(No Model.) 3 Sheets—Sheet 1.

M. C. BULLOCK & S. W. DOUGLASS.

ROCK DRILL.

No. 511,119. Patented Dec. 19, 1893.

Fig. 1.

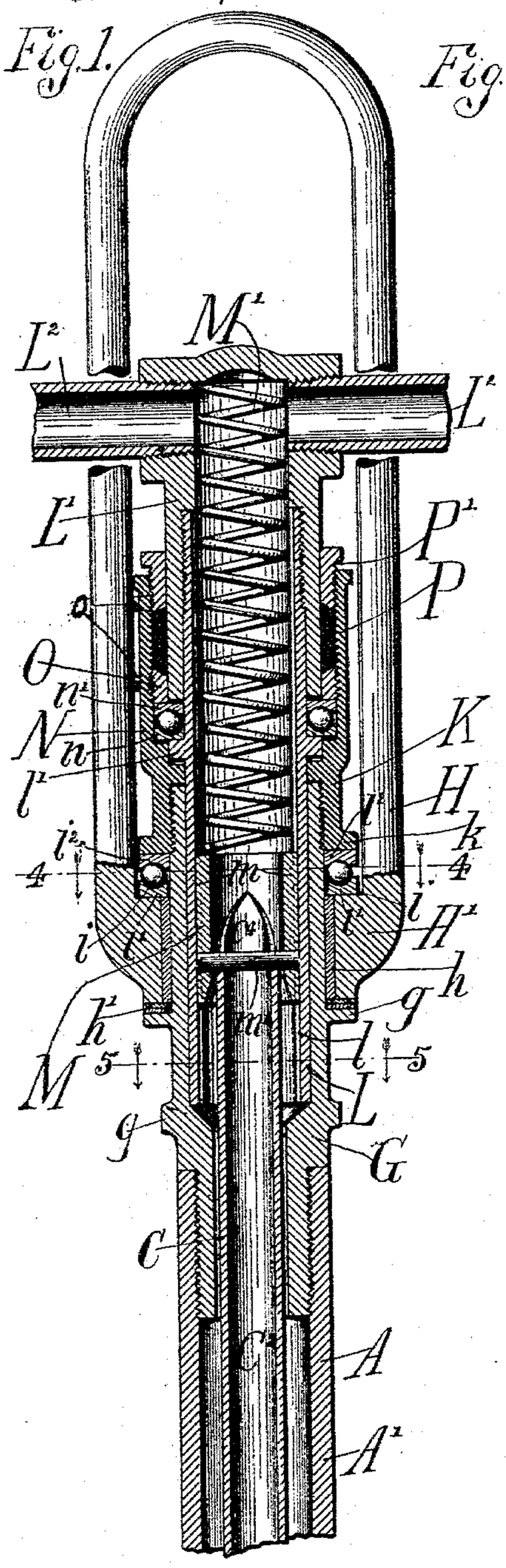


Fig. 2

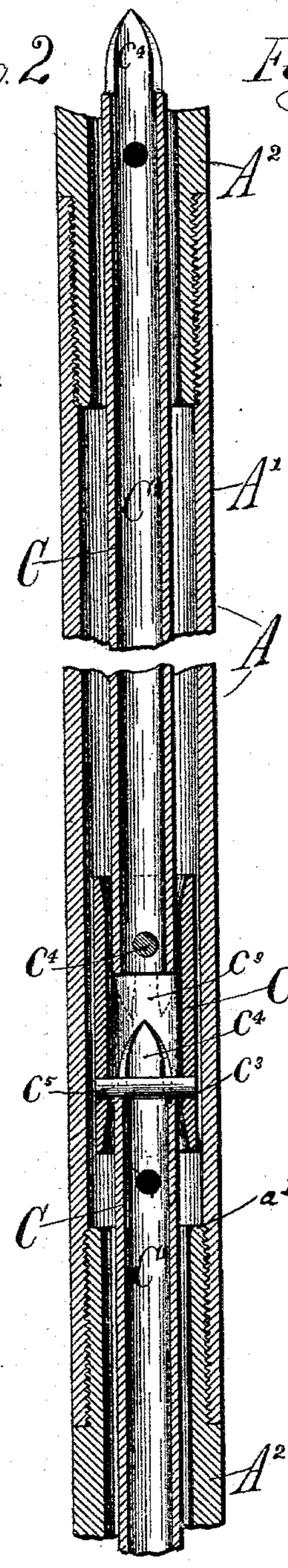
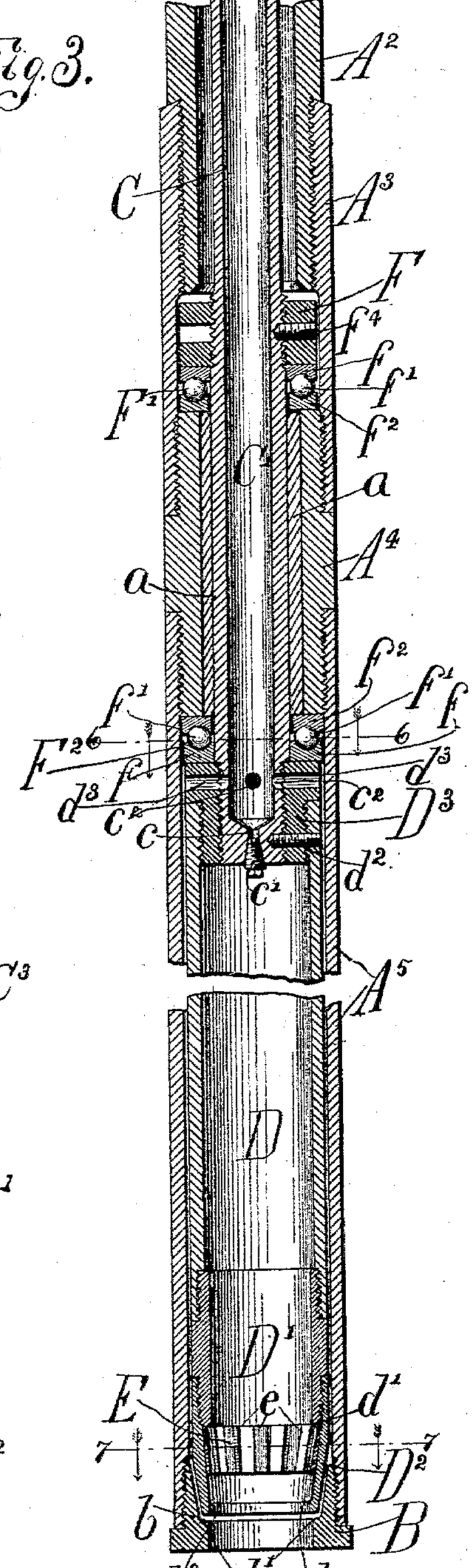


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

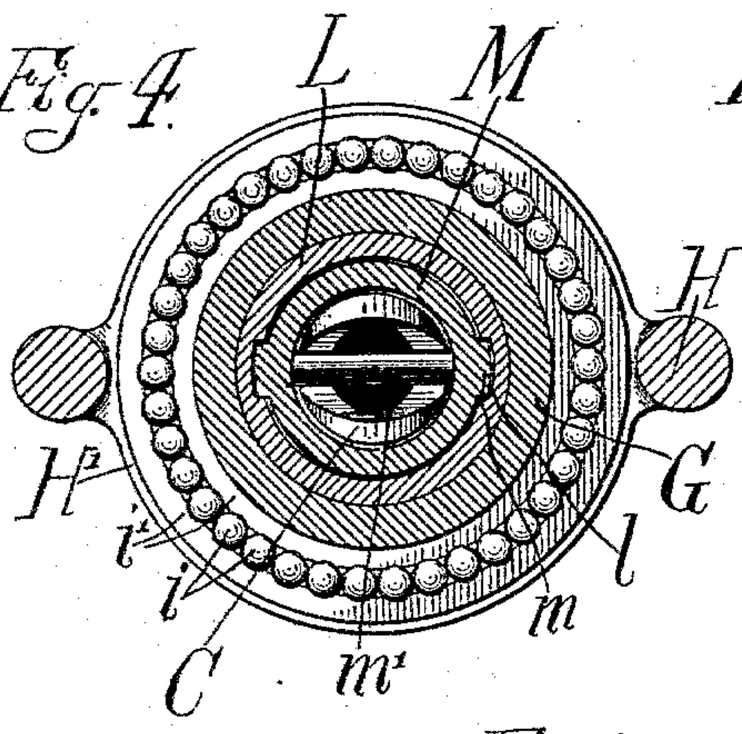


Fig. 5.

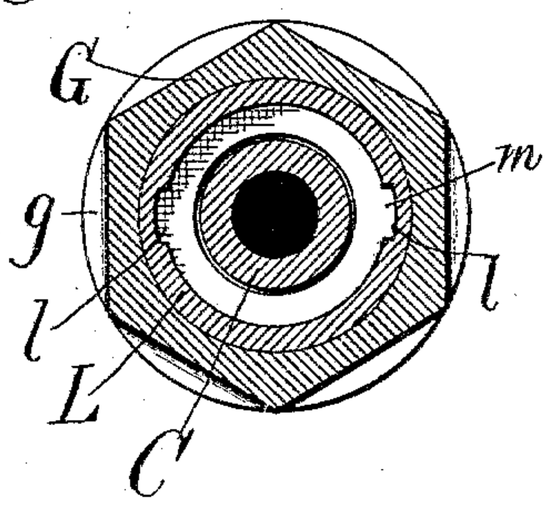


Fig. 6.

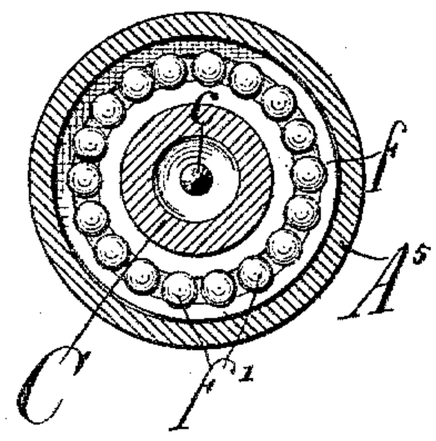


Fig. 7.

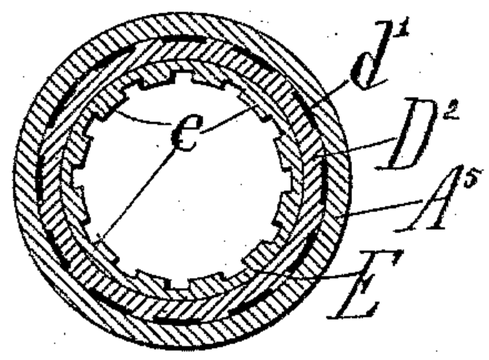


Fig. 8.

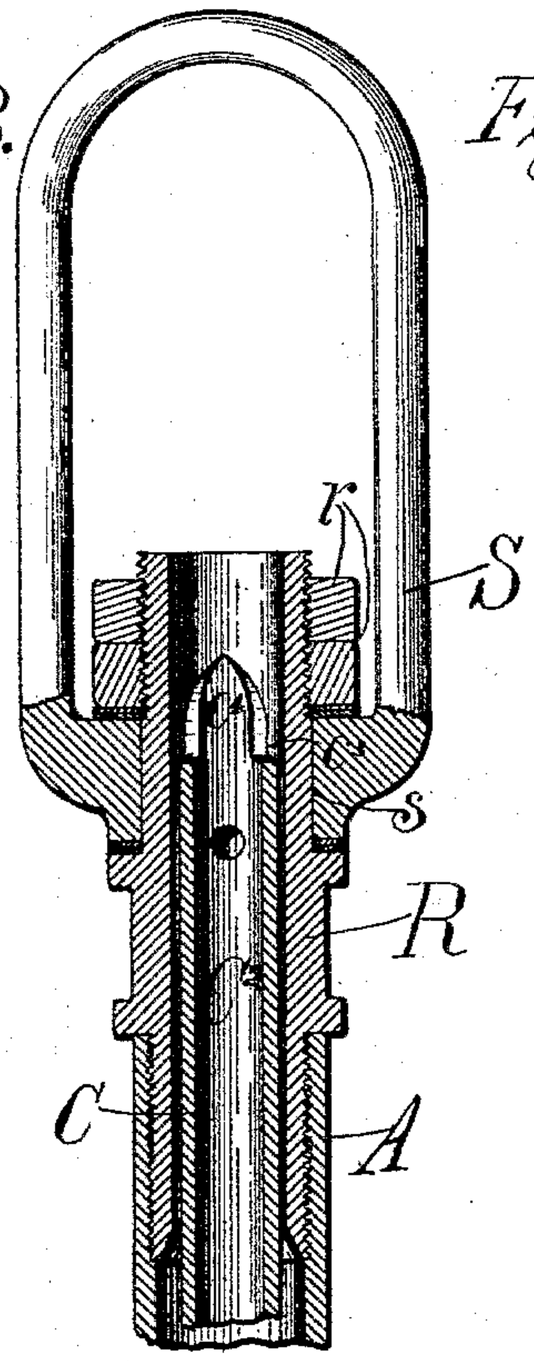


Fig. 9.

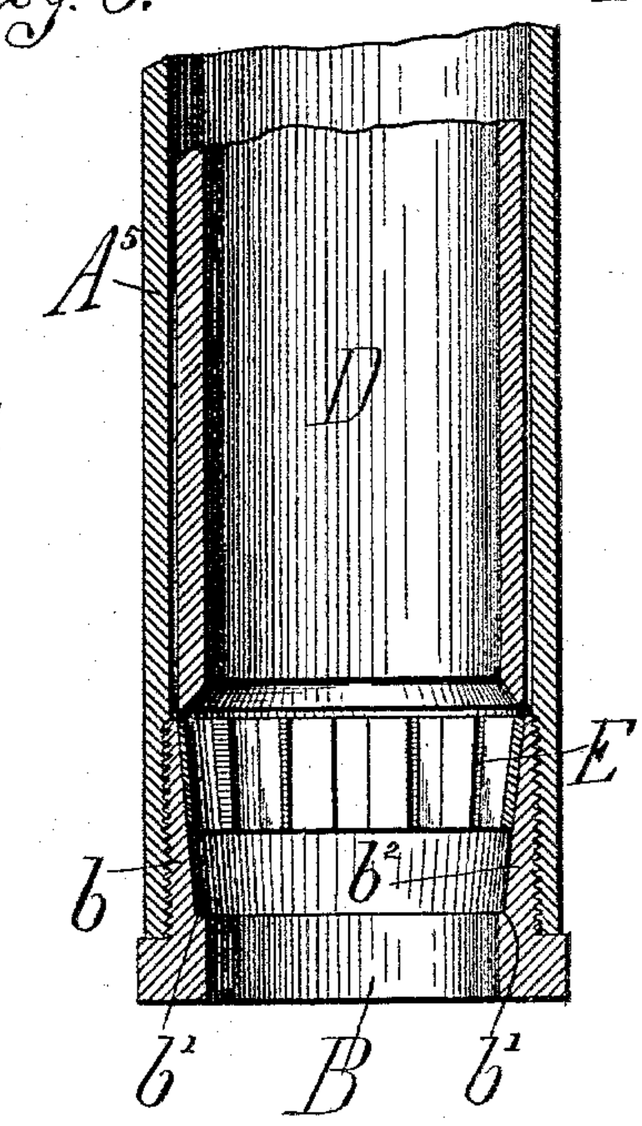
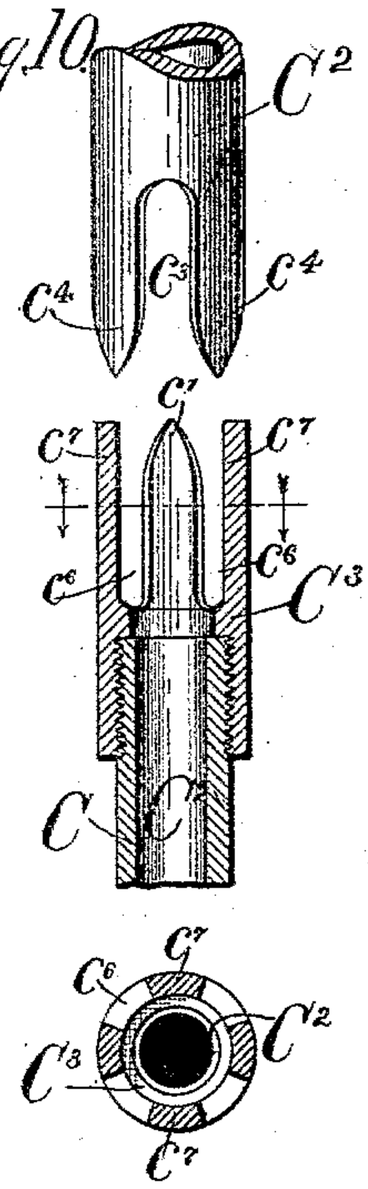


Fig. 10.



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ROCK DRILL.

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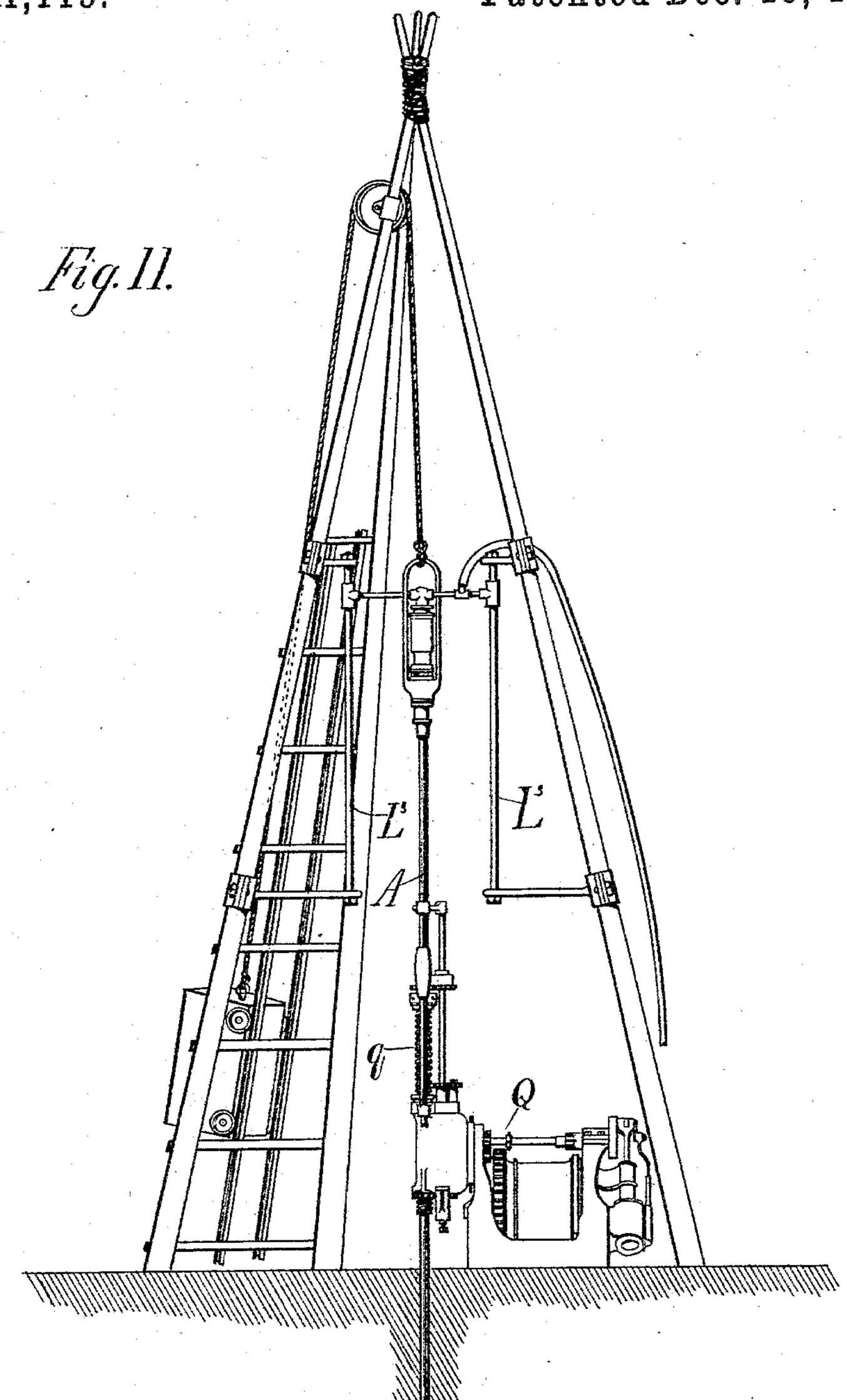
Fig. 11.



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UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK AND SAMUEL W. DOUGLASS, OF CHICAGO, ILLINOIS;
SAID DOUGLASS ASSIGNOR TO SAID BULLOCK.

ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 511,119, dated December 19, 1893.

Application filed May 17, 1892. Serial No. 433,354. (No model.)

To all whom it may concern:

Be it known that we, MILAN C. BULLOCK and SAMUEL W. DOUGLASS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rock-Drills; and we 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, which form a part of this specification.

This invention relates to rock core drills or drilling apparatus of that kind in which a tubular drilling tool is used, which makes an annular cut and forms a central body or core which extends into the tool and which may be removed for examination in order to determine the character of the strata through which the boring is carried.

The object of this invention is to so construct such apparatus that the core formed in soft or friable formations, such as salt, clay and bituminous coal, may be preserved while drilling and removed intact for inspection, as desirable in prospecting and under other circumstances.

To this end the invention consists in the matters to be hereinafter described and particularly pointed out in the appended claims.

As heretofore constructed the tubular drilling tool has commonly consisted of a tubular drill rod, provided with a cutting head, and having above its cutting head an internal tube or core-barrel, adapted to receive the core as it is formed, and which is pivotally connected with the drill rod so as to be free to rotate within the latter, the intention being that the core-barrel shall be held stationary by its engagement with the core, so that liability of breaking the core which would result from the contact of the revolving drill tube therewith is avoided. This device, however, has not been found efficient in preserving the core formed in friable strata, such as is often encountered in prospecting; it being found that notwithstanding the pivotal connection of the core-barrel with the drill-rod, the core-barrel rotates to a greater or less extent with the drill-rod, owing to the fact that the space between the drill rod and core-barrel is filled with water which, by frictional contact with the rod and barrel, tends strongly to cause the motion of the rod to be imparted to the barrel, so that in most cases the core barrel will turn with the drill rod, and by reason of its frictional contact with the core within it, or the water which is present between the core barrel and core, will exert a constant twisting action on the core, tending to break or loosen the outer or free part of the same from its base and to give rotary motion to any detached or loose parts of the core. When in the use of such a core-barrel, in the operation of forcing the drill into the rock, a seam is encounterted, which interrupts the continuity of the core, or the core is broken by the twisting action thereon of the core-barrel due to the rotary motion of the drill tube, the detached part of the core will revolve with the core barrel and will be thereby caused to grind against the stationary part of the core, with the result of causing an appreciable loss of the core in hard formations, and the practical destruction of the core in soft or friable strata, thereby defeating what is often the main purpose of the work, especially in prospecting, namely, the securing of the complete core to show the exact character and thickness of all strata bored through, both in character and thickness. With a view of overcoming these objections the construction illustrated in the accompanying drawings has been devised.

In the accompanying drawings: Figures 1, 2 and 3 represent by longitudinal section, the top, middle and lower parts of a drill rod embodying our improvements. Fig. 4 is a transverse section on the line 4—4 of Fig. 1. Fig. 5 is a transverse section on line 5—5 of Fig 1. Fig. 6 is a transverse section on line 6—6 of Fig. 3. Fig. 7 is a transverse section on line 7—7 of Fig. 3. Fig. 8 is a longitudinal section through the hoisting plug and the upper end of the drill rod section showing their relative positions when raising or lowering the drill rods. Fig. 9 is a longitudinal section of a modified form of bit and core lifter. Fig. 10 is a detail illustrating a modified form of clutch for the inner rods. Fig. 11 is a view in side elevation of a drilling machine and derrick adapted for use in connection with a drilling apparatus embodying my invention.

In said drawings the drilling tool is repre-

sented as composed of an outer tubular rod, A, which carries the annular cutting head or bit, B, at its lower end and is driven by connection with any suitable rock drilling machine, an inner stationary or non-rotating rod, C, extending throughout the entire length of the drill-rod, and a non-rotating core-barrel, D, attached to the lower end of the rod C, and provided with a core-lifting ring, E, of the usual construction.

The outer rod A is composed of tubular sections, A′, united with each other by coupling sections, A^2, the lowermost section being connected by a sleeve, A^3, with a coupling section, A^4, which is in turn connected by a screw joint with the lowermost drill-rod section, A^5, which contains the core-barrel, D. Said sleeve A^3, coupling section A^4 and lower drill rod section A^5 have the same exterior diameter, and are preferably somewhat larger than the parts of the drill rod above the same. The lower end of the drill-rod section A^5 is internally threaded to receive the threaded end, *b*, of the drill-head or bit B, said end *b* being tapered interiorly from its inner end to an annular shoulder, *b′*, thus forming an inwardly and downwardly tapering chamber, b^2.

The body of the core barrel D is of a diameter slightly less than the interior diameter of the drill-rod section A^5, and is provided at its lower end with a female thread to receive the threaded upper end of a coupling sleeve, D′, the outer surface of which is flush with the surface of said core barrel and having an inner diameter slightly greater than that of the bit B, and less than that of the core barrel D. The lower end of the coupling sleeve D′ is also threaded to engage a female screw formed in the upper end of a thimble, D^2, the lower part of which is tapered to fit the tapering chamber b^2 formed by the upper end *b* of the bit B, said sleeve being also tapered interiorly from the lower end of its internal thread to an annular shoulder, *d*, formed at its lower end. Upon this interior tapered surface of the thimble D^2 is seated the lifter ring, E, which is of usual construction, consisting of a split ring of steel provided with interior ribs or lugs, *e*, and shaped exteriorly to fit the inner tapered surface of the thimble or core lifter shell D^2, and adapted to slide vertically therein; the shoulder *d′* and the lower end of the coupling D′ constituting stops to limit the vertical movement of said ring. The upper cylindric part of the thimble or core lifter shell D^2 is of a diameter to fit snugly within the outer core barrel A^3, and is provided with spiral or other grooves or channels, *d′* (Fig. 7) to permit of the free passage of water downward between said shell D^2 and the drill rod to the bit B. The upper end of the body of the said core barrel is threaded internally to engage the male threads of a head, D^3, said barrel and head being further secured together by a set-screw, d^2, passing through the side of the core barrel into the head.

The core barrel head D^3 is provided with a central threaded opening through which passes the lower threaded end of a tubular rod C, said rod being secured immovably within the head by means of the set screw d^2 which also locks said head D^3 within the upper end of the core barrel D. The lower end of this rod C′ is provided with a small vertical opening, *c*, which is closed by a screw plug, *c′*, whereby communication between the interior of the tubular rod C′ and the core barrel D may be opened or closed for purposes to be hereinafter explained. Radial openings, c^2, are also formed in the lower part of this tubular rod C′, which openings communicate with radial openings d^3, formed in the flanged upper end of the core barrel head D^3, said openings d^3 leading to the annular space between the core barrel and the drill rod section A^5, as shown, whereby a flow of water passing down through the inner tubular rod C will pass outward through said radial openings, and down between the core-barrel D and the drill rod to the bit B. The rod C, which is rigidly attached to the core-barrel in the manner described, extends upwardly through the drill-rod and is held at its upper end from vertical movement so that it serves to hold the core barrel positively from rotation during the operation of drilling. Means are provided, however, for holding the said core-barrel and rod C from longitudinal movement within the drill-rod, in order that the said core-barrel may be carried forward with the drill-rod and retained in proper position with reference to the drill-head or bit, and so that the said rod C may be raised and lowered with or by the drill rod. For this purpose suitable downwardly and upwardly facing annular bearing faces or shoulders are formed on the inner surface of the drill rod and similar opposing shoulders on the core barrel or rod C, said shoulders in the construction shown being formed by means of the upwardly and downwardly facing ends of the coupling-section A^4, the upper surface of the core barrel head D^3 and the lower surface of the collar, F, on the rod C, between which core-barrel head and collar the said section A^4 is located. In this construction the opposing shoulders formed by the top of the core barrel head and the lower end of the section A^4, prevents the core-barrel being thrust or moved upwardly or backwardly within the drill rod, while the opposing shoulders formed by the collar F and the upper end of the said section A^4, prevents the core barrel head or rod C from downward movement relatively to the drill rod. In other words, the shoulder at the lower end of said section A^4 takes the upward thrust of the core barrel in drilling, while the shoulder at the upper end of said section carries the weight of the rod C by which said core barrel is held from turning. To enable the outer drill rod or tube A to rotate freely upon the inner rod C, notwithstanding endwise pressure between the parts, ball bearings, F′ and

a screw-threaded connection, as shown. Said head L′ is provided with two arms, L^2, L^2, which engage stationary vertical guides, L^3, L^3, (Fig. 11.) by which the head and the tube L are held from turning with the drill-rod. Said drill rod is driven in the usual manner by a drilling machine, such as is indicated at Q, Fig. 11, having a hollow driving and feed spindle, *q*, through which the drill rod passes, and which is provided with a clutch to engage the drill rod. The sliding splined connection between the tube L and sleeve M and the engagement of the cross pin *m′* of the latter with the uppermost one of the rod sections C^2 C^2, prevents the rotation of the line of said rod sections, while at the same time permitting said sleeve to slide vertically in the tube to compensate for any slight variation in the lengths of the sections C^2 C^2.

To prevent the accidental disengagement of the longitudinally arranged clutch members of the rod sections C^2 C^2 through the endwise movement of one or more of said sections, or of the sleeve M, it is expedient to provide means for the maintenance of a constant pressure on said sleeve M, and this is conveniently accomplished by the employment of a coiled spring, M′, which is seated within the tube L and bears at one end against the end of the sliding sleeve M and at the other end against the closed part of the head L′, as shown in Fig. 1; said head and its tube L having swiveled connection with the two part tubular shell G, K, to prevent an upward or outward movement of said tube within said two part shell, due to the outward pressure of the spring against the closed end of the head L′.

In the construction shown, this swiveling connection consists of an anti-friction bearing, N, interposed between oppositely arranged projections or shoulders forming parts of, or attached to the tube L and the upper member K of the two-part shell G K. To this end the tube L is provided exteriorly with a collar or flange, *l′*, and the sleeve K is enlarged above the flange *l′* to receive the lower steel ring *n* of the ball bearing N. The upper ring *n′* of this bearing rests in contact with a keeper ring, O, which is threaded exteriorly and engages the female threads formed in the upper enlarged part of the sleeve K, said ring O being further secured after adjustment by a set screw, *o*, Fig. 1. The ball bearing thus takes the end pressure due to the action of the spring M′, which spring by pressing against the closed upper end of the sleeve L tends to draw the said sleeve upwardly, and to hold the flange *l′* against the lower ring of the ball-bearing, the upper ring of which presses against the ring O, as described. A male thread is formed upon the upper end of the tube L, which thread engages the threaded stem of an I-coupling, L′, which in this instance constitutes the head of the tube L, and from this head project the branches or arms, L^2, as already explained. The lower end of this head L′ extends beyond the screw-thread therein, and fits within the keeper ring O, and between the same and the sleeve K a packing, P, is interposed, said packing being confined between the upper end of the keeper ring O and the lower end of a gland, P′, as shown in Fig. 1.

In operation the shackle H which supports the drill rods, will remain stationary and the shell or casing G K of the water swivel, with the drill rod A, will be rotated by the drilling machine, said swivel shell turning in the eye H′ of the shackle and being supported thereon by the ball bearing N and sleeve K. The inner rod C with its core barrel D will meanwhile remain stationary, each section of said rod being held from rotating by engagement with that next above it, and the top section being held by the sliding clutch sleeve M, clutch tube L and its head L′ and arms L^2. The weight of said inner rod is also supported by the shackle H through the agency of the sleeve K which connects the inner and outer rods C and A. In order that the threaded connections of the inner rod C may not be unwound by the rotation of the drill rod A, left hand screw threads are used in said connections. The purpose of the vertical opening *c* in the bottom of the lower section C′ of the rod or tube C, with its screw plug *c′*, is to admit of obtaining a flow of water over the core, which is sometimes desirable when drilling in hard formations where there is little or no liability of erosion.

In the modification shown in Fig. 9, the core lifter shell (D Fig. 3) is dispensed with, the core lifter ring E being seated in a tapering chamber formed by the bit B and adapted to move vertically therein between the shoulders *b′* at the lower end of said bit, and the lower end of the inner core barrel D. This construction admits of the employment of a bit having a somewhat greater interior diameter, thus producing a larger core.

In the modified form of the clutch shown in Fig. 10, for the rod sections C^2, the coupling sleeve C^3 is threaded internally at one end to engage a male thread on the end of a rod section C^2, the other end of said sleeve being notched to form crotches, c^6, and lugs, c^7, corresponding to and adapted to interlock with similar crotches c^3 and intermediate legs c^4 at the other end of the rod section C′.

The hoisting swivel shown in Fig. 8 is of well known construction, consisting of a sleeve, R, threaded at its lower end to engage the threads of the drill rod sections A, and passing at its upper end through the eye, *s* of a shackle, S. The upper end of the sleeve which projects above the eye of the shackle is threaded to receive a nut or nuts, *r*, by which the shackle S is secured to the sleeve. By the employment of such a hoisting swivel the handling of the heavier and more cum-

F^2 are arranged at each end of the coupling section A^4 of the outer core barrel A^3. The lower bearing F′ consists of a steel ring, *f*, seated upon the upper end of the core barrel head D^3, and surrounding the end of the lower tube or section C′ of the inner rod C, but having free movement with respect to the drill rod. In the upper face of this ring *f* is formed an annular groove or channel within which is seated a series of steel balls, *f′*, and resting upon these balls is another similar ring, f^2, resting against the shoulder formed by the lower end of the coupling section A^4, and so arranged as to have free movement with respect to the said lower section C′ of the rod C. The upper bearing F′ is similarly arranged in all respects, its upper ring *f* being seated against the collar F which, in the instance shown is held in place by engagement with a screw thread formed on the section C′, said collar being locked upon the tube section C′ by a set screw, f^4. In practice the section A^4 of the drill tube is provided with a bushing, *a*, of brass or other suitable metal to afford for the tube C′, a bearing which may be readily removed as it becomes worn from lateral pressure. The upper end of the drill rod coupling section A^4 is provided with a male thread to engage a female thread in the lower end of a connecting sleeve A^3, the upper end of which is also threaded internally to receive the male thread at the lower end of the drill rod coupling A^2, which coupling is also provided at its upper end with a male thread to engage the lower threaded end of a drill rod section A′, the upper end of said coupling A^2 forming an upwardly facing annular shoulder, *a′*, the purpose of which will be hereinafter explained. The remainder of the drill rod sections A′ are connected with each other by similar coupling sections A^2.

The inner rod C consists of a plurality of sections C′ C^2 C^2, corresponding in length with the sections A′ of the drill rod, the section C′ being the lowermost one, which is directly attached to the core-barrel, as above described, and the sections C^2 C^2 being those above the same. Joints between the said sections adapted for the separation thereof by an endwise movement away from each other of the adjacent sections are formed by interlocking clutch members as follows: The upper end is notched to form a crotch, c^3, the legs c^4, c^4, of which are tapered to points at their ends and form guides leading to said crotch c^3. The lower end of each section (except the lowermost one C′) is inserted within a coupling sleeve, C^3, and secured therein by a pin, c^4. Another pin, c^5, extends diametrically across each sleeve C^3 somewhat below the end of the section C^2 which is secured therein, and the lower end of each section C^3 is beveled interiorly to more readily receive the upper end of another section C′ or C^2. The sleeves C^3 are made larger in external diameter than the internal diameter of the coupling sections A^2, so that when the drill rod sections are disconnected from each other, each section will contain one of the inner rod sections, sustained therein by the contact of the sleeve C^3 thereof with the upper end of the coupling section A^2, which in every instance is left attached to the upper section in disconnecting the sections.

In extending or lengthening a drill rod as the work progresses, a section A′ of the outer or rotating rod containing a section of the inner rod is attached by the means described and the section C^2 with its coupling sleeve C^3, which is within the said drill-rod section, is connected with the next rod-section C^2 below it, without special attention on the part of the operator, the sleeve C^3 being adapted to receive the upper end of the rod section beneath it and the pin c^5 therein to engage the crotch thereof. The legs c^4 tapered or pointed as described, act to guide said pin c^5 into the crotch c^3 of the lower section, thus locking the sections firmly together, as far as the rotation of said sections is concerned. The drill rod is connected at its upper end with a water-swivel, by which the drill rod is supported in a manner to allow its free rotation, and is supplied with water which is forced downwardly through said drill rod for removing detritus from the cutting head. The upper length or section A′ of the drill rod A engages a male thread formed on the lower end of a tubular shell or casing consisting of lower and upper parts G and K, connected by a screw joint, as shown. Upon a cylindric part of this shell is mounted a swivel link or shackle, H, the eye, H′, of which surrounds the part G and is held between a shoulder, *g*, on said part G, and a shoulder *k* on the lower end of the part K.

To reduce friction and provide a bearing surface that may be renewed to compensate for wear, the eye H′ of the shackle H is shown as provided with a bushing, *h*, of brass or other suitable material, and a friction washer or washers *h′*, are preferably interposed between the flange *g* and the lower end of said eye H′. Above the eye H′ of the shackle H is a ball bearing, I (Figs. 1 and 4) consisting of an annular series of steel balls, *i*, arranged between two grooved steel rings, *i′*, and i^2, the lower one *i′* of which rests against the upper end of said eye H′ and the lower one i^2 against the flange *k*.

The part G of the shell is bored to admit of the free passage through it of the inner rod C, the bore being enlarged above the upper end of the drill rod section A′ to receive a tube, L, the bore of which is provided at opposite sides with grooves, *l*, within which are seated feathers or splines, *m*, projecting from opposite sides of a sliding sleeve, M, attached to the upper end of the rod-section C^2 and adapted to slide endwise within said tube L, the grooves *l* and splines *m* being designed to prevent the rotation of the sliding sleeve M within the tube L. This tube L is attached at its upper end to a head, L′, preferably by

bersome water swivel is avoided during the hoisting out of the drill rod sections.

W claim as our invention—

1. A rock-drill comprising a tubular drill-rod, a core-barrel, and a second rod within the drill rod, attached to the core barrel to hold the latter from rotation, substantially as described.

2. A drilling apparatus, comprising a rotating tubular drill-rod, a core-barrel, a second rod within the drill rod, attached to the core barrel and extending outside of or beyond the drill rod and engaging a non-rotating part to hold the same from rotation with the drill rod, substantially as described.

3. A drilling apparatus comprising a tubular drill rod, a core barrel within the drill rod, an inner rod attached to the core barrel and extending out of the drill rod to hold said core barrel from rotation with the drill rod, and means for holding said core barrel and inner rod from endwise movement relatively to the drill rod, substantially as described.

4. A drilling apparatus, comprising a tubular drill rod, a core barrel, a second inner rod attached to the core barrel to hold the same from rotation, and oppositely facing shoulders or bearing faces on the said parts for holding the core barrel and inner rod from endwise movement relatively to the drill rod, substantially as described.

5. A drilling apparatus comprising a tubu- drill rod consisting of detachable sections, a core barrrel, and a second rod attached to the core barrel and extending through the drill rod, said second rod being formed of a plurality of sections provided at their ends with interlocking parts, separable by an endwise movement of the sections, substantially as described.

6. A drilling apparatus, comprising a tubular drill-rod, a core barrel and a second or inner rod attached to the core-barrel, said inner rod consisting of a plurality of sections provided at their ends with interlocking clutch members, separable by an endwise movement of the sections, and a spring acting endwise on the said inner rod to hold the interlocking part in engagement, substantially as described.

7. A drilling apparatus comprising a tubular drill-rod consisting of detachable sections united by coupling pieces smaller in internal diameter than the drill rod, a core barrel, and a second or inner rod consisting of detachable sections provided with interlocking clutch members, separable by an endwise movement of the sections and each of which is provided at its lower end with projecting parts adapted to engage the said coupling pieces of the outer or drill-rod sections, whereby a section of the inner rod will be held in each section of the outer rod when the sections of the latter are separated, substantially as described.

8. The combination, with a tubular drill-rod and a core-barrel, of a second inner rod attached to the core-barrel and consisting of separable sections, and interlocking clutches for uniting the sections of said inner rod, consisting of sleeves provided with cross-pins, and notched heads adapted to enter the sleeves and engage said pins, substantially as described.

9. A drilling apparatus, comprising a tubular drill rod, a core barrel within the drill rod, a second rod attached to the core barrel and extending out of the drill rod to hold the core barrel from rotation with said drill rod, said inner rod being made hollow or tubular for the passage of water therethrough, substantially as described.

10. A drilling apparatus comprising a tubular drill rod, a core barrel within the drill rod, an inner rod attached to the core barrel and extending out of the drill rod to hold the core barrel from rotation with said drill rod, said inner rod being made tubular for the passage of water therethrough, and a channel or duct leading from the interior of the inner rod to the space between the drill rod and core barrel, substantially as described.

11. A drilling apparatus comprising a tubular drill rod, a core barrel within said drill rod, an inner rod attached to the core barrel and extending out of the drill rod to hold the core barrel from rotation with said drill rod, said inner rod and core barrel being provided with oppositely facing annular bearing surfaces engaging opposing surfaces provided on the drill rod, whereby the core barrel and inner rod are held from longitudinal movement relatively to the drill rod, substantially as described.

12. The combination, with a tubular drill-rod and core-barrel provided with a solid head, of a second inner rod attached to the core barrel, and made tubular or hollow for the passage of water, a collar on the inner rod adjacent to the core-barrel, said drill-rod being provided with oppositely facing shoulders opposed to the upper end of the core-barrel and the said collar, and ducts or water passages leading from the interior of the inner rod through the core barrel head to the space between the drill rod and core barrel, substantially as described.

13. The combination with a tubular drill-rod and a core-barrel, of a second inner rod attached to the core-barrel, a water swivel attached to the drill-rod for supplying water to the same, said water swivel embracing a non-rotating part through which the water is supplied, with which the inner rod is engaged, and by which said inner rod is held from rotation.

14. The combination, with a tubular drill rod and a core-barrel, of a second inner rod attached to the core-barrel, and a water swivel, comprising a swivel head to which the drill rod is attached, a shackle, and a non-rotating

sleeve engaged with the inner rod and water supply pipe connected with said sleeve, substantially as described.

15. The combination, with a tubular drill-rod and a core barrel, of a second inner rod connected with the core-barrel and consisting of a plurality of sections detachably connected by interlocking clutch members, and a water swivel comprising a swivel head to which the drill rod is attached, a non-rotating sleeve, connected by a sliding joint with the upper section of said inner rod, and a spring located within said sleeve and acting on the end of the rod, substantially as described.

In testimony that we claim the foregoing as our invention we affix our signatures in presence of two witnesses.

MILAN C. BULLOCK.
SAMUEL W. DOUGLASS.

Witnesses:
C. CLARENCE POOLE,
G. W. HIGGINS, Jr.