are preferably four of the keys 36 so that each lug is embraced by two of the keys and that the keyways 38, on the opposite sides of the keys engaged, are open for passage of flushing fluid.

The drawing herein shows the drive bushing 23 as made separate and distinct from the hold-down bushing or member 40. The hold-down bushing, however, is positioned in the passage 16 in the drill collar the same as the drive bushing 23. Fig. 2 shows the adjacent ends of the drive bushing and the hold-down bushing as abutting together at 41. It is intended, however, that the drive bushing and hold-down bushing may be made as a single integral member if desired. The hold-down bushing 40 may be of considerable length and extends upwardly in the drill collar 15 to hold the core barrel in position against upward movement with respect to the drive bushing. This hold-down bushing is resiliently mounted in the drill collar because it abuts against the drive bushing 23 which can move downwardly and is held against upward movement by the spring 42, which is passed into the drill collar 15 directly above the hold-down bushing. This spring 42 abuts against the drill sub 43, which is threaded into the upper end of the drill collar 15. The sub 43 serves as a connection for the succeeding joints of drill stem which extend to the surface in a manner well known.

With the foregoing construction it will be seen that the drive bushing and hold-down bushing are supported for sliding movement with respect to the drill collar in which they are mounted and that the hold-down bushing may rotate with respect to the drill collar if desired.

The core barrel 8 extends upwardly and is closed at its upper end by the plug 45 except for a small passage or vent 46, which is closed by the usual type of ball valve 47 to prevent the entrance of flushing fluid from above but to permit the escape of gases or accumulated fluid in the core barrel at the time the core is being taken.

Directly above the plug 45 is the latching mechanism indicated generally at 50. This mechanism is best seen in Figs. 3 and 4 and includes the lower connection 51, which is threaded or otherwise connected to the head of the core barrel. The upper end of the latching mechanism includes a head 52, which is arranged to receive the retrieving device 54, which will be later described. The heads 51 and 52 are provided with pivot pins 55 and 56, respectively. These pivot pins are arranged to receive the latching levers 57 and 58. These levers are so constructed that they will move laterally of the vertical plane of the latching device 50. The lower ends of the levers are pivoted on the pin 55 and can oscillate upon such pin. The upper ends of the levers are confined for very slight lateral movement by the pin 56, which is mounted in the eccentric openings 53. This opening is so designed that it has an inclined surface 58, a straight surface 59, and a second inclined surface 60.

Due to this arrangement, the upper head 52 is slidably mounted with respect to the levers and the lower head 51.

When the core barrel is to be positioned it is dropped into the drill stem and falls by gravity or is forced down by pump pressure to the bottom of the drill stem. It is the experience that the core barrel falls with considerable speed by the force of gravity. As the core barrel passes into the hold-down bushing the levers 57 will be moved inwardly to the position shown in Fig. 4 with the head 52 in its uppermost position. When, however, the drive lugs land in the drive bushing the downward movement of the core barrel and the head 51 as well as the levers 57

will be halted. The head 52 by the force of gravity, however, will continue its downward movement and the pin 56 will move down in the slots 57. The pin will travel along the straight surface 59 and strike the inclined surface 60. The continued downward movement of the pin 56 will cause the lever 57 to move outwardly so that the base 61 of the slot will move into a central position along a central line of the latching mechanism. In this manner the corner 62 of the lever will move outwardly to the position shown in Fig. 1. The lever 58 is identical with the lever 57 except that its position is reversed, so that it will be caused to move laterally in the opposite direction from the lever 57. Fig. 1 shows the two levers in extended position to latch the core barrel to the hold-down member 40. When it is desired to retrieve the bore barrel after the core has been taken, a lifting tool or overshot is connected to the retrieving mechanism 54 and the head 52 is raised. The raising of this head raises the pin 56 which travels along the inclined face 58 to cam the levers back to their retracted position shown in Fig. 4.

This movement withdraws the corners 62 into a position shown in Fig. 4, so that they are within the confines of the slot 63 in the head and the outer surface or edge 64 of the head serves to protect the levers so that they will not serve as obstructions in withdrawing the core barrel.

The upper end of the drive bushing 40 is formed with a head 66, which provides a shoulder 67 beneath which the corner 62 of the latching levers are arranged to engage as seen in Fig. 1. The opening through the head 66 is of sufficient area to permit a flow of flushing fluid through the hold-down bushing around the core barrel.

The upper end of the core barrel is provided with the retrieving mechanism shown generally at 54, which includes the barrel 70. This barrel receives the stem 71, which is provided with a head 72 to receive the overshot or retrieving tool which is lowered into the well when the core barrel is to be removed. The particular form of this retrieving mechanism is shown and described in my co-pending application Serial No. 628,464; filed August 12, 1932, and is adapted to release the overshot in event the core barrel is hung or stuck in the drill bit or bushing. This same prior application also claims broadly the yieldable drive bushing.

It will be noted that practically all of the parts positioned inside of the drill stem are beveled or streamlined so that resistance to the flow of fluid is minimized. The mounting of the drive and hold-down bushings between the springs 28 and 42 permits it to float in accordance with the pressures applied either from above or below so that the cutter may be ahead, flush with, or retracted into the drill bit.

The present invention contemplates broadly the positioning of a combination drive and hold-down bushing which is yieldably mounted in the drill collar so that the shock of landing of the core barrel will be absorbed and the core barrel will be held yieldably against the formation so that the same will not be destroyed by the application of excessive pressure from the drill stem. With the present construction a standard form of drill collar may be used and it is only necessary to provide the additional bushings, springs and core barrel, in order to adapt the construction for use.

What is claimed is:

1. A wire line core barrel for use in combination with a core drill and stem including a barrel portion to be dropped into the core drill, fixed lugs on said barrel, a bushing slidably but non-rotatably mounted in said stem, fixed spaced lugs in said bushing whereby said barrel is caused to rotate with said stem, said bushing being yieldably mounted to move downwardly to absorb the shock of receiving said barrel.

2. In a well coring assembly, a drill stem and drill bit, a drive bushing and a hold-down bushing disposed in said stem and adapted to drive and hold the core barrel, and means yieldably supporting said bushings for movement upwardly or downwardly with respect to said drill stem.

3. In the combination of a core drill and core barrel, a drive bushing carried by the core drill to impart rotation to the core barrel, and means resiliently supporting said bushing for vertical sliding movement with the core barrel.

4. In the combination of a drill and core barrel, a drive bushing to rotate the core barrel, a hold-down bushing to hold the core barrel in core cutting position, and spring means above and below said bushings whereby they may move with the core barrel in response to pressures thereon.

5. A hold-down mechanism for core barrels including a bushing disposed in the drill, means on the core barrel to latch into said bushing to hold the core barrel down, said core barrel being releasable upwardly from said bushing and yieldable means to hold said bushing.

6. The combination of a drill collar adapted to receive a core barrel, a core barrel drive bushing therein, and a resiliently mounted, longitudinally slidable core barrel hold-down bushing also in said drill collar.

7. The combination of a drill collar adapted to receive a core barrel, a core barrel drive bushing therein, a core barrel hold-down bushing also in said drill collar, and resilient means disposed in said drill collar to hold said bushings in a floating position.

8. In a core drill-core barrel combination, a drive bushing to yieldably restrain the core barrel against downward movement, and a hold-down bushing to yieldably restrain the core barrel against upward movement.

9. In a core drill for wells, a drill collar, a core drill thereon, a drive bushing resiliently supported in said drill collar, means to prevent relative rotation of said bushing and said collar, a core barrel insertible downwardly through said drill and said bushing, interengaging means to prevent rotation of said core barrel in said drive bushing, a hold down bushing engaging said drive bushing and said core barrel, and a spring to hold them resiliently downward.

10. A core drill, a drill collar thereon, a drive bushing resiliently mounted in said drill collar, a hold down bushing above said drive bushing, and a core barrel insertible downwardly through said bushings, and adapted to engage therewith, both of said bushings being longitudinally movable in said drill collar.

11. A device of the character described for use with a core drill and core barrel assembly including a vertically slidable drive bushing engaging about said core barrel to cause rotation of the core barrel with the core drill and a holddown bushing to receive said core barrel and engage above said drive bushing and about said core barrel and hold said barrel in core-cutting position.

12. A device of the character described for use with a core drill and core barrel assembly including a drive bushing slidable vertically in said drill and engaging said barrel to cause rotation of the core barrel with the core drill, a holddown bushing, resilient means to hold said holddown bushing against said drive bushing and thus hold the core barrel in core cutting position, and separate devices carried by the core barrel to engage both of said bushings.

13. In a core drilling assembly a core barrel of the character described including a core cutter on the lower end thereof, said barrel being adapted to be dropped into the drill stem to fall to core cutting position, and cushion means to receive said core barrel and absorb the shock of landing.

14. In a core drill and core barrel assembly, a cushion means carried by the core drill, the core barrel being adapted to be dropped into the drill stem to fall to the core drill, said cushion means serving to absorb the shock of landing.

15. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interioraly thereof and arranged for yieldable movement in the direction of the axis of the drill stem and being non-rotatable with respect thereto, an interior abutment therein spaced from said sleeve, of a core barrel assembly arranged to be insertable within and removable from said drill stem having a boring tool normally extending below the end of the drill stem, and means on said core barrel assembly arranged to engage the abutment on said drill stem to limit movement of said core barrel assembly past said sleeve in the direction of said abutment, and means on said core barrel assembly arranged for releasable engagement with said sleeve.

16. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interiorally thereof and arranged for yieldable movement in the direction of the axis of the drill stem and being non-rotatable with respect thereto, an interior abutment therein spaced from said sleeve, of a core barrel assembly arranged to be insertable within and removable from said drill stem having a boring tool normally extending below the end of the drill stem, and means on said core barrel assembly arranged to engage the abutment on said drill stem to limit movement of said core barrel assembly past said sleeve in the direction of said abutment, and means on said core barrel assembly arranged for releasable engagement with said sleeve whereby said core barrel assembly is yieldably urged toward said abutment.

17. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interiorally thereof and arranged for yieldable movement in the direction of the axis of the drill stem and being non-rotatable with respect thereto, an interior abutment, of a core barrel assembly arranged to be insertable within and removable from said drill stem having a boring tool normally extending below the end of the drill stem, and means on said core barrel assembly arranged to engage the abutment on said drill stem to limit movement of said core barrel assembly past said sleeve in the direction of said abutment, and means on said core barrel assembly arranged for releasable engagement with said sleeve whereby said core barrel assembly is yieldably extended beyond the end of the drill stem.

18. In a rotary drill of the class described the combination of a drill stem assembly having an internal sleeve, said sleeve being arranged for limited longitudinal movement with respect to said stem, and being non-rotatable independently of said stem; yieldable means interioraly of said drill stem assembly urging said sleeve longitudinally thereof; an abutment interiorally of said assembly and spaced from said sleeve; a core barrel assembly arranged to be insertable within said drill stem assembly and removable therefrom and means releasably interconnecting said core barrel assembly and said sleeve whereby said core barrel assembly is yieldably urged beyond the end of the drill stem assembly.

19. A rotary drill including a drill stem, a core barrel rotatable with the drill stem and normally projecting below the latter, and means for detachably securing the core barrel with the stem, said means comprising a sleeve carried by the drill stem and reciprocable therein, a spring in the drill stem, and a latch movably mounted on the core barrel for engaging said sleeve to prevent upward movement of the core barrel with respect to the sleeve, said spring serving to exert a downward pressure upon the sleeve and to yield upwardly when hard formations are encountered by the core barrel to permit the core barrel to withdraw into the drill stem.

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