

Mar. 27, 1923.

O. E. MOORE

1,449,533

WELL DRILLING APPARATUS

Filed Jan. 30, 1922

3 sheets-sheet 1

Fig. 1.

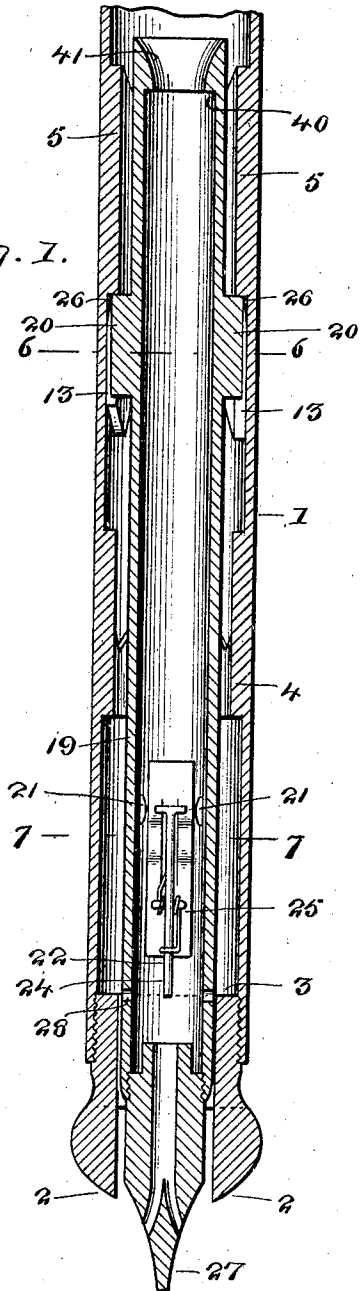
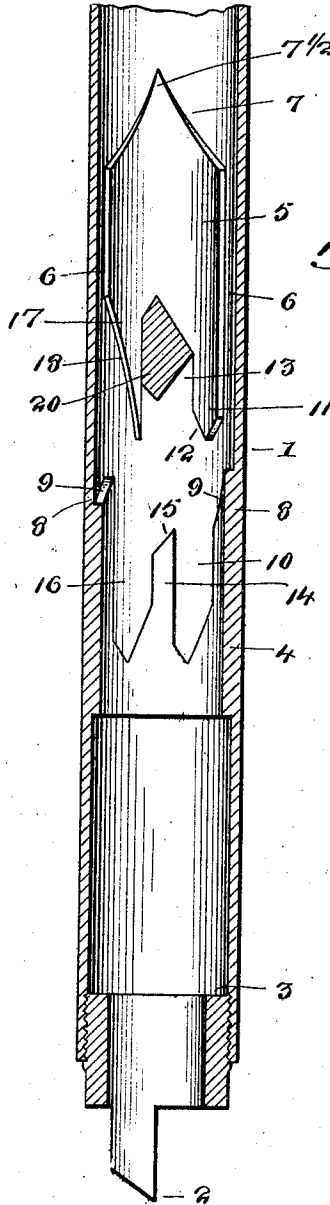


Fig. 2.



WITNESSES

E. Q. Ruppert.
R. F. Michle, Jr.

INVENTOR

O. E. Moore

BY Victor J. Evans

ATTORNEY

Mar. 27, 1923.

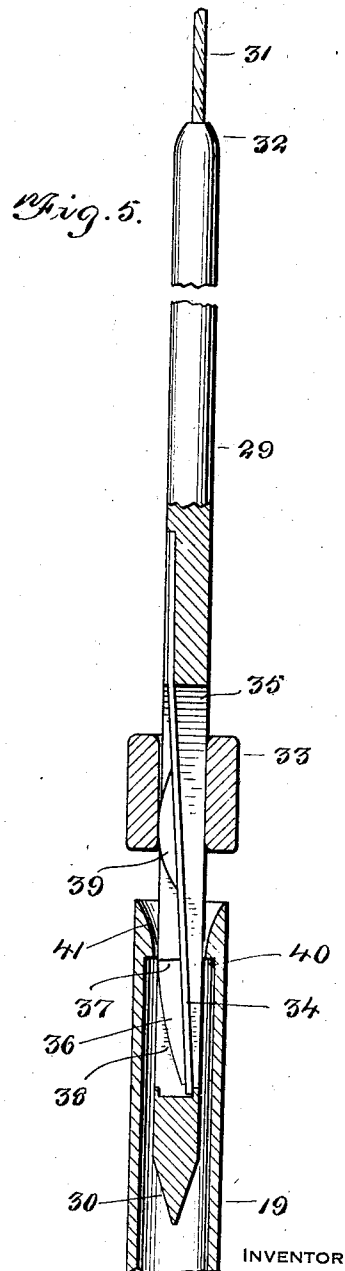
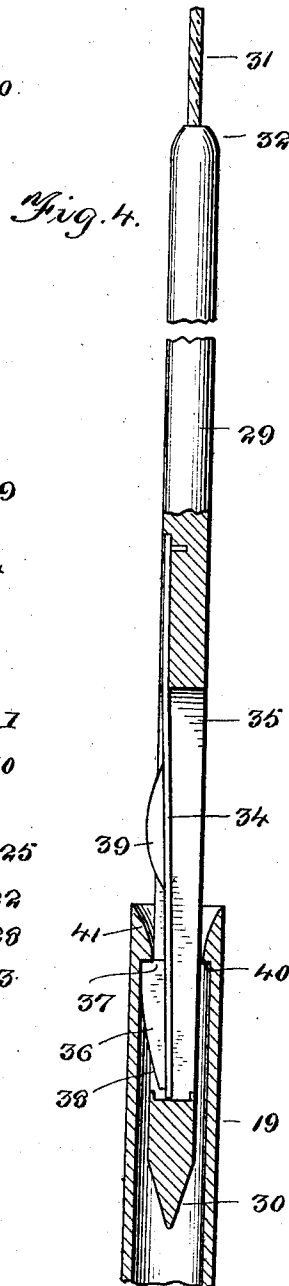
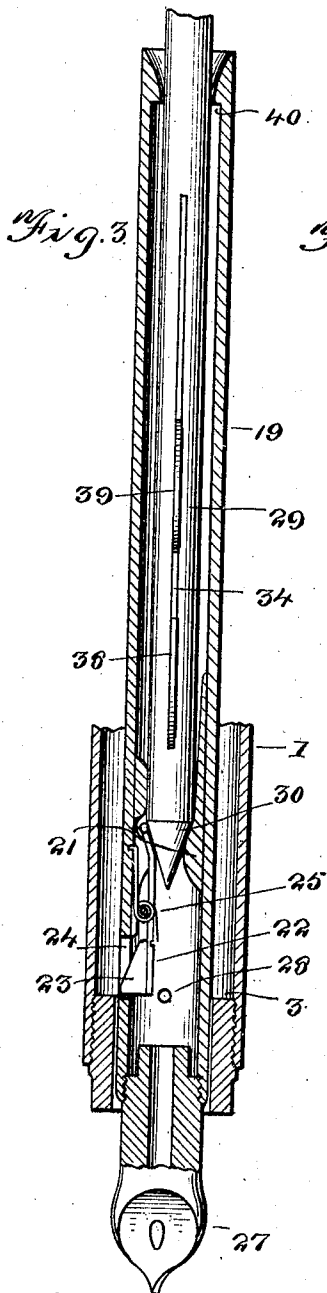
O. E. MOORE

1,449,533

WELL DRILLING APPARATUS

Filed Jan. 30, 1922

3 sheets-sheet 2



WITNESSES

E. R. Ruppert
R. F. Mickle, Jr.

O. E. Moore

BY Victor J. Evans

ATTORNEY

Mar. 27, 1923.

O. E. MOORE

1,449,533

WELL DRILLING APPARATUS

Filed Jan. 30, 1922

3 sheets-sheet 3

Fig. 6.

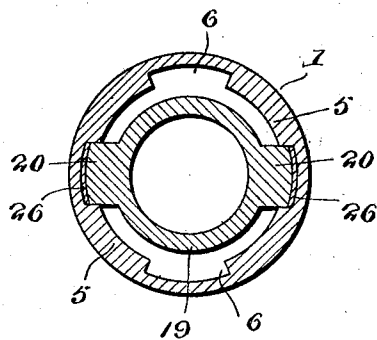


Fig. 7.

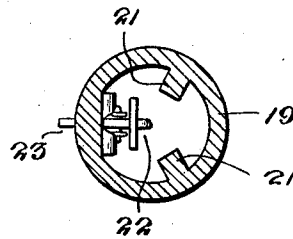


Fig. 9.

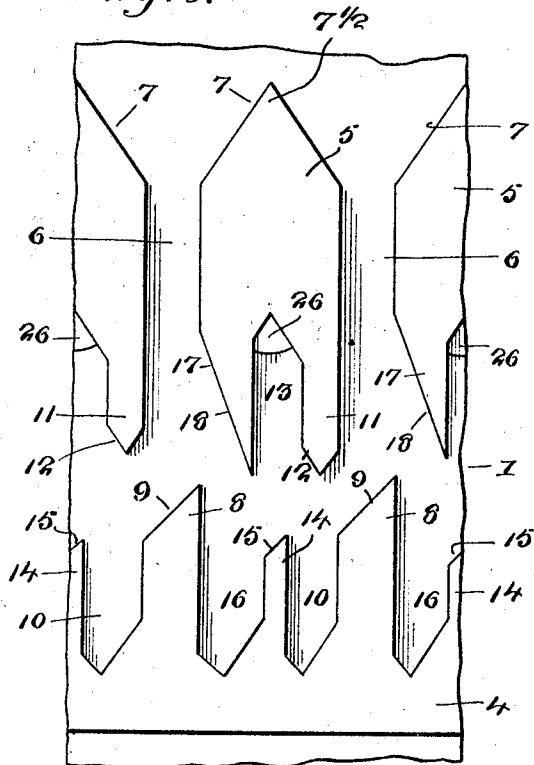


Fig. 8.

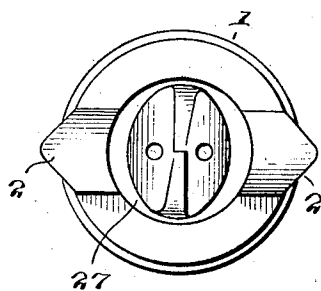
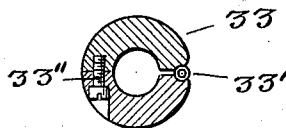


Fig. 10.



WITNESSES

E. R. Ruppert
R. F. Mickle, Jr.

O. E. Moore

BY Victor J. Evans

ATTORNEY

UNITED STATES PATENT OFFICE.

OSCAR E. MOORE, OF DORRIS, CALIFORNIA.

WELL-DRILLING APPARATUS.

Application filed January 30, 1922. Serial No. 532,817.

To all whom it may concern:

Be it known that I, OSCAR E. MOORE, a citizen of the United States, residing at Dorris, in the county of Siskiyou and State of California, have invented new and useful Improvements in Well-Drilling Apparatus, of which the following is a specification.

My invention relates to well drilling apparatus and has for its object; first, to provide an outer drill tube and an inner drill tube and means for driving said inner drill tube from said outer drill tube, said means being adapted to be operated from the upper end of the outer drill tube to disengage said inner drill tube from said outer drill tube to remove the same, second, to provide an outer drill tube and a short inner drill tube and means for driving said inner drill tube from said outer drill tube and means for disengaging said inner drill tube from said outer drill tube whereby the inner drill tube may be removed from the outer drill tube without withdrawing the outer drill tube from the hole.

A further object of my invention is to provide an outer drill tube and a short inner drill tube adapted to be engaged and driven by the outer drill tube, the driving engagement of the tubes being such that the inner drill tube may be disengaged from the outer drill tube by means of a rope so that said inner drill tube may be removed from the outer drill tube without necessitating withdrawing the outer drill tube from the well hole.

My invention is particularly adapted for driving of deep wells where strata of different hardness are encountered. In drilling deep wells only a certain amount of weight is available to drive the drill downwardly, and when drilling through hard strata the weight of downward pressure is not sufficient to force the drill downwardly and the drill merely slips over the hard surface of the stratum. My invention contemplates drilling a small hole through these hard strata in advance of the larger hole by lengthening the inner drill tube and telescoping it through the bottom of the outer tube.

In my invention the inner tube and inner drill may be quickly removed from the well, leaving a clear circular opening in the center of the bottom of the outer drill, said opening being approximately one-half the diameter of the outer tube. Then by raising the outer tube and drill a short distance, churn

drills and cable tools may be freely used through this opening and the hardest strata drilled without removing the outer or main drilling tube from the well. In this method the available weight is concentrated upon the smaller drill when drilling through hard strata, and sufficient weight is available to drive the drill downwardly. In conjunction with this the detachable driving connection between the outer drill tube, upon which the reamer is mounted, and the inner drill tube, upon which the small drill is mounted, is very beneficial in that a new drill may be mounted upon the inner drill tube without necessitating withdrawing the outer drill tube from the hole. And further, in the use of a small drill and a following reamer, the hardest work is placed upon the drill, which, it will be noted, is easily replaced and the reamer has comparatively light service to do in reaming out the hole after it is made by the drill. As a result it is not necessary to renew the reamer frequently, and inasmuch as the inner drill may be easily replaced the drilling of deep wells is greatly facilitated in the use of my invention.

My invention is also a very useful device for setting well screens in oil or water sands. The small hole may be drilled any desired distance in advance of the larger hole in such sands, then remove the small drill from the inner tube and attach the desired length of screen pipe to the inner tube and lower it into place in the same manner as if placing the inner drill in drilling position, then the outer tube may be left in the well for well casing with the screen attached as stated.

The device is also useful in furnishing a means of access to the bottom of the well hole so that cementing or plugging may be advantageously accomplished when necessary or desirable and a core barrel bit may be used at any time.

Frequently it is necessary to cement the well outside the well casing in order to cut off water from running into oil sands.

With these and other objects in view which will be hereinafter fully described and particularly pointed out in the claims, the invention consists in the novel construction and arrangement of parts illustrated in the accompanying drawings forming a part of this specification, in which:—

Figure 1 is a vertical sectional view of a drilling apparatus embodying my invention,

showing the inner and outer drill tubes in driving engagement with each other.

Figure 2 is a similar view with the inner drill tube removed, a vertical section of one of the driving lugs of the inner tube being shown in driving relation with the outer drill tube.

Figure 3 is a vertical sectional view of the inner drill tube with the operating spear inserted therein to retract the tube latch.

Figure 4 is a vertical sectional view of the upper portion of the inner drill tube showing the spear latch in engagement with the inner drill tube.

Figure 5 is a similar view showing the weighted collar in engagement with the spear latch cam whereby the spear may be disengaged from the inner drill tube.

Figure 6 is a horizontal section of the device on the line 6—6 of Figure 1.

Figure 7 is a horizontal section of the inner drill tube on the line 7—7 of Figure 1.

Figure 8 is a bottom plan view of the device.

Figure 9 is a diagrammatic view of a part of the engaging and disengaging cams, the cams being laid out flat to illustrate the action of the same relative to the driving lugs of the inner drill tube.

Figure 10 is a detail view of the weighted collar.

Like characters of reference indicate like parts in the various views.

In the drawings 1 designates the outer drill tube which has a reaming cutter 2 screw threaded into the rear end thereof and having an upwardly facing shoulder 3. Secured within the outer drill tube some distance above the shoulder 3 is a cam ring 4 which is provided with an upwardly facing cam surface formed with alternate high and low portions. Secured within the outer drill tube some distance above the cam ring 4 are cam plates 5 which have downwardly facing cam surfaces formed with high portions, said high portions being disposed above respective low portions of the cam surface of the cam ring 4. In the preferred embodiment of my invention two cam plates 5 are provided, although any number may be used. Said cam plates 5 are spaced apart and form slots 6 therebetween, and have diagonally disposed upwardly facing cam surfaces 7 formed at the upper ends thereof, leading upwardly from said slots. The cam surface of the cam ring 4 is provided with relatively high portions 8 which are disposed directly below respective slots 6. The upper ends of said high portions 8 are slanted downwardly toward the left, as designated at 9, and lead into respective low portions 10, and high portions 11 of the cam plates 5 are disposed above respective low portions 10 and have surfaces 12 at the extreme end thereof which slant upwardly

to the left and lead into respective longitudinal recesses 13 formed in the cam plates 5. High portions 14 are formed on the cam ring 4 and extend upwardly just below respective recesses 13, and have surfaces 15 at the extreme upper ends thereof which slant downwardly and to the left and lead into respective low portions 16 of the cam ring. High portions 17 are formed on the cam plates 5 and extend downwardly toward respective low portions 16 and have surfaces 18 which slant upwardly and to the left and lead into respective slots 6.

19 designates an inner drill tube which is adapted to fit within the cam ring 4 and the cam plates 5. A pair of lugs 20 are secured upon opposite sides of the inner drill tube and are adapted to engage the cam surfaces of the cam ring 4 and the cam plates 5. When the inner drill tube is inserted into the outer drill tube from the upper end thereof, the lugs 20 engage respective upwardly facing cam surfaces 7 of the cam plates 5, and are guided thereby into respective slots 6. Upon further downward movement of the inner drill tube the lugs 20 encounter respective slanting surfaces 9 of the high portions 8 and are guided thereby into respective low portions 10 of the cam ring, the drill tube rotating to the left as it moves downwardly. The drill tube is now moved upwardly, and the lugs encounter respective slant portions 12, of the high portions 11 of the cam plates 5, and are guided thereby into respective recesses 13, the tube turning to the left during this movement. This engagement of the lugs 20 with respective recesses 13 constitutes the driving engagement of the outer drill tube with the inner drill tube, means, which will be hereinafter described, being provided for retaining said lugs in engagement with said recesses. When it is desired to remove the inner drill tube from the outer drill tube, said inner drill tube is moved downwardly from this position, whereupon the lugs 20 encounter respective slant surfaces 15, of the high portion 14 of the cam ring 4, and are guided into respective low portions 16, the drill tube turning toward the left during this movement. The inner drill tube is then moved upwardly and the lugs 20 engage respective cam surfaces 18, of the high portions 17 of the cam plates 5, and are guided into respective slots 6 thereby, the inner drill tube turning toward the left during this movement. When the lugs 20 move into the slots 6 the tube may be lifted upwardly out of the outer drill tube.

It will be noted that the high portions 7, 11 and 17 of one of the cam plates 5 are longer than corresponding high portions of the other cam plate 5, and that the corresponding high portions 8 and 14 of the cam

ring 4 are also relatively high, respecting the other high portions 8 and 14 of the cam ring, so that when the inner drill tube is manipulated to engage the cams with the lugs 20, one of said lugs will engage the slanting portions of said above noted relatively high portions before the other lug engages the same. As a result, these relatively high portions engage one of the lugs 20 and turn the inner drill tube before the opposite lug engages its respective cam surfaces whereby the lugs are prevented from engaging the opposite sides of any corresponding pair of high portions and clamping thereon.

A series of radial projections 21 are secured within the inner drill tube near the bottom thereof. A latch lever 22 is pivoted at a point intermediate the ends thereof upon the inner wall of the inner drill tube and has its upper end lying in the planes of said radial projections 21, and is provided at its lower end with a latch member 23 which is adapted to normally project through a slot 24 in the wall of the inner drill tube. A spring 25 having its one end secured to the inner drill tube, and having the other end thereof engaging said latch lever 22, serves to retain said latch member 23 projecting through said slot 24. The latch member 23 is so disposed that, when the lugs 20 are in engagement with respective recesses 13 said latch lever engages the shoulder 3 of the reaming cutter 2 to prevent the inner drill tube from moving downwardly and disengaging said lugs 20 from the recesses 13. Wedge cams 26 are formed upon the outer drill tube and are disposed within respective recesses 13 and serve to center the inner drill tube within the outer drill tube when said lugs 20 are in engagement with said recesses 13. A drill 27 is screw threaded into the lower end of the inner drill tube, and holes 28 are formed just above the same to allow water to be pumped down through the drill tubes to wash away the cuttings of the drill.

29 designates the operating spear of the device. The lower end of the spear is pointed as is designated at 30 and a rope 31 is secured to the upper end thereof, said upper end being rounded, as designated at 32, to allow a weighted collar 33 to slide over the same. A latch lever 34 has its upper end secured upon said spear, and has its lower end adapted to move in a slot 35 formed in said spear. The lower end of said latch lever 34 is provided with a latch member 36 having an upwardly facing shoulder 37 formed thereon and a downwardly facing cam surface 38 formed below said shoulder. A cam 39 is mounted upon said latch lever 34 some distance above said latch member 36, and the weighted collar 33 is adapted to slide over said spear

and engage said cam 39 to retract the latch member 36 within the slot 35. An inwardly extending flange 40 is formed at the upper end of the inner drill tube and has its upper surface slanted, as designated at 41, to guide the spear 29 within the aperture thereof.

The latch member 36 is adapted to engage the under surface of the flange 40 with the shoulder 37 for purposes hereinafter described.

When it is desired to remove the inner drill tube from the outer drill tube the spear 29 is lowered down into the outer drill tube by means of the rope 31. The spear passes into the inner drill tube, and the lower end thereof engages the radial projections 21 and the upper end of latch lever 22, and moves said latch lever to retract the latch member 23 from engagement with the shoulder 3, whereupon the inner drill tube drops downwardly and the lugs 20 are disengaged from the recesses 13. As the inner drill tube moves downwardly the lugs 20 encounter the high portions 14 of the cam ring, as hereinbefore described, and are guided into the low portions 16, the inner drill tube turning to the left during this movement. The rope is then pulled and the spear moves upwardly and the shoulder 37 of the latch member 36 engages the lower surface of the flange 40, and the inner drill tube is pulled upwardly thereby. As the inner drill tube is pulled upwardly the lugs 20 are guided into the slots 6 by means of the slant surfaces 18 hereinbefore referred to. The inner drill tube is then pulled upwardly and removed from the outer drill tube as desired.

When it is desired to replace the inner drill tube in driving relation with the outer drill tube, it is lowered by means of the spear 30 and the rope 31 and is guided down through the slots 6 by the cams 7. As the lugs 20 reach points in said slots 6 in the plane of the recesses 13 the latch member 23 engages the shoulder 3 and stops the downward movement of the inner drill tube. The spear then moves downwardly and retracts said latch member, as hereinbefore described, and the drill tube then moves downwardly until the lugs 20 engage the low portions 10, being guided by the slant portions 9. The spear is then pulled upwardly, and the inner drill tube is lifted as the latch member 36 engages the under surface of the flange 40. The upward movement of the drill tube from this point engages the lugs 20 with respective slant portions 12 which guide said lugs into the recesses 13, at which point the latch member engages the upwardly facing shoulder 3 to hold said lugs in engagement with the recesses and in this position the wedge cams 26, which slant upwardly and inwardly, engage the outer surface of respective lugs

20 to center the inner drill tube within the outer drill tube. The operating spear 29 is then removed from the inner drill tube by allowing the weighted collar 33 to slide
 5 down the rope 31 and over the operating spear to engage the cam 39, which disengages the latch member 36 from the flange 40 whereupon the spear may be pulled upwardly quickly. The collar cannot slip down past
 10 the latch member 36 as the upwardly facing shoulder 37 thereof projects some distance beyond the outermost portion of the cam 39.

When it is desired to remove the inner drill tube from the outer drill tube the
 15 spear is lowered into the outer drill tube and is guided into the inner drill tube by the slant portion of the flange 40, and the pointed end 30 thereof engages the radial projections 21 and the end of the latch
 20 lever 22 to retract the latch member 23 from engagement with the shoulder 3. Upon the release of the latch member 23 from engagement with the shoulder 3 the inner drill
 25 tube drops of its own weight and the lugs 20 are guided into the low portion 16 of the cam ring 4 by the slanting surfaces 15. The spear is then pulled upwardly, and the latch member 36 engages the under side of
 30 the flange 40, whereupon the inner drill tube moves upwardly with the spear. As the lugs 20 move out of the low portions 16 they engage the slant surface 18 of the high portions 17 of the cam plates and are
 35 guided into the slots 6, after which the inner drill tube may be removed from the outer drill tube without further manipulation.

The weighted collar 33 is formed in two sections which are hinged together as at
 40 33' and a bolt 33'' holds the two sections in closed position. This construction will enable the collar to be easily placed on the cables.

Having thus fully described my invention, I claim:—

1. In a device of the character described, the combination with an outer drill tube, of an inner drill tube, a cam ring secured on
 50 said outer drill tube and having an upwardly facing cam surface thereon formed with alternate high and low portions, cam plates secured on said outer drill tube above
 55 said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of the cam ring, said cam plates being spaced apart to form slots therebetween, and lugs on said
 60 inner drill tube adapted to pass through respective slots to engage said cam surfaces.

2. In a device of the character described, the combination with an outer drill tube, of an inner drill tube, a cam ring secured on
 65 said outer drill tube and having an upwardly facing cam surface formed with alternate

high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed
 70 above respective low portions of said upwardly facing cam surface of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, and lugs on said
 75 inner drill tube adapted to pass through respective slots and to engage said cam surfaces.

3. In a device of the character described, the combination with an outer drill tube, of an inner drill tube, a cam ring secured
 80 on said outer drill tube having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces
 85 thereon, formed with high portions disposed above respective low portions of the cam ring, said cam plates being spaced apart to form slots therebetween and having
 90 diagonally facing cam surfaces extending upwardly from said slots, and lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces.

4. In a device of the character described, the combination with an outer drill tube, of
 95 an inner drill tube, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured
 100 on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surface of the cam ring and
 105 forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots and to engage said cam surfaces, and
 110 wedge cams secured on said outer drill tube adapted to engage respective lugs as they are positioned in said recesses.

5. In a device of the character described, the combination with a drill tube having an
 115 inwardly extending flange, of a spear adapted to pass through said flange, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to normally project from said spear,
 120 and a weighted collar adapted to pass over said spear and engage said cam to retract said latch from engagement with said flange.

6. In a device of the character described, the combination with a drill tube having an
 125 inwardly extending flange, of a spear adapted to pass through said flange, a spring lever mounted on said spear, a latch member mounted on said lever and adapted to normally project laterally from said spear and
 130

having an upwardly facing shoulder and a downwardly facing cam surface, a cam mounted on said lever and adapted to normally project from said spear, and a

5 weighted collar adapted to pass over said spear and engage said cam to retract said latch from engagement with said flange.

7. In a device of the character described, the combination with a drill tube having an inwardly extending flange, of a spear adapted to pass through said flange and having a longitudinal slot formed therein, a spring lever mounted on said spear and adapted to move in said slot, a latch member mounted on said lever and adapted to normally project from said spear and having an upwardly facing shoulder and a downwardly facing cam surface, a cam mounted on said lever and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and engage said cam to retract said latch from engagement with said flange.

8. In a device of the character described, the combination with a drill tube, of a spring lever mounted within said tube, and a spear adapted to pass into said tube and to engage said spring lever to move said spring lever.

9. In a device of the character described, the combination with a drill tube having a spring lever mounted within said tube, a series of radial projections in said tube, and a spear adapted to pass into said tube and to engage said spring lever and said projections to move said spring lever.

10. In a device of the character described, the combination with a drill tube having a slot formed therein, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project from said slot, and a spear adapted to pass into said tube and to engage said spring lever to retract said latch member into said tube.

11. In a device of the character described, the combination with a drill tube having a slot formed therein, a spring lever mounted within said tube, a series of radial projections in said tube, a latch member mounted on said spring lever and adapted to normally project from said slot, and a spear adapted to pass into said tube and to engage said spring lever and said projections to retract said latch member into said tube.

12. In a device of the character described, the combination with a drill tube having a slot formed therein and having an inwardly extending flange, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project from said slot, a spear adapted to pass through said flange, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to

normally project from said spear, and a weighted collar adapted to pass over said spear and engage said cam to retract said latch from engagement with said flange.

13. In a device of the character described, the combination with a drill tube having a slot formed therein and having an inwardly extending flange, a spring lever mounted within said tube, a series of radial projections in said tube, a latch member mounted on said spring lever adapted to normally project through said slot, of a spear adapted to pass through said flange, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and engage said cam to retract said latch from engagement with said flange.

14. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder formed thereon, of an inner drill tube having a slot formed therein, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project through said slot and adapted to engage said upwardly facing shoulder, and a spear adapted to pass into said tube and to engage said spring lever to retract said latch member from engagement with said shoulder.

15. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder formed therein, of an inner drill tube having a slot formed therein, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, a spring lever mounted within said drill

tube, a latch member mounted on said spring lever and adapted to normally project through said slot and adapted to engage said upwardly facing shoulder, a series of radial projections in said tube, and a spear adapted to pass into said tube and to engage said spring lever and said projections to retract said latch member into said tube.

16. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder thereon, an inner drill tube having a slot formed therein, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring, said cam plate being spaced apart to form slides therebetween, and having diagonally facing cam surfaces extending upwardly from said slide, lugs secured on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, a spring lever, a latch member mounted on said spring lever and adapted to normally project through said slot to engage said upwardly facing shoulder, and a spear adapted to pass into said tube and to engage said spring lever to retract said latch member into said tube.

17. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder formed thereon, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass from respective slots to engage said cam surfaces, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project through said slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange to engage said spring lever to retract said latch member into said tube, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to normally project from the spear, and a weighted collar adapted

to pass over said spear and to engage said cam to retract said latch from engagement with said flange.

18. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, a spring lever mounted within said tube, a series of radial projections in said tube, a latch member mounted on said spring lever and adapted to normally project through said slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange to engage said projections and said spring lever to retract said latch member into the tube, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and to engage said cam to retract said spring latch from engagement with said flange.

19. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring, said cam plate being spaced apart to form slots therebetween and having diagonally facing cam surfaces extending upwardly from said slots, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project through said slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange to engage said spring lever to retract said latch member into said tube, a spring latch on said spear adapted to engage said flange, a cam mounted on said latch and adapted to normally project from

said spear, and a weighted collar adapted to pass over said spear and to engage said cam to retract said spring latch from engagement with said flange.

20. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube and having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having diagonally facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, wedge cams on said outer drill tube adapted to engage respective lugs as they are positioned in said recesses, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project through said slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange and to engage said spring lever to retract said latch member into said tube, a second spring lever mounted on said spear, a second latch member mounted on said second spring lever and adapted to normally project from said spear and having an upwardly facing shoulder and a downwardly facing cam surface, a cam mounted on said second spring lever and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and to engage said cam to retract said second latch member from engagement with said flange.

21. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surfaces in the cam ring, said cam plates being spaced apart to form slots therebetween and having diagonally facing cam surfaces extending upwardly from said slots, lugs on said inner drill tube adapted to pass through said slots and to engage said cam surfaces, a spring lever mounted within said tube, a latch member mounted on said spring lever and adapted to normally project through said

slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange and to engage said spring lever to retract said latch member into the tube, a second spring lever mounted on said spear, a second latch member mounted on said lever and adapted to normally project from said spear and having an upwardly facing shoulder and a downwardly facing cam surface, a cam mounted on said lever and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and to engage said cam to retract said second latch member from engagement with said flange.

22. In a device of the character described, the combination with an outer drill tube having an upwardly facing shoulder, of an inner drill tube having a slot formed therein and having an inwardly extending flange, a cam ring secured on said outer drill tube having an upwardly facing cam surface formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having diagonally facing cam surfaces formed with high portions disposed above respective low portions of said upwardly facing cam surface of the cam ring and forming longitudinally disposed recesses, said cam plates being spaced apart to form slots therebetween, lugs on said inner drill tube adapted to pass through respective slots to engage said cam surface, wedge cams on said outer drill tube adapted to engage said lugs as they are positioned in said recesses, a spring lever mounted within said tube, a series of radial projections in said tube, a latch member mounted on said spring lever and adapted to project through said slot to engage said upwardly facing shoulder, a spear adapted to pass through said flange and to engage said spring lever and said radial projections to retract said latch member into the tube, a second spring lever mounted on said spear, a second latch member mounted on said second spring lever and adapted to normally project from said spear and having an upwardly facing shoulder and a downwardly facing cam surface, a cam mounted on said second spring lever and adapted to normally project from said spear, and a weighted collar adapted to pass over said spear and to engage said cam to retract said second latch member from engagement with said flange.

23. In a device of the character described, the combination with an outer drill tube, of an inner drill tube, a cam ring secured on said outer drill tube and having an upwardly facing cam surface thereof formed with alternate high and low portions, cam plates secured on said outer drill tube above said cam ring and having downwardly facing cam surfaces formed with high portions disposed above respective low portions of said

upwardly facing cam surfaces of the cam ring, said cam plates being spaced apart to form slots therebetween, and lugs on said inner drill tube adapted to pass through respective slots to engage said cam surfaces, the high portions of one of the cam plates and the corresponding high portions of said cam ring being extended beyond the other high portions of the remaining cam plate of the ring whereby one of said lugs engages said relatively high portions before the other lug engages its corresponding high portions. 10

In testimony whereof I affix my signature.

OSCAR E. MOORE.