Sept. 19, 1939. W. E. BOYD 2,173,677

CORE BARREL

Filed June 20, 1933 2 Sheets-Sheet 1

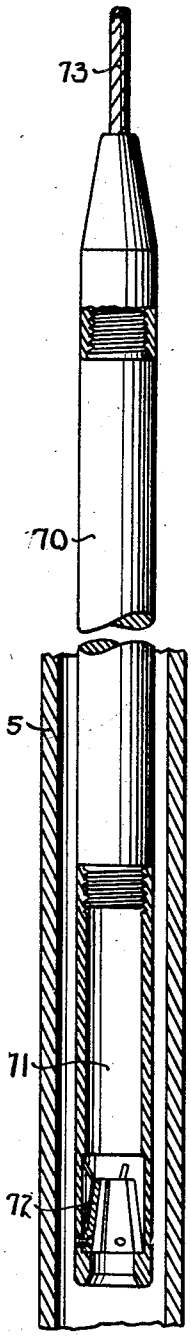


Fig. 1.

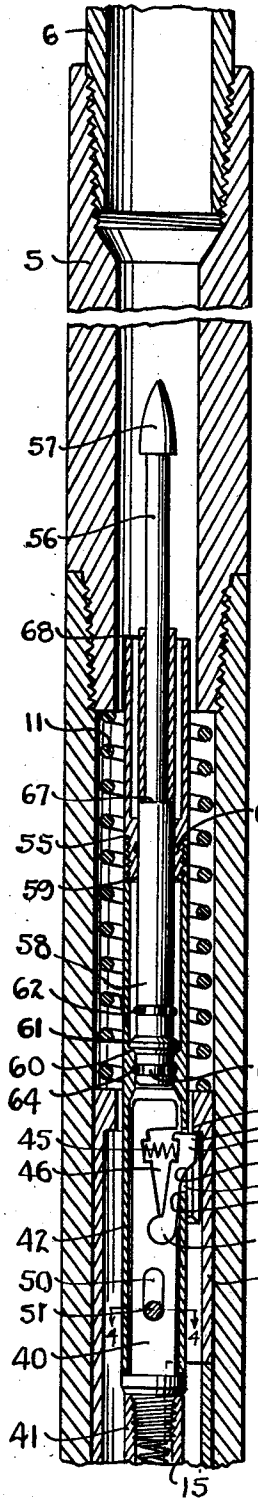


Fig. 2.

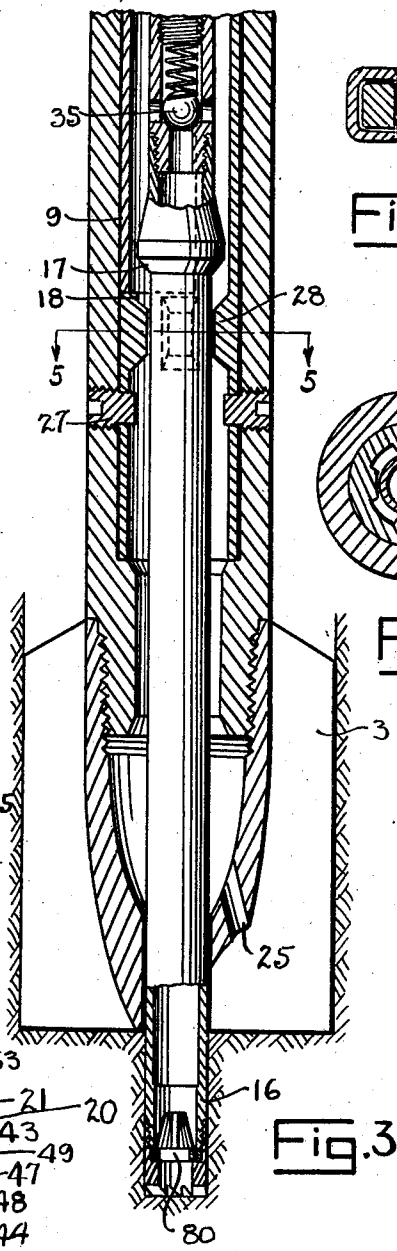


Fig. 3.

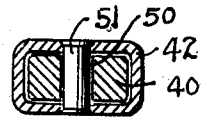


Fig. 4.

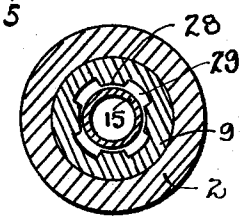


Fig. 5.

Inventor
WILLIAM E BOYD.
Jesse R. Stone
Lester B. Clark
Attorneys.

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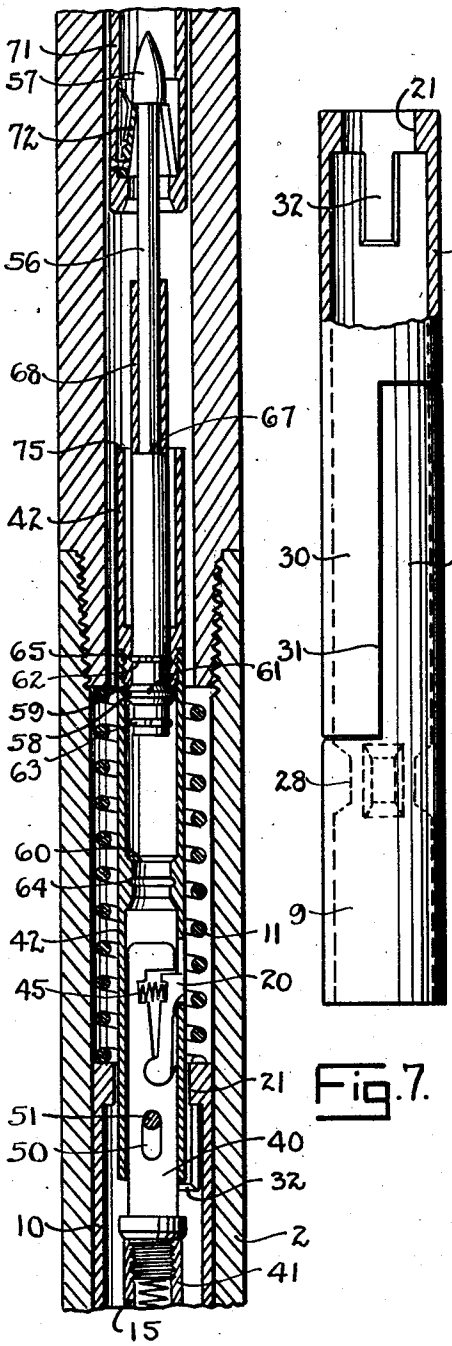


Fig. 6.

Fig. 7.

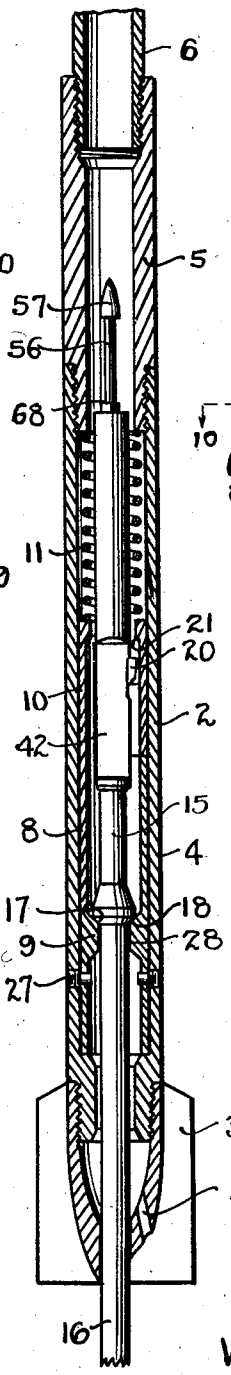


Fig. 8.

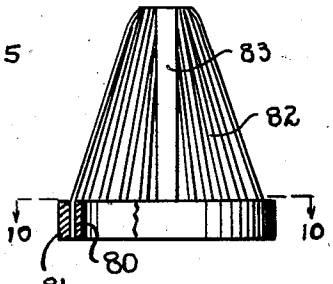


Fig. 9.

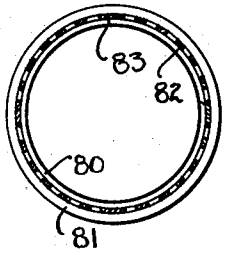


Fig. 10.

Inventor
WILLIAM E. BOYD.
Jesse R. Stone
Lester B. Clark
By
Attorneys

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CORE BARREL

William E. Boyd, Shreveport, La., assignor to The Brewster Company, Inc., Shreveport, La., a corporation of Louisiana

Application June 20, 1933, Serial No. 676,666

23 Claims. (Cl. 255—72)

The invention relates to an improvement in core barrels and is directed to novel latching, driving, and recovering mechanisms for the core barrel.

It is one of the objects of the invention to provide an improved form of retrieve release for the core barrel so that the retrieving tool may be repeatedly released from the core barrel in event the barrel becomes firmly lodged in the core bit and can not be withdrawn.

Another object of the invention is to provide a latching mechanism to hold the core barrel in position with the driving bushing so that there may be a slidable driving connection.

Another object of the invention is to provide a two-part drive bushing so that the core barrel may be caused to rotate with the core drill and have vertical sliding movement with respect to the core drill during the rotation thereof.

Another object of the invention is to provide a seal between the core barrel and the drive bushing so that circulation of fluid may be cut off, when the core barrel is in its lowermost extended position.

Another object is to provide a seal between the core barrel and the drive bushing so that the flow of fluid is cut off when a very soft formation is encountered by the core barrel which permits the core barrel to move to its lowermost position.

Another object of the invention is to provide a core drill and core barrel wherein the circulation of fluid will be automatically cut off when a very soft formation is encountered so that the circulating fluid will not wash away the core.

The present invention relates to somewhat similar subject matter to that disclosed in my copending application Serial No. 629,823, filed August 22, 1932.

The invention will be readily understood by reference to the accompanying drawings wherein

Fig. 1 is a side elevation partly in section and showing the overshot or retrieving tool.

Fig. 2 and Fig. 3 are vertical sectional views of top and bottom, respectively, of the core drill and core barrel with the core barrel latched in position.

Fig. 4 is a section taken on the line 4—4 of Fig. 2 and showing the construction of the slip joint latching mechanism.

Fig. 5 is a section taken on the line 5—5 of Fig. 2 and showing the arrangement for sealing off the flow of liquid when the core barrel is in its lowermost position.

Fig. 6 is a sectional view showing the retrieving tool in position to remove the core barrel from the core drill.

Fig. 7 is a side elevation partly in section of the two-part driving bushing.

Fig. 8 is a vertical sectional assembly view of the entire core drill and core barrel.

Fig. 9 is a side elevation of the improved form of core catcher which may be used in the core barrel.

Fig. 10 is a section taken on the line 10—10 of Fig. 9 and showing the arrangement of the fingers in the core catcher.

By having reference to Fig. 8, the core drill is indicated generally at 2 and comprises the drill head 3, the drill collar 4, and the drill sub 5, all of which are connected in the order named to the drill stem 6. Disposed inside of this core drill is the drive bushing 8, which is made up of the drive sleeve 9 and the driven sleeve 10. The driven sleeve 10 being normally urged downwardly against the drive sleeve 9 by means of the spring 11 which abuts against the lower end of the drill sub 5.

The core barrel is indicated generally at 15 and is arranged to move into the core drill by being dropped through the drill stem 6 so that it will fall by gravity until the lower end 16 thereof passes into the bit head 3 and the shoulder 17 on the core barrel engages the shoulder 18 in the drive bushing 8. This limits the downward movement of the core barrel and is so constructed that when the core barrel is in its lowermost position the latch 20 will move outwardly from the core barrel and will catch beneath the rim 21 of the driven bushing 10 to prevent upward movement of the core barrel except in combination with the driven bushing 10. The latch 20 is engaged by the driven bushing 10 so that the core barrel will be caused to rotate with the core drill.

The drill bit may be formed in any desired manner and is provided with the passages 25 so that liquid may be circulated during the drilling and coring operations to wash away the cuttings from the bit.

The drill collar 4 has the drive bushing 9 disposed therein and preferably fixed to the drill collar by means of anchor bolts 27 so that the drive bushing will be fixed in the drill collar as to elevation and rotation. The inside of the bushing 9 is provided with the outstanding lugs 28, which are best seen in Fig. 5 and form the shoulder 18 which receives the shoulder 17 formed on the core barrel. It will be noted that the passages 29 are formed between the lugs 28

but these passages are of such a radial thickness that when the shoulder of the core barrel seats on the shoulders 18 the shoulder 17 extends radially beyond the passages and serves to cut off any flow of liquid through these passages. This construction forms a seal at this point which is of advantage when the core barrel strikes a very soft formation and is moved downwardly by the spring 11 because as soon as the core barrel moves to its full extended position the shoulder 17 engages the shoulder 18 and cuts off any flow of liquid. Thus the flow of liquid to the drill bit could be cut off automatically whenever the core barrel strikes a very soft formation and even before the operator is aware of this fact. The engagement of the shoulders 17 and 18 may also be used to indicate to the driller when the core barrel has landed in position when it is first inserted, because the circulation of liquid is then cut off.

The drive bushing 9 above the lugs 28 is provided with the drive portion 29 which is in the form of a semi-circle or half round projection which is arranged to receive a similar and complementary portion 30, which is formed on the driven bushing 10. The thrust caused by the rotation of the drive bushing 9 is imparted to the drive bushing 10 by the engagement of the parts 29 and 30. These parts may engage along the entire length of their contacting faces 31 when the drive bushings are in the position shown in Fig. 9. The upper end of the driven bushing 10 is in the form of a sleeve which has the overhanging rim 21, which is arranged to receive the latch 20 thereunder, and in this manner prevent upward movement of the core barrel. A drive lug 32 is shown as position inside of the driven bushing 10 and upon rotation of the bushing this lug 32 will engage the latch 20 and impart to the core barrel the rotation of the core drill.

The spring 11 normally bears against the upper end of the driven bushing 10 and tends to urge this bushing into the position shown in Figs. 7 and 8, the upper end of the spring abutting against the lower end of the drill sub 5 so that the spring is confined in this area. Of course, when the cutting end 16 of the core barrel engages a formation to cut the core there will be some resistance to penetration and this will be taken up by the spring 11. When the core barrel moves upwardly upon encountering the formation the latch 20 will engage the rim 21 and cause the driven bushing 10 to move upwardly with the core barrel against the resistance of the spring 11.

In this manner if a very hard formation is encountered the core drill can move up into the bit head 3 so that the bit head will take the entire thrust caused by the weight of the drill pipe 6. The spring 11 normally urges the cutting end 16 of the core barrel against the formation and, if desired, it may be constructed so that the end of the core barrel projects ahead of the cutting faces of the core drill 3 or it may be constructed so that in normal cutting position the core barrel is flush with the core drill.

The valve 35 may be positioned in the core barrel so that the liquid being pumped into the well will not enter the core barrel and so that any liquid forced out of the core barrel by the entrance of the core will escape past the valve 35.

The latching mechanism is best seen in section in Fig. 2 and includes the stem 40 which is attached to the barrel portion 41 of the core barrel 15. This stem is arranged to have telescoped thereover the sleeve 42 which serves to accommodate the latch 20 and move it to retracted position when the core barrel is to be retrieved after the core has been cut. The latch 20 includes the dog 43 which is pivoted at 44 in the stem 40 and is normally urged outwardly by the spring 45. This dog is, of course, disposed in the recess 46 in the stem 40. The sleeve 42 has an opening 47 therein through which the dog 43 is adapted to project when the opening 47 is at the proper elevation. When, however, the sleeve 42 is telescoped upwardly with respect to the stem 40 the edge 48 at the lower side of the opening 47 engages the curved portion 49 of the dog at 43 and cams the dog inwardly to withdraw it from beneath the rim 21 on the driven bushing 10. Thus, in order to allow the latch to move outwardly it is only necessary for the sleeve 42 to telescope downwardly on the stem 40 to the position shown in Fig. 2 and, to release the latch, the sleeve 42 need only be moved upwardly to cause the dog 43 to move into the confines of the sleeve.

The relative sliding movement of the stem 40 and the sleeve 42 is limited by means of the slot 50 sliding on the pin 51. In order to manipulate the sleeve 42 the trip release mechanism is indicated generally at 55. This release mechanism includes the rod 56 which is provided with the head 57 and the enlarged portion 58. The enlarged portion is slidably arranged within the upper end of the sleeve 42 but is limited as to sliding movement by the upper seat 59 and the lower seat 60. These seats serve to confine the enlarged portion 58 because of the flange 61 thereon which is arranged to engage either the seat 59 or the seat 60. Arranged on this enlarged portion 58 are the latch rings 62 and 63, which are in the form of spring rings disposed in a groove in the rod. Each of these rings are arranged to spring outwardly into a recess such as 64 in the central portion of the sleeve 52 or the recess 65 at the upper end of the sleeve. The ring 63 is shown as seated in its recess 64 in Fig. 2, and in Fig. 6 the rod is shown as moved to its uppermost position with the ring 62 seated in its recess 65.

The differences in diameter between the rod 56 and the enlarged portion 58 form a shoulder 67, upon which the release nipple 68 will normally rest. This nipple is slidably mounted upon the rod 56 and is provided to release the overshot or retrieving tool 70 from the core barrel when the core barrel can not be removed as intended. The release nipple 68 is of substantially the same diameter as the largest portion of the head 57.

The overshot 70 carries a hollow tube 71 on its lower end which is provided with a plurality of pawls 72 which are arranged to engage beneath the head 57, as seen in Fig. 6, in order to exert an upward pull on the core barrel to retrieve it after the core has been taken. The parts in Fig. 6 are arranged in substantially the position they would assume as the core barrel is being removed from the well with the latch 20 having been retracted and released from the rim 21 of the driven bushing 10. With the parts in this position it will be noted that the rod 56 has moved upwardly in the sleeve 42 until the flange 61 engages the upper seat 59. This makes a positive connection and a considerable pull can then be exerted on the retrieving tool 70 by means of the cable 73, which is used to manipulate the retrieving tool.

In some instances where sand or other materials have lodged about the core barrel or where it becomes otherwise wedged in position, it is impossible to at first remove the core barrel when it is engaged by the retrieving tool. Obviously it is desirable then to release the retrieving tool from the core barrel and with the parts in the position shown in Fig. 6 the cable 73 may be slacked off so that the weight of the retrieving tool 70 will cause it to slide downwardly with respect to the rod 56, so that the pawls 72 will be moved outwardly and serve to grip the release nipple 68. It will be remembered that the rod 56 is held in its uppermost position because the spring ring 62 has been received into its recess 65.

When the pawls 72 have moved outwardly and are frictionally engaging the release nipple 68 the retrieving tool can be again raised with respect to the core barrel. Inasmuch as the dogs 72 are pressing against the release nipple 68, this nipple will slide upwardly with the retrieving tool until it abuts against the underside of the head 57. This stops the sliding movement of the release nipple and the pawls 72 are in this manner caused to slide over the head 57 so that the retrieving tool is completely released. Of course, the release nipple will then drop by gravity to the position shown in Fig. 6 and if desired the retrieving tool can be removed from the well and if it is determined that the core barrel can not be removed, then the entire drill stem and core drill can be withdrawn and the core barrel removed.

In many instances, however, it is desirable to make a number of attempts to release the core barrel and if this is desired the retrieving tool can be raised and lowered inside of the stem so that it will strike the head 57 and cause the rod to move downwardly to the position shown in Fig. 2, or the retrieving tool may be again lowered over the rod 56 until it engages the upper end 75 of the sleeve 42. When in this position, if the retrieving tool is raised sharply a considerable jar

bination driving and latch bushing in said drill comprising two interfitting semi-circular portions, one of which is driven by the core drill and the other of which serves to drive the core barrel.

2. A core drilling assembly including a core drill, a core barrel carried thereby, and a combination driving and latch bushing in said drill comprising two interfitting semi-circular portions, one of which is driven by the core drill and the other of which serves to drive the core barrel, said portions having a sliding engagement whereby said core barrel may have limited movement relative to said core drill.

3. A drive mechanism for core barrels including a drive bushing anchored in the core drill and having an upstanding driving portion, a driven bushing slidably mounted in the core drill and having a downwardly extending complementary portion to be engaged by said driving portion on said drive bushing, and means on said driven bushing to impart rotation to the core barrel.

4. A drive mechanism for core barrels including a drive bushing anchored in the core drill and having an upstanding driving portion, a driven bushing slidably mounted in the core drill and having a downwardly extending complementary portion to be engaged by said driving portion on said drive bushing, means whereby on said driven bushing to impart rotation to the core barrel, and additional means to normally urge said driven bushing downwardly.

5. In a core drilling assembly a core drill, a core barrel adapted to be disposed therein, a drive bushing to cause said core barrel to rotate with said core drill, and co-engaging sealing shoulders on said core barrel and said bushing whereby the circulation of liquid thru said bit is cut off when the core barrel is in its lowermost position.

6. In a core drilling assembly a core drill, a core barrel adapted to be disposed therein, a

part a jar to the core barrel, and a latching mechanism for the core barrel adapted also to impart a jar to the core barrel.

11. A core drilling construction including a core barrel, means to limit the downward movement of the core barrel with respect to the core drill, said means tending to center the core barrel in the drill and to also cut off the circulation of liquid to the drill as an indication to the operator that the core barrel is in its lowermost position.

12. A combination latch and drive means for wire line core barrels including a latch and drive member carried on the core barrel structure, a sleeve about the core barrel structure, and means whereby the sleeve is slidable to engage and retract said member when the core barrel is to be released.

13. A jar release for wire line core barrels wherein a latch on the core barrel engages a driving means in the core drill, comprising a sleeve connected to the retrieving mechanism and movable thereby to retract said latch and jar the core barrel.

14. A retrieving head for wire line core barrels including a sleeve carried by the upper end of the core barrel, a rod slidable therein, a pair of spaced grooves inside of said sleeve, and a pair of expansible rings on said rod, one of which is adapted to fit in each of said grooves whereby said rod may be held in either raised or lowered position.

15. In combination with a retrievable core barrel, a retrieving tool receiving member, and means to position said member on the core barrel in either retrieving tool receiving or releasing position.

16. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interiorly 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.

17. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interiorly 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.

18. In a rotary drill of the class described the combination including a drill stem having a sleeve mounted interiorly 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.

19. 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 interiorly of said drill stem assembly urging said sleeve longitudinally thereof; an abutment interiorly 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.

20. The combination with a rotary drill stem, of a core barrel rotatable with the stem, a member slidable longitudinally within the stem, movable means carried by the core barrel and cooperable with said member for detachably securing the core barrel within said member, and yieldable means mounted in the stem normally urging said member downwardly, said yieldable means being adapted to permit the core barrel and said member to move upwardly a limited distance relatively to the stem upon encountering a hard formation, said member and means being hollow so that the core barrel may be inserted or withdrawn.

21. 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 within 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.

22. A rotary drill including a drill stem having a shoulder therein, a core barrel rotatable with the stem, a sleeve vertically movable in the drill stem below said shoulder, a spring in said drill stem between the sleeve and shoulder, a dog pivotally carried by the core barrel, a releasing device movable with respect to the dog, and yieldable means cooperating with the dog to yieldably hold it in operative position, said core barrel being insertable downwardly in the drill stem into operative position and said dog being movable underneath the sleeve when the core barrel is in said position, said spring serving to exert a downward pressure on the core barrel and to yield upwardly to permit the latter to withdraw into the drill stem when hard formations are en-

countered, said dog being movable into inoperative position upon upward movement of said releasing device and said core barrel being removable upwardly through the drill stem by an upward pull on the releasing device.

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

WILLIAM E. BOYD.