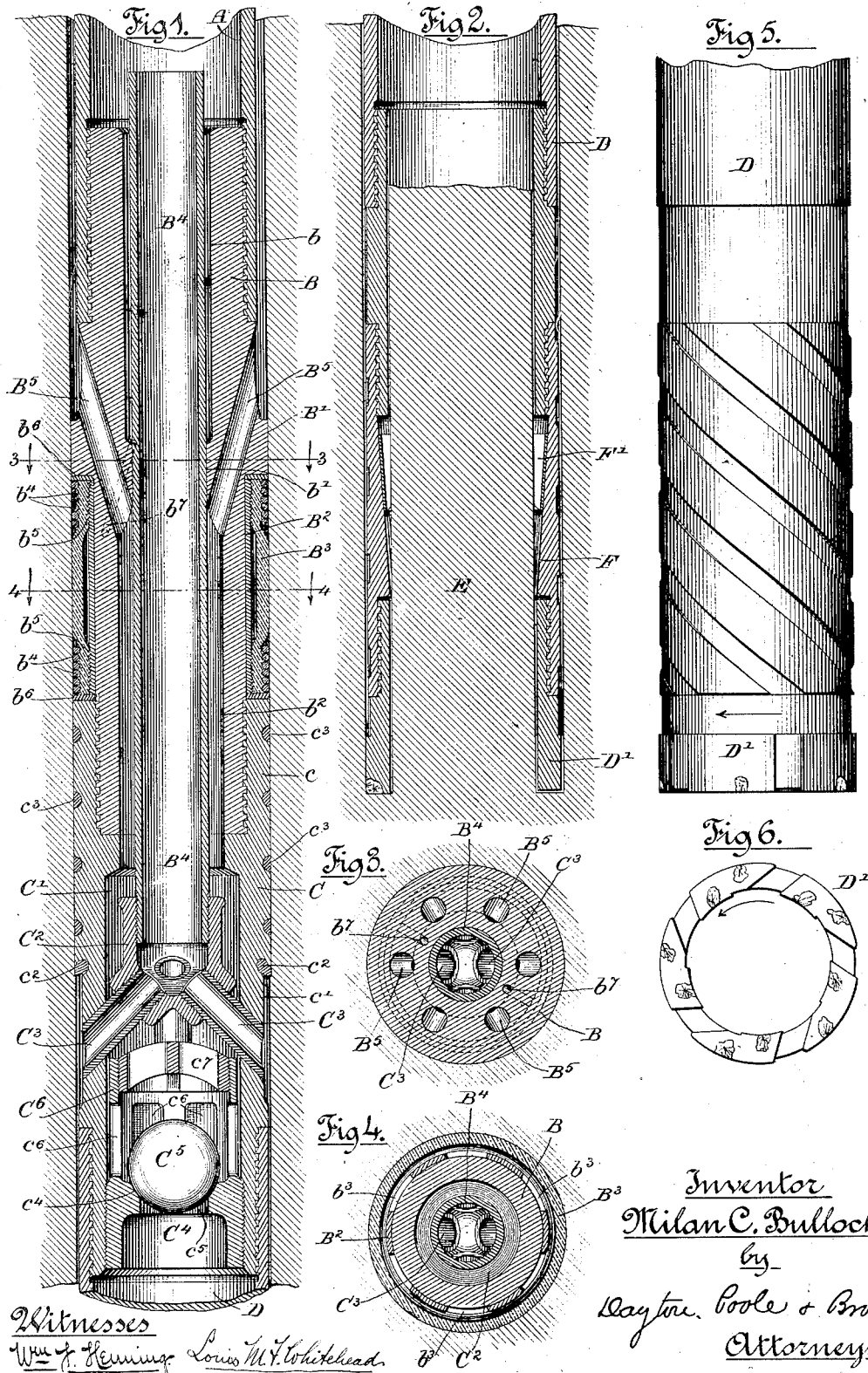


M. C. BULLOCK.
DRILLING APPARATUS.

No. 462,392.

Patented Nov. 3, 1891.



Witnesses

Wm. F. Hemming Louis M. Whitehead

Inventor
Milan C. Bullock

by

Dayton, Poole & Brown
Attorneys.

(No Model.)

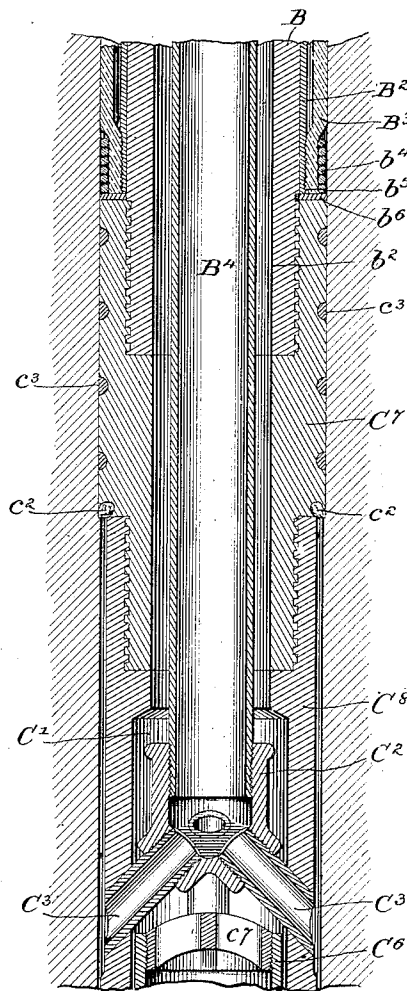
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Fig 7.



Witnesses

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UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK, OF CHICAGO, ILLINOIS.

DRILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 462,392, dated November 3, 1891.

Application filed July 12, 1889. Serial No. 317,322. (No model.)

To all whom it may concern:

Be it known that I, MILAN C. BULLOCK, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Drilling Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon,
10 which form a part of this specification.

This invention relates to rock-drilling apparatus having an annular revolving cutting-head acting by attrition, and more particularly to a novel construction in the core-barrel of such apparatus, or that part which carries the cutting-head and receives the core as the latter is formed.

Heretofore in rock-drilling it has been customary, where annular cutters are employed
20 for cutting a core, to supply water to the said cutters for lubricating them and removing detritus by passing the same down through the drill-rod, under or around the cutters, and then upwardly exterior to said drill-rod.
25 It is very desirable to remove intact the pieces or sections of the core as they become detached or are broken from the end thereof within the core-barrel, so that a sure indication may be had of the nature and condition
30 of the strata through which the drill is passing. It is seldom that the core remains in an unbroken piece the length of the core-barrel; but usually the core is broken into short pieces, either by reason of the presence of
35 seams or from the softness of the rock. As the drilling operation continues, after one or more of such short sections become detached and loose within the core-barrel the rotary motion of the water induced by the revolving
40 core-barrel, together with the downward pressure of the water upon said detached sections of cores, will often cause the latter to grind upon the stationary or undetached part of the core and upon each other, so that by
45 attrition they are worn rapidly away to such an extent that in some instances they are entirely disintegrated and carried away by the current of water in a finely-divided state. This is especially liable to occur in working
50 in soft strata, such as coal, when in prospecting it is most desirable to obtain the core in

a perfect state, in order to secure an accurate knowledge of the thickness and character of the strata through which the drill is passing. It will thus be seen that the core removed, instead of representing the strata passed through
55 in character and length, will consist of small broken and fractured pieces, often consisting of the harder parts or rock strata only, or in some cases the entire core will be ground into fine particles, leaving no indication of the character of the formation bored through. To overcome these objections, and to enable the core to be removed in sections as large as possible and without loss by breaking or attrition,
60 I make use of the method described by me in an application for Letters Patent, Serial No. 305,255, filed in the United States Patent Office March 29, 1889. Said application embodies the method of forcing the water down
65 exterior to the drill-rod and core-barrel and upwardly within the same.

The construction of the apparatus in the present application differs from that described in the application referred to, but comprises
75 the features of forcing the water down under pressure exterior to the core-barrel and upwardly within the same with the same result set forth in said application—to wit, that the force of the water flowing inwardly within
80 the core-barrel will raise the separated sections of the core and sustain them out of contact with the stationary part of the core with each other, so that they will be prevented from being ground away in the manner above described and can be removed in the same condition as when first detached.
85

The invention consists in the various details of construction and combination of parts hereinafter fully described, and pointed out
90 in the appended claims.

In the drawings, Figure 1 is a view in central vertical section of the lower end of a tubular drill-rod and parts connected therewith. Fig. 2 is a view in central vertical section of a part of the core-barrel, showing a core therein. Fig. 3 is a horizontal sectional view taken on the line 3 3 of Fig. 1. Fig. 4 is a horizontal sectional view taken on the line 4 4 of Fig. 1. Fig. 5 is a view in side elevation of the lower end of the core-barrel and the cutter-head. Fig. 6 is a plan view of the
100

under side or working face of said cutter-head. Fig. 7 is a view in central vertical section of a modified form of construction embodying my invention.

5 As shown in said drawings, A indicates the lower end of a tubular drill-rod, which extends upwardly above the surface of the ground and is connected with a suitable drilling machine or engine, by means of which it is given
10 rotary movement and fed or advanced into the hole. The said drill-rod A is connected at its lower end by a screw-threaded joint with the upper end of a core-barrel head B, which forms one of the tubular parts connect-
15 ing the core-barrel with the drill-rod. The said head B is formed with a central aperture or chamber divided into three parts or sections, as follows, to wit: an upper section b , an intermediate contracted section b' , and
20 a lower enlarged section b^2 , which is of a greater diameter than the section b . The upper and lower sections b and b^2 are about the same length and extend from the ends of said head nearly to the center thereof, where
25 they are separated by the intermediate contracted section b' , which is relatively short.

B^4 is a pipe, which is passed through the head B, and is of an external diameter the same as that of the internal diameter of the
30 contracted portion of the core-barrel head B, so that it separates the upper section or chamber b from the lower section or chamber b^2 . The said pipe B^4 is longer than the head B and projects beyond the same at either end
35 thereof.

The head B is in its principal part of a diameter less than that of the surrounding hole, so as to provide a space exterior to the head for the passage of water. About mid-
40 way its length the head B is provided with an annular enlargement or outwardly-extending flange B' , which is of the same size as the hole being drilled.

The lower end of the head B is connected
45 with the upper end of a core-barrel coupling C by a screw-threaded joint, said coupling being of the same diameter as the flange B' . Around the smaller part of the head B and between the enlargement B' and the upper
50 end of the coupling C, I place a cylindrical tube or sleeve B^2 , which is annular and continuous at its upper and lower end portions and has a series of intermediate vertical slots
55 $b^3 b^3$.

B^3 is a belt or short tube, of rubber or similar material, tightly secured at its ends upon the continuous portions of the sleeve B^2 . I have shown in the drawings said rubber belt
60 as secured to the sleeve by means of a wrapping of wire b^4 or other material, and the sleeve is scored or roughened, as at $b^5 b^5$, so that the rubber may be more securely held thereto. In constructing and arranging the sleeve B^2 and accompanying parts upon the
65 head said sleeve is made sufficiently large to turn thereon, and to facilitate such turning of the sleeve two friction-rings $b^6 b^6$ are pref-

erably arranged, respectively, between the ends of said sleeve B^2 , the lateral flange B' , and the upper end of the coupling C.

$b^7 b^7$ are water-passages leading from the lower end of the upper chamber b of the head outwardly to a point on the head adjacent to or opposite the vertical slots $b^3 b^3$ of the sleeve B^2 . It will be obvious that the water passing
75 from the chamber b through the water-passages $b^7 b^7$ will pass through the slots $b^3 b^3$ and enter beneath and expand the rubber tube, thereby pressing the same against the walls of the hole being drilled, so that it forms a
80 practically water-tight joint between the drill-rod and the walls of the hole to prevent the passage of water at this point. It will also be noted that the rubber tube, pressing against the walls of the hole and being loosely mount-
85 ed upon the head, will not revolve with the head as it is turned by the drill-rod. The said tube is arranged as thus described, for the reason that if turned continually with the drill-rod the constant rubbing against the
90 sides of the hole would in a short time wear it out.

$B^5 B^5$ indicate a plurality of ports leading from the upper end of the chamber b^2 to the outside of the head B above the enlarge-
95 ment B' .

The coupling C, before mentioned, is in its upper part c of the same external diameter as the diameter of the hole, but near its lower part is reduced in size, as at c' , forming a wa-
100 ter-space at this point. At its lower end it is secured to the upper end of the core-barrel by a screw-threaded joint. The coupling C is provided with a central opening or chamber
105 C' , which is considerably larger than the chamber b^2 , and is desirably contracted at its upper end to form a shoulder, against which the end of the head B bears. The pipe B^4 extends into the opening or chamber C' and is provided at its lower end with a pipe-fitting C^2 ,
110 which communicates with the water-space c' by means of a plurality of branch pipes $C^3 C^3$, which are connected with the said pipe-fitting C^2 at their upper ends and pass through the sides of the coupling C adjacent to the
115 water-space c' . Upon the external shoulder formed between the upper portion c and the lower contracted portion c' of the coupling C, I insert diamonds $c^2 c^2$ or other suitable cutting-points. The external diameter of the up-
120 per part c of the coupling is a little larger than the cutting-head at the lower end of the core-barrel, and the cutting-points $c^2 c^2$, located at the lower end of said part c , are arranged slightly to enlarge or ream out the hole pre-
125 viously cut by the cutting-head. The said cutting-points $c^2 c^2$ are thus arranged for the purpose of making the wall of the hole to accurately conform to the part c of the coupling; so that the latter will closely fit the reamed-out part
130 of the hole, it being obvious that the walls of the hole made by the advance cutting-head may not be sufficiently uniform to make a close joint with the coupling C. The cut-

ting of said points $c^2 c^2$ and the contact of the coupling with the walls of the hole above said points will also serve to steady the upper end of the core-barrel and prevent vibratory movement thereof, which is likely to be present when the drill-rod is unsupported at its sides above the cutting-head, as is the case in the absence of such cutting-points $c^2 c^2$. Such vibratory movement of the core-barrel is often so great as to break the core within the core-barrel, and it is therefore of great advantage to avoid the same.

$c^3 c^3$ are packing-rings inserted in the face of the portion c of the coupling C and serve to form a tight joint between said coupling and the walls of the hole.

Within the lower end of the coupling C , I arrange an upwardly-opening check-valve C^4 , herein shown as consisting of a valve-seat c^4 , formed with a central opening c^5 and screw-threaded within the lower end of said coupling C , and a ball C^5 , resting in said seat. Said ball is held from displacement by means of a cage formed by a cylindric extension C^6 upon the valve-seat, said extension being slotted, as shown at $c^6 c^6$, and an apertured top or cover c^7 , conveniently secured to said extension by a screw-threaded joint.

To the lower end of the coupling C is secured the core-barrel D , which latter is provided at its lower end with a cutting-head D' of familiar construction.

E, Fig. 2, indicates a portion of a core which has been cut and stands within the core-barrel. Interiorly the core-barrel is provided near its lower end with a conical enlargement F , having its greater diameter at the top, and within this conical enlargement or recess is located a contractible metal ring F' for the purpose of gripping and supporting the core when the core-barrel is raised. The ring F' is open at one side to permit of its spreading and contracting, and it is also desirably provided with a series of interior vertically-arranged notches or recesses, as shown, so as to be freely flexible and form passages for water between it and the core. The gripping-ring F' is of such normal diameter as to drop to or near the lowest part of the conical recess F , and in this position its interior diameter is less than that of the core which will be cut by the drill. On the other hand, when expanded in the upper part of the conical recess F , the ring F' will have an interior diameter large enough to permit the core to pass through. The ring will be forced upward and expanded by the core as the latter is formed, and when the core-barrel is lifted the ring, which embraces it closely, will be drawn downward in the conical recess at the same time it bites the core, and through this gripping action of the ring the core will be broken off and brought upward with the core-barrel.

The parts of my invention being constructed and arranged as described, the operation is as follows: As the cutting operation com-

mences water is forced down within the tubular drill-rod A and passes into the pipe B^1 and chamber b . From the chamber b a sufficient quantity will pass through the passages $b^1 b^1$ to expand the rubber tube B^2 against the walls of the hole, and thus make a tight joint at this point, as before described. The greater part of the volume of water passing down through the pipe B^1 will pass through the branch pipes $C^3 C^3$ into the water-space c^7 , and thence downwardly between the outside of the core-barrel and the rock being cut to the cutters, around which it passes to lubricate the same and to remove the detritus as fast as formed. The water then passes upwardly within the core-barrel and around the core through the check-valve, chambers C^4 and b^2 , and then outwardly through the passages or parts $B^5 B^5$ to the exterior of the drill-rod and between the same and the surrounding hole, from whence it will rise to the surface of the ground.

It will be obvious from the foregoing description that as the current of water passes upwardly around the core as soon as the same breaks or becomes detached the detached piece or pieces will be lifted by the force of the upflowing water and held in an elevated position and free from contact with the undetached part of the core, thereby preventing the grinding away of the core, which would otherwise occur, for reasons hereinbefore stated. The check-valve C^4 will effectually prevent a downward flow of water upon the top of the core at the time of lifting the core-barrel to remove the core.

It will be understood that when the drill-rod is being withdrawn the water contained in the same will readily flow out, as described, into the bottom of the hole, and thus prevent the formation of a partial vacuum below the drill-rod.

It will be manifest that I do not intend to restrict myself to the specific construction and arrangement of the packing-ring herein described, except in the case where specific claims are made for such construction, as it is entirely obvious that an enlargement at a point between the exterior openings of the passages in the drill-rod and core-barrel of a size sufficient to fill the hole and prevent the passage of the greater part of the water past said point would serve the ends of this invention and in itself form a packing-ring.

In Fig. 7 I have illustrated a modified form of construction embodying my invention and which comprises a novel construction in the coupling connecting the core-barrel B with the core-barrel D . In this form of construction, instead of the coupling C being provided with the points $c^2 c^2$ and having branch pipes $C^3 C^3$ passing through the lower portion thereof, two coupling-sections $C^7 C^8$ are used. The coupling-section C^7 is of the same diameter as the upper portion c of the coupling C or a little larger than the cutting-head. At its upper end the coupling-section C^7 is connected with the

lower end of the head B by a screw-threaded joint, and at its lower end said coupling-section is connected with the coupling-section C³, which is of a diameter less than that of the coupling-section C¹ and corresponds in external diameter with the reduced lower portion c' of the said coupling C¹, thereby forming a shoulder at the point at which said coupling-sections are joined. The lower end of the said coupling-section C¹ is provided with the cutting points or diamonds c² c², and packing-rings c³ c³ are located upon the said coupling in the same manner, as before described. Said coupling-section C³ being of a diameter less than that of the coupling section C¹, the necessary water-space is formed between said coupling-section C³ and the walls of the hole. The branch pipes C³ C³ pass through openings in the said coupling-section C³, and said section is connected with the upper end of the core-barrel by a screw-threaded joint. I provide this construction so that the cutting-points will be supported by a section different from that through which the branch pipes pass, whereby said coupling-section C¹, supporting said diamonds or cutting-points, can be removed to reset or repair the same without disturbing the said branch pipes, which pass through the section C¹.

I claim as my invention—

1. A drilling apparatus comprising a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of the drill-rod, one of said parts being provided with an enlargement or packing at a point between the exterior openings of the said passages in the drill-rod and core-barrel, substantially as described.

2. A drilling apparatus, a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of the drill-rod, one of said parts being provided with an enlargement at a point between the exterior openings of the said passages in the drill-rod and core-barrel, which enlargement is provided with an external annular packing-ring, substantially as described.

3. A drilling apparatus comprising a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of the drill-rod, one of said parts being provided with an enlargement at a point between the exterior openings of said passages in the drill-rod and core-barrel, which enlargement is provided with a series of external annular packing-rings, substantially as described.

4. A drilling apparatus comprising a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of

the drill-rod, one of said parts being provided with an enlargement at a point between the exterior openings of said passages in the drill-rod and core-barrel, which enlargement is provided with an external annular revoluble packing-ring, substantially as described.

5. A drilling apparatus comprising a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of the drill-rod, one of said parts being provided with an enlargement at a point between the exterior openings of said passages in the drill-rod and core-barrel, which enlargement is provided with an exterior annular recess or contracted portion communicating with the interior of the drill-rod, and a non-rotating flexible tube or packing-ring located within said recess and adapted to be expanded to engage the walls of the hole by the pressure of water from within the drill-tube, substantially as described.

6. A drilling apparatus comprising a drill-rod and core-barrel and pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel and from the interior of the core-barrel to the exterior of the drill-rod, one of said parts being provided with an enlargement at a point between the exterior openings of the said passages in the drill-rod and core-barrel, which enlargement is provided with an exterior annular recess or contracted portion communicating with the interior of the drill-rod, a slotted sleeve loosely mounted within said recess, and a flexible tube or packing-ring surrounding said tube and adapted to be expanded to engage the walls of the hole by the pressure of water from within the drill-tube, substantially as described.

7. A drilling apparatus comprising a drill-rod, a core-barrel, and a coupling uniting the same, said coupling being provided with an intermediate enlargement or packing filling the hole, and pipes or passages leading through said coupling from the interior of the drill-rod to the exterior of the core-barrel at one side of said enlargement and from the interior of the core-barrel to the exterior of the drill-rod at the opposite side of said enlargement, substantially as described.

8. A drilling apparatus comprising a drill-rod, a core-barrel, and a coupling uniting said parts, having an enlargement or packing filling the hole, said coupling being provided with a central chamber extending from its lower end past said enlargement or packing, and a pipe secured in the upper part of said coupling and extending through said central chamber, said pipe communicating at one end with the interior of the drill-rod and at its opposite end by means of a series of branch pipes with the exterior of the core-barrel at one side of said enlargement, the said chamber being arranged to communicate at one end with the interior of the core-barrel and

at its opposite end with the exterior of the drill-rod at the opposite side of said enlargement by means of apertures in the coupling, substantially as described.

5 9. A drilling apparatus comprising a drill-rod, a core-barrel, and a coupling uniting said parts, said coupling being provided with an exterior annular recess or contracted portion, a non-rotating flexible tube or packing-ring
10 located within said recess, a central chamber extending through said coupling and provided with a contracted portion, and a pipe secured in said contracted portion and extending through said central chamber, said pipe communicating at one end with the interior of the drill-rod and at its opposite end by means of a pipe with the exterior of the core-barrel at one side of said packing-ring, the portion of the said chamber below said contracted portion arranged to communicate at one end with the interior of the core-barrel and at its opposite end with the exterior of the drill-rod at the opposite side of said packing-ring by means of a series of apertures in the coupling and the portion of the said central chamber above said contracted portion arranged to communicate with the said exterior annular recess by relatively small apertures in the coupling, substantially as described.

15 10. A drilling apparatus comprising a drill-rod and core-barrel, a coupling uniting said parts, said coupling consisting of two parts connected by a screw-threaded joint and having an exterior annular recess formed between a shoulder on one part and the end of the other part, said recess communicating with the interior of the drill-rod, a slotted

sleeve loosely mounted upon said coupling within said recess, a flexible tube or packing-ring surrounding the said sleeve, pipes or passages leading from the interior of the drill-rod through said coupling to the exterior of the core-barrel at one side of said packing-ring, and pipes or passages leading from the interior of the core-barrel through said coupling to the exterior of the drill-rod at the opposite side of said packing-ring, substantially as described.

11. A drilling apparatus comprising a drill-rod and core-barrel, one of said parts being provided with an enlargement or packing, pipes or passages leading from the interior of the drill-rod to the exterior of the core-barrel at one side of said enlargement, and pipes or passages leading from the interior of the core-barrel to the exterior of the drill-rod at the opposite side of said enlargement and provided with an upwardly-opening check valve, substantially as described.

12. A drilling apparatus comprising a drill-rod and a core-barrel provided with a cutting-head, one of said parts being provided with an annular enlargement or packing of a diameter greater than that of the cutting-head and having cutting-points adapted to enlarge the said hole to fit said annular enlargement or packing, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

MILAN C. BULLOCK.

Witnesses:

C. CLARENCE POOLE,
HARRY COBB KENNEDY.