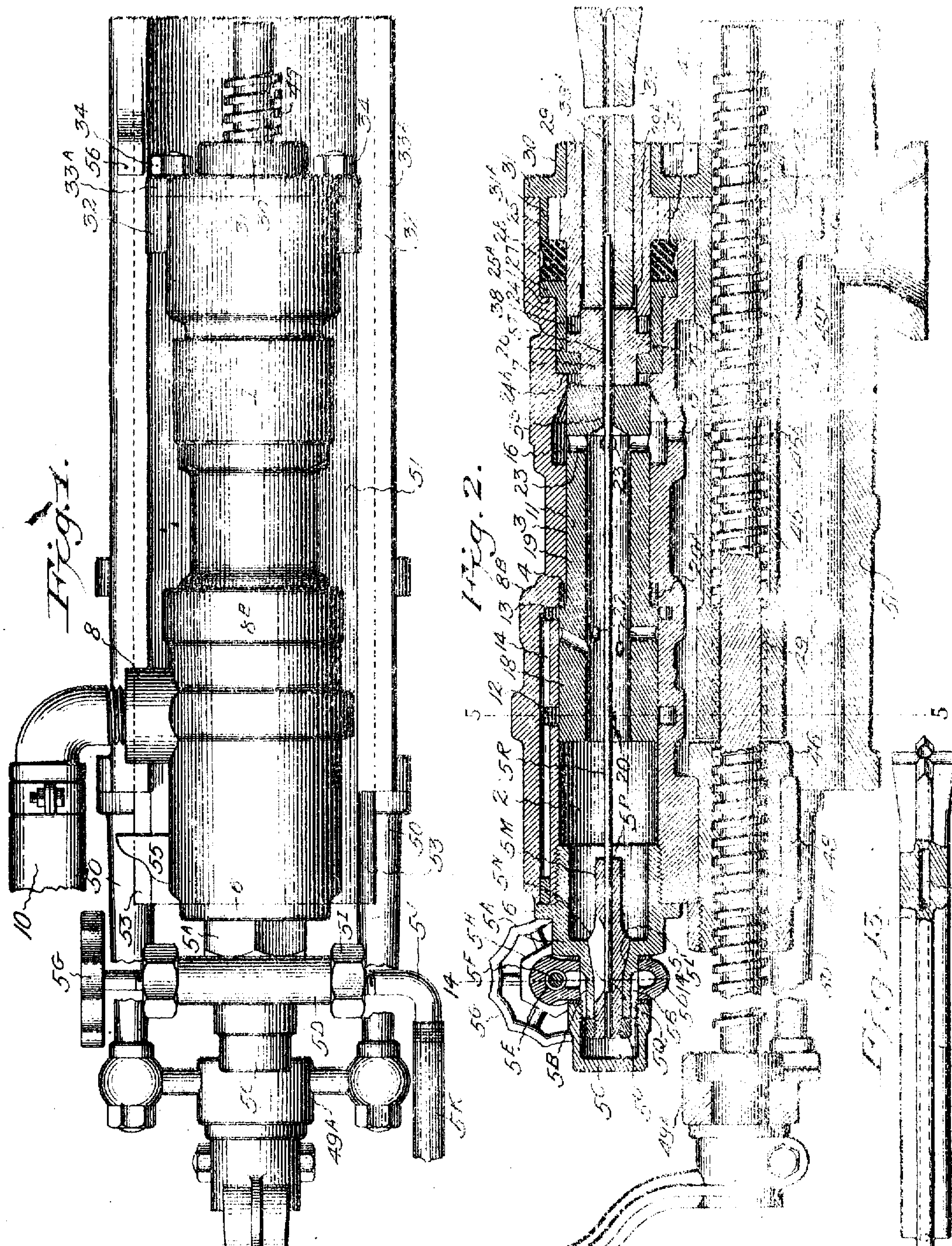
J. G. LEYNER.

ROCK DRILLING ENGINE.

APPLICATION FILED AUG. [illegible]

914,737. Patented Mar. 9, 1909.

[illegible] SHEET 1.



Witnesses:

R. Louise Brown

Luther H. Wygant, Jr.

Inventor:

John George Leyner

By H. S. Bailey Attorney.

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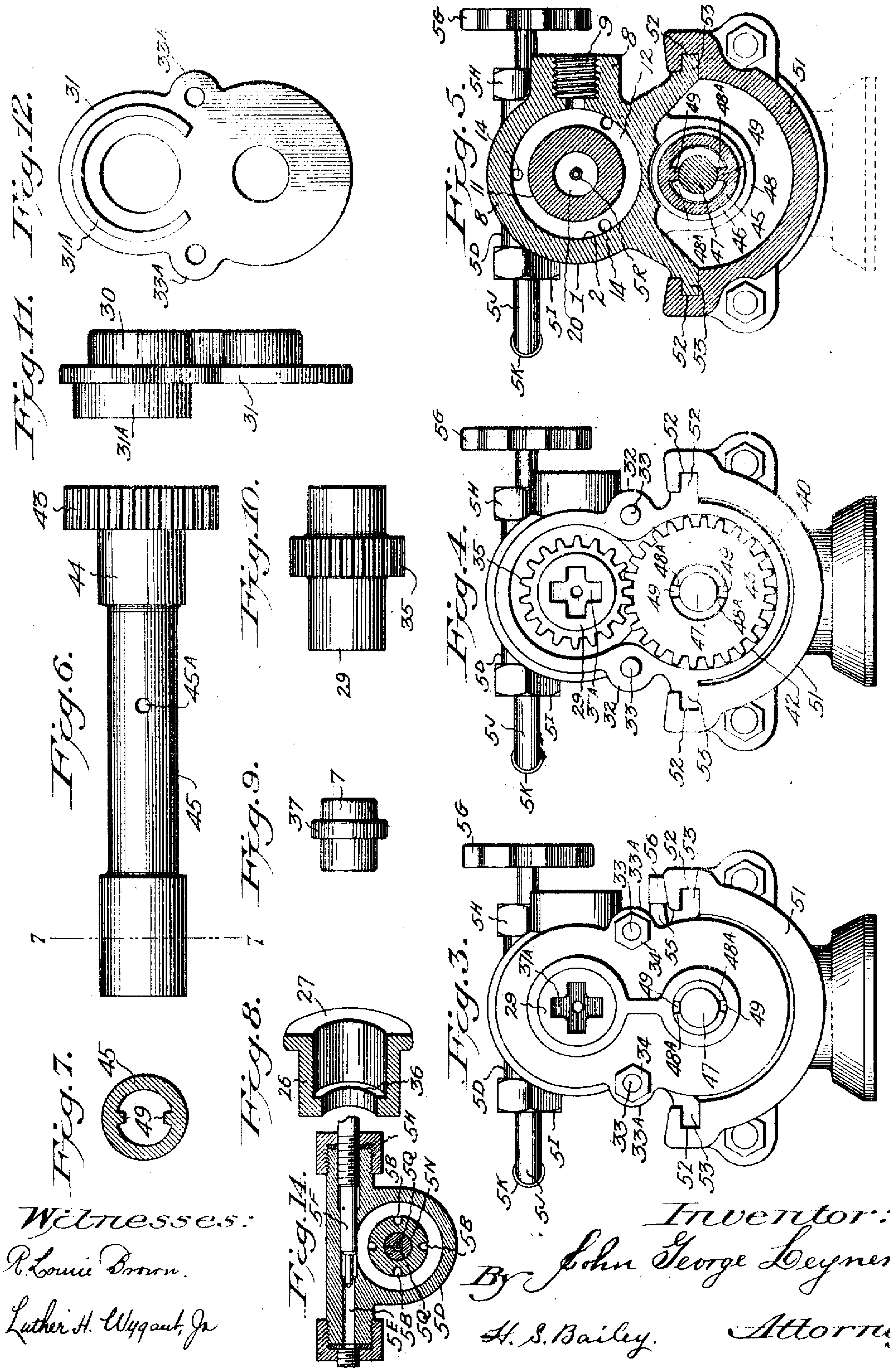
2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

JOHN GEORGE LEYNER, OF DENVER, COLORADO.

ROCK-DRILLING ENGINE.

No. 914,737. Specification of Letters Patent. Patented March 9, 1909.

Application filed August 1, 1905. Serial No. 272,174.

To all whom it may concern:

Be it known that I, JOHN GEORGE LEYNER, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented a new and useful Rock-Drilling Engine, of which the following is a specification.

My invention relates to improvements in rock drilling engines, and the objects of my invention are: First. To provide a combined air and water feeding hammer-piston, drill-bit striking-pin, feed-screw-rotating rock-drilling engine, that is arranged and adapted to feed a supply of commingled air and water to the rock cutting end of its rock-cutting drill-bit, to eject the rock cuttings from holes in rock while drilling them. Second. To provide an air and water feeding rock drilling engine, having a striking-pin for the hammers of piston hammer drills, provided with a water feeding conduit through it, provided with a water feeding tube extending loosely through it. Third. To provide a water feeding rock drilling engine, having a striking-pin member and a hammer piston, both of which are reciprocally mounted on a water conveying tube, the striking pin of which is interposed between the piston hammer and the drill-bit, and is adapted to be struck by the piston hammer during its reciprocal strokes in its cylinder, and impart the blows it receives from the piston-hammer to the end of the drill-bit. Fourth. To place a hardened steel compensating reciprocal movement striking-pin member, that is reciprocally mounted on a water conveyer, between the piston hammer and the drill-bit of fluid pressure drills, and that is adapted to drive the drill-bit by imparting the blows of the hammer-piston to it. Fifth. To provide in a water feeding rock-drilling engine, a manually operated hollow drill-bit rotating and drill-bit feeding device, that operates through the medium of the rotation of the feed screw that is especially designed for use with piston hammer rock drills. Sixth. To provide a water feeding rock-drilling engine, having a hollow drill-bit, and adapted to automatically feed a supply of water to the drill-bit's rock-cutting point. Seventh. To provide means within a water-feeding rock-drilling engine, to enable the users to employ for rock cutting drill-bits any form or character of cross-section of any merchantable tool steel, provided with a water passage conduit to or adjacent to its rock cutting point, that is adapted for use as rock-cutting drill-bits, without forming or placing upon them collars or shoulders or other devices that act as an abutment for defining the length of the shank that projects into the drilling engine within the reciprocal path of the piston hammer. Eighth. To provide a combined air and water feeding rock-drilling engine, provided with a rock cutting drill-bit, having a shank consisting of a straight piece of the steel of which the drill-bit is made without a collar or shoulder or a turned portion, and provided with a water passage or conduit arranged to be connected to a supply of commingled air and water or of water alone, and adapted to convey them to its rock-cutting end, and a drill holding sleeve adapted to receive it and hold it in operative striking relation to the piston hammer. Ninth. To provide a small, light-weight combined air and water feeding rock-drilling engine, of simple construction, that can be reciprocally fed in a supporting shell that is adapted to be supported by any of the drill-clamping and supporting columns or tripods in common use. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of my combined air and water feeding rock-drilling engine. Fig. 2 is a central, vertical, longitudinal sectional view through the same. Fig. 3 is an elevation of the front end of the drilling engine. Fig. 4 is an elevation of the front end of the drilling engine, with the front cylinder-head removed. Fig. 5 is a transverse, vertical, sectional view of the line 5—5 of Fig. 2. Fig. 6 is a plan view of the sleeve through which the feed screw passes, and which has an integral gear wheel at one end. Fig. 7 is a transverse, sectional view of the same, on the line 7—7 of Fig. 6. Fig. 8 is a sectional view in perspective, of the striking-pin-holding buffer sleeve. Fig. 9 is a side elevation of the drill-striking pin. Fig. 10 is a side elevation of the drill-holding gear chuck. Fig. 11 is a side elevation of the front cylinder head. Fig. 12 is a rear view thereof. Fig. 13 is a perspective view of the drill-bit, and Fig. 14 is a cross section of the water tube and its supporting stem and collar, on line 14—14 of Fig. 2.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings:—The numeral

1 designates the cylinder of my rock-drilling engine. This cylinder is provided with an axial bore of two diameters, 2 and 3, the largest of which, 2, extends into it from its rear end, for about one-half of the length of the piston's hammer stroke, where it terminates in a square shoulder, 4, at the beginning of the smaller bore, 3, which continues from the shoulder to the end of the piston's portion of the cylinder. The entrance to the rear end of the cylinder bore is threaded and receives a cylinder head, 5, which comprises a flange portion 6, and a rearwardly extending nut portion 5^A. This rear cylinder head is threaded to screw into the threaded bore of the cylinder until the flange bears tightly against the end of the cylinder. This rear cylinder head contains an axial aperture through it, and is provided with a reduced stepped portion at its outer end, the end portion of which is threaded and is provided with several longitudinal slots 5^B, which are formed in its shell at suitable distances apart, around its surface, and extend from its end along the greater portion of the length of the reduced portion. These slots form water passages into the interior of the cylinder head. To the threaded end of this cylinder head, I thread a cap 5^C. On the reduced stepped portion of the cylinder head, I mount a valve-controlled water inlet collar 5^D, which is clamped between the end of the cap 5^C and a shoulder formed by the nut portion that threads into the cylinder. This water collar is hollow, and a water inlet 5^E is formed across the top of it, in one end of which a plug valve 5^F is operatively seated. The stem of this valve extends beyond the water inlet tube, and a hand wheel 5^G is secured to its outer end. A stuffing box 5^H surrounds the stem of the valve, and is threaded to the end of the tubular portion of the water collar. The opposite end of the water inlet tube is threaded and a nut 5^I is threaded to it into the outer side of which one end of a curved nipple 5^J is threaded, and to the opposite end of this nipple one end of a hose 5^K is secured, the opposite end of which extends to a supply of water under pressure. The aperture through this rear cylinder head is made in two diameters, the smaller of which is at the reduced end of the cylinder head, and a portion of this smaller aperture is tapered, the taper 5^L being arranged to diverge outwardly from the rear end of the cylinder head toward the front end of the cylinder. In this tapered aperture, I fit a stem 5^M, which contains a tapered portion 5^N, intermediate of its ends, that fits the taper 5^L, of the aperture, while the rear end of the stem projects through and beyond the end of the cylinder head, far enough to receive a nut 5^O, which is threaded and bears against the end of the cylinder head. The opposite or forward end of the stem projects forward from the tapered portion into the larger diameter of the cylinder head. A small aperture 5^P is formed axially through the center of the stem, and through the tapered and adjacent portions of the stem a plurality of radial slots 5^Q are formed, that extend through the stem to its central aperture. One end of a water conveying tube 5^R is inserted in the aperture in the stem, and extends through its length, and when the nut 5^O is tightened against the end of the cylinder, the split tapered portion of the stem is drawn tightly into the tapered aperture in the cylinder head, and the split or slotted portion is contracted against the tube, and clamps the water tube rigidly to the stem. The opposite end of this water tube extends axially through the cylinder into the end of the hollow rock cutting drill-bit, and passes loosely through an axial aperture 5^S, formed through a hammer piston, which is reciprocally mounted in the cylinder, and also through an axial aperture 5^T, formed in a hammer piston striking pin 7.

At a short distance from the rear end of the cylinder, I form on the cylinder a transverse cylindrical boss portion 8, in which is formed a circular air inlet aperture 9, the entrance of which is threaded to receive the threaded connecting end of a hose 10, which leads to a supply of compressed air. The air inlet aperture connects with a circumferential recess, 12, formed in the periphery of the bore of the cylinder, which forms the air inlet port of the cylinder. Adjacent to the shoulder, 4, and in the larger bore of the cylinder, a circumferential air inlet port, 13, is also formed, and the port 12, is connected to the port 13, by ports 14, that are drilled into the rear end of the shell of the cylinder in axial alinement with the axis of the cylinder, and in position to intersect the port 12, and to extend to and intersect the port 13, which is located in a circumferential rib 8^B, that surrounds the cylinder over the port 13. The entrances to the port holes 14, are tightly plugged after they are drilled. At the front end portion of the smaller diameter of the piston's bore a circumferential exhaust port 16, is formed in the cylinder. This exhaust port is open to the atmosphere through an exhaust aperture 17, which extends through the bottom of the shell of the cylinder into it. In the bore of the cylinder I reciprocally mount a piston hammer 11, the peripheral surface of which is made in two diameters 18 and 19, to fit the two diameters of the cylinder's bore. The piston hammer is provided with an axial aperture 20, which extends into it from its rear end 21, to within a short distance from its front end, and from the front end of this large aperture, the small aperture 5^S is formed, through the front end of the hammer piston, through which the water tube extends loosely. This piston is provided, adjacent to its rear end, with radial port holes 22, which extend from the interior face of the piston hammer through its shell. These ports are preferably arranged so that a part of them will radiate at substantially a right angle to the axis of the hammer, and the remainder will stand at an obtuse forward angle from the interior base of the hammer, and they are also preferably arranged so that their entrances within the bore of the hammer are arranged in an alternating zig-zag line, and their outer openings are in a circumferential line. The forward end of the piston hammer, at the inner end of its axial bore, is provided with a radial row of port holes, 23, that extend from the interior bore through the shell of the hammer. At the end of the cylinder's piston hammer bore, an axial bore 24, is formed, which is larger in diameter than the bore of the hammer, and at the end of the bore 24, a still larger bore 25, is formed in the cylinder that extends to its front or drill-bit holding end; substantially square shoulders, 24^A, and 25^A, are formed between these three bores of the cylinder. The corners of the shoulder 25^A, are, however, preferably rounded. In the bore 24, I place a steel buffer sleeve 26. This sleeve fits loosely, but snugly, in the bore, and normally against the shoulder 24^A, formed between the piston hammer's bore and the bore 24, and on the outer end of this sleeve an enlarged collar portion 27, is formed, which fits normally in the large end bore 25, against the shoulder 25^A, formed between the bore 24 and the bore 25. Against the forward end of the steel buffer sleeve, I place a rubber buffer ring 28, having a large axial aperture, through which projects loosely one end of a drill-bit holding chuck or sleeve 29, which projects at one end into the end of the cylinder, and through the rubber buffer ring and also loosely into the sleeve 26, for a short distance of the sleeve's length. The opposite end of the chuck projects forward beyond the end of the cylinder, and is inclosed by a hub 30, formed in the front cylinder head 31. The opposite sides of the front end of the cylinder are provided with lugs 32, to which one end of studs 33, are threaded. The front cylinder head is provided with lug portions 33^A, that are provided with holes that fit over the studs, and the nuts 34 are threaded to the free ends of the studs, which project through the holes in the cylinder head. The drill-bit holding chuck is provided at about the central portion of its length with a gear 35, which is formed preferably by an enlarged integral portion, in the peripheral surface of which the teeth of the gear are formed. This gear portion of the chuck fits snugly but rotatably between the front cylinder head and the rubber washer. This gear, however, is not large enough in diameter to extend to the inner peripheral surface of the cylinder, and I fill up the space between the outside diameter of the gear and the inner peripheral surface of the cylinder by a ring-shaped hub portion 31^A, that is formed integral with the front cylinder head and that projects from its inner side into the end of the cylinder between the gear and the inner periphery of the cylinder. A portion of the under side of this hub is cut away to allow the gear 35, to mesh with a gear placed below it, as will be more fully explained hereinafter.

The steel buffer sleeve is provided at its end facing the piston hammer with an axial aperture 36, of smaller diameter than the aperture in its opposite end, into which the drill holding chuck extends, and in this aperture 36, I fit loosely the front end of a hardened steel pin 7, the opposite end of which fits loosely into the adjacent end of the drill-bit holding chuck. Upon the body of this pin, I form a circumferential collar 37, which fits loosely in the larger axial aperture of the steel buffer sleeve, and normally rests against the shoulder formed between the larger aperture of this buffer sleeve and the smaller aperture 36. The drill-bit holding chuck does not extend into the larger aperture of the steel buffer sleeve to the collar formed on the steel pin, but stops at a short distance from it, and a compensating space 38 is left within the steel buffer sleeve and between the end of the chuck and the collar of the striking-pin. This steel pin 7, I term the striking-pin, and the end of this striking-pin that projects through the aperture 36, in the steel buffer sleeve, projects beyond the sleeve a short distance into the reciprocal path of the piston hammer, and the compensating movement of this pin is to permit the striking-pin to be driven forward when it is struck by the hammer within the drill-holding chuck. The rock cutting drill-bit 39, is preferably formed of what is known as cruciform steel, and the shank of this drill-bit consists of a bar of any predetermined length of this character of merchantable steel, and the rock cutting lips are formed upon its outer end in the usual manner. This drill-bit is provided with a water conveying passage or conduit, which may be arranged in any desired manner, such as along its sides or in its edge or partially through it, and partially along it, but I preferably use an aperture 39^A formed centrally through the drill-bit, from end to end, and when the drill-bit is in operative rock drilling position against the striking-pin, the water tube projects loosely into its end a short distance, as shown in Fig. 2. The chuck is provided with an axial aperture 37^A, which is cruciform for the greater portion of its length, to correspond to the shape of the drill, while the rear end of the chuck is counterbored to receive the forward end of the striking-pin 7. This counterbore, 29^A, is of slightly greater depth than the distance traveled by the striking-pin, and is also a little greater in diameter than the cruciform aperture, in order to accommodate the end of the striking-pin. The shank end of the drill projects loosely into the drill-holding chuck and this shank end is free from shoulders or projections, or forge or machine work of any kind, and it consists simply of the natural end of this bar of steel projecting loosely into the drill-holding chuck and against the striking-pin, and into the short compensating or reciprocal movement of the striking-pin. The drill-bit is held in operative relation to the rock in which it is drilling by properly feeding the cylinder forward in such a manner that the shank end of the drill-bit is held against the end of the striking pin and the striking-pin's collar is held against the shoulder formed between its smaller and larger apertures. Then when the piston hammer strikes the striking-pin, the blow is imparted by the striking-pin to the end of the drill-bit, and it is driven into the rock and the compensating movement of the striking-pin allows forward feeding movement of striking-pin to compensate for the blow of the piston, driving the cutting points of the drill-bit into rock, and also for failure on the part of the operator to feed the cylinder to hold the drill-bit close up to or with slight pressure against the rock.

A depending lug portion 40, is formed on the cylinder, which contains an aperture 41, through it, and a counter-bore, 42, is also formed in it concentric to the aperture 41. In this counter-bore I place a gear 43, the teeth of which mesh with the teeth of the drill holding chuck gear 35. This gear 43, is provided with a hub portion 44, that fits rotatably in the aperture through the lug 40, and from this hub a long sleeve 45, extends forward under the cylinder to close to a nut 46, which is secured in a depending lug 48, formed on the rear end of the cylinder. This nut 46, is threaded and a feed screw 47 is rotatably threaded to it, and this screw extends loosely through the gear 43, hub 44, and the sleeve 45, with the exception of its outer end, which is feathered to the feed screw in the following manner: The feed screw 47, is provided with two key ways 48^A, which are cut through its threads on opposite sides of it, and the axial aperture in the outer end of the sleeve is reduced in diameter and the metal is swaged or drifted away from the opposite side of the inner peripheral surface of the wall of this reduced axial aperture by drifts or swages, in such a manner as to leave two feather keys 49, depending from the inner periphery of the aperture. These feather keys are arranged and adapted to fit slidably in the key ways in the opposite sides of the feed screw, so that when the feed screw is rotated the sleeve and gear will be rotated with it, and will also feed along its length as the cylinder is moved, which movement of the cylinder is caused by the opposite or outer end of the feed screw being secured rotatably to the head portion 49^A, of two rearwardly extending arms 50, which are secured at their inner ends to a supporting shell 51. This supporting shell is provided with slide-ways 52, on its opposite sides, and the cylinder is provided with guide-ways 53, which are arranged and adapted to fit and slide in the slide-ways of the supporting shell. The bottom of the shell is provided with an inverted fan-tail or dove-tail shaped circular hub, which is adapted to be clamped by a stopping bar chuck in a well known manner. The outer end of the feed screw is provided with a crank handle 54, which is secured to the feed screw in such a manner that the feed screw is rotatably journaled to the head portion 49^A, of the arms 50, against longitudinal movement. The front cylinder head depends down over the gear 43, and is provided with a hub portion through which the feedscrew projects loosely. The sleeve 45, is provided with axial apertures 45^A, which are placed through its shell opposite the exhaust port 17, which permits the exhaust air to enter the sleeve and keep the screw free from dust and lubricate it. On the rear end of the cylinder I form or secure, by any suitable means, an arm 55, which is positioned to stand over the slide-ways of the shell, and on the opposite end of the shell in the path of this arm I form or secure a projecting abutment stop 56, against which the arm strikes when the cylinder is fed forward in the shell as far as it should be, and which limits the operating feeding stroke of the cylinder, and prevents the cylinder being fed too far forward in the shell.

The operation is as follows: When the screw is rotated by the crank, the cylinder is fed to and fro in its supporting shell, as the nut 46, which is attached to the cylinder, feeds to and fro, depending on which way the feed screw is turned, and the sleeve 45, and its gear 43, turn with the feed screw, being held by its feather keys, and they also slide along the feed screw with the cylinder. As the gear 43, is rotated by the feed screw, it rotates the drill holding chuck gear, and the drill holding chuck rotates the rock-cutting drill-bit. The piston hammer and ports operate in the following manner: Assuming the piston to be at the end of its forward stroke in the cylinder, as shown in Fig. 2, the compressed air flows from its source of supply through the hose 10, into the inlet port 12, and through the longitudinal port 14, to the port 13, and entering the cylinder between the shoulder 4, of the cylinder, and the shoulder 20^A of the piston hammer, moves the piston backward to the rear end of its stroke in the cylinder, and when the ports of the piston hammer pass the inlet port 12, the air rushes from the inlet post into and through the plurality of radial ports 22, into the interior of the piston hammer and to the rear end, cushioning it just before it strikes the cylinder head and starting it and throwing it forward impinging it with great velocity against the end of the striking pin, as the air flows through the port holes 22 into the interior of the piston hammer in much greater volume than against its shoulder. When the piston hammer reaches the forward end of its stroke, its exhaust ports 23, register with the exhaust port 16, and the air in the interior of the piston hammer flows out to the atmosphere through its exhaust ports 23. The air then again enters the inlet port 12, and the reciprocal stroke is repeated. The piston hammer strikes the striking-pin with great rapidity, causing it to strike the end of the rock-cutting drill-bit each time it is struck by the piston hammer, and the operator rotates the crank handle which rotates the feed-screw and feeds the cylinder forward in its supporting shell just fast enough to keep the drill-bit in operative relation to rock. In case, however, the drill-bit is so loosely held in the drill-chuck that the striking-pin does not strike it or is not in the drill-chuck, the striking-pin is then driven against the adjacent end of the drill-chuck, and the piston hammer strikes against the end of the steel buffer sleeve, which cushions against the rubber buffer and the steel washer and the gear and cylinder-head. The rubber buffer cushions the blows, however. As soon as the rock-drilling engine is set in operative position to rock, and the drill-bit has been fed by the feed screw into operative striking relation to rock, the supply of water from the hose 10 is turned on by the valve 5^F into the water collar 5^D and flows from its interior through the water recesses 5^B into the hood 5^C of the rear cylinder head from which it flows into the water tube 5^R and through it into the rear end of the rock-cutting drill-bit through which it flows to its cutting point to the bottom of the hole in the rock, as it is being drilled. This supply of water does not flow alone through the drill-bit to its cutting point. The water tube fits loosely in the shank end of the drill-bit, and the striking pin is also loosely and reciprocally mounted in its supporting sleeve, and at each reciprocal stroke of the hammer piston a portion of the compressed air flowing into the forward end of the cylinder flows by the striking pin into the aperture in the drill-bit around the end of the water tube, and combines and commingles with the water, and this combined air and water is discharged in jets and puffs as a commingled spray, at each reciprocal stroke of the hammer piston in the bottoms of holes in rock while drilling them.

It will be seen by the above that by the use of the striking-pin I am enabled to use rock-cutting drill-bits having straight, bar shanks of any kind or character of cross-section, without doing any work on them or providing them with collars or shoulders or lugs, or other members that are intended to bear against the end of the cylinder and define the distance the striking end of the shank shall extend into the cylinder, thus enabling me to do away or dispense with all that character of work, and greatly cheapen the cost of the rock-cutting drill-bits. The drill-bits are thrown around the floor of shafts, stopes, and tunnels, and get covered with grit, sand, and mud, and this striking-pin, taken in connection with the steel sleeve, also prevents this sand, mud, and grit from working into the cylinder of the piston hammer.

Although I preferably use cruciform steel, still my invention contemplates the use of any form of cross-section of any merchantable tool steel used for cutting rock, as round, square, hexagon, triangular, ribbed, cross-ribbed, or of any polygonal form, that is provided with a passage-way or conduit or an air or water or a commingled air and water aperture, adapted to convey air or water or both separately or combined or commingled to its cutting point, and to the bottoms of holes in rock while drilling them.

While I have illustrated and described the preferred construction and arrangement of my improved combined water and air rock cuttings ejecting piston hammer striking-pin feed screw, drill-bit rotating, fluid pressure rock-drilling engine, and improved form of rock-cutting drill-bit, I do not wish to be limited to the construction and arrangement shown, as many changes might be made therein without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A rock drill, comprising a cylinder, a piston-hammer, an apertured striking-pin, a hollow drill-bit, and means for delivering water through said striking-pin and drill-bit.

2. A rock drill, comprising a cylinder, a piston-hammer, an apertured striking-pin, a hollow drill-bit, and a water-supply pipe extending through said striking-pin into said drill-bit.

3. A rock drill, comprising a cylinder, a piston-hammer, an apertured striking-pin, a hollow drill-bit, a revoluble chuck loosely receiving said drill-bit, and means for delivering water through said striking-pin and drill-bit.

4. A rock drill, comprising a cylinder, a piston-hammer, an apertured striking-pin, a hollow drill-bit, a revoluble chuck loosely receiving said drill-bit, and a water-supply pipe extending through said striking-pin into said drill-bit.

5. A rock drill, comprising a cylinder, a piston-hammer, a striking-pin, and a hollow drill-bit, said drill having passages for delivering water and air through said striking-pin into said drill-bit.

6. A rock drill, comprising a cylinder, a piston-hammer, an apertured striking-pin, a hollow drill-bit, a water-supply pipe loosely extending through said striking-pin into said drill-bit, said drill having passages for deliving compressed air between said striking-pin and pipe.

7. A rock drill provided with a drill steel having a centrally located longitudinal passage, a reciprocating hammer having a corresponding longitudinal passage, a head piece screwed into the rear extremity of the drill casing and provided with an alined passage, a fluid delivery tube inserted in said passages, the said tube being open at both ends, and a cap located in the forward extremity of the casing for supporting said tube.

8. In a rock drilling machine, the combination with a casing, a drill bit mounted therein and having a central longitudinal passage, a hammer mounted to reciprocate therein and having a corresponding passage, a fluid delivery tube passing through the hammer and extending through the rear extremity of the casing for the passage of fluid through the hammer and drill steel, and a supporting cap located at the forward extremity of the tube and open to register with the tube and the drill bit passage.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN GEORGE LEYNER.

Witnesses:

R. LOUISE BROWN,

LUTHER A. WYGANT, Jr.