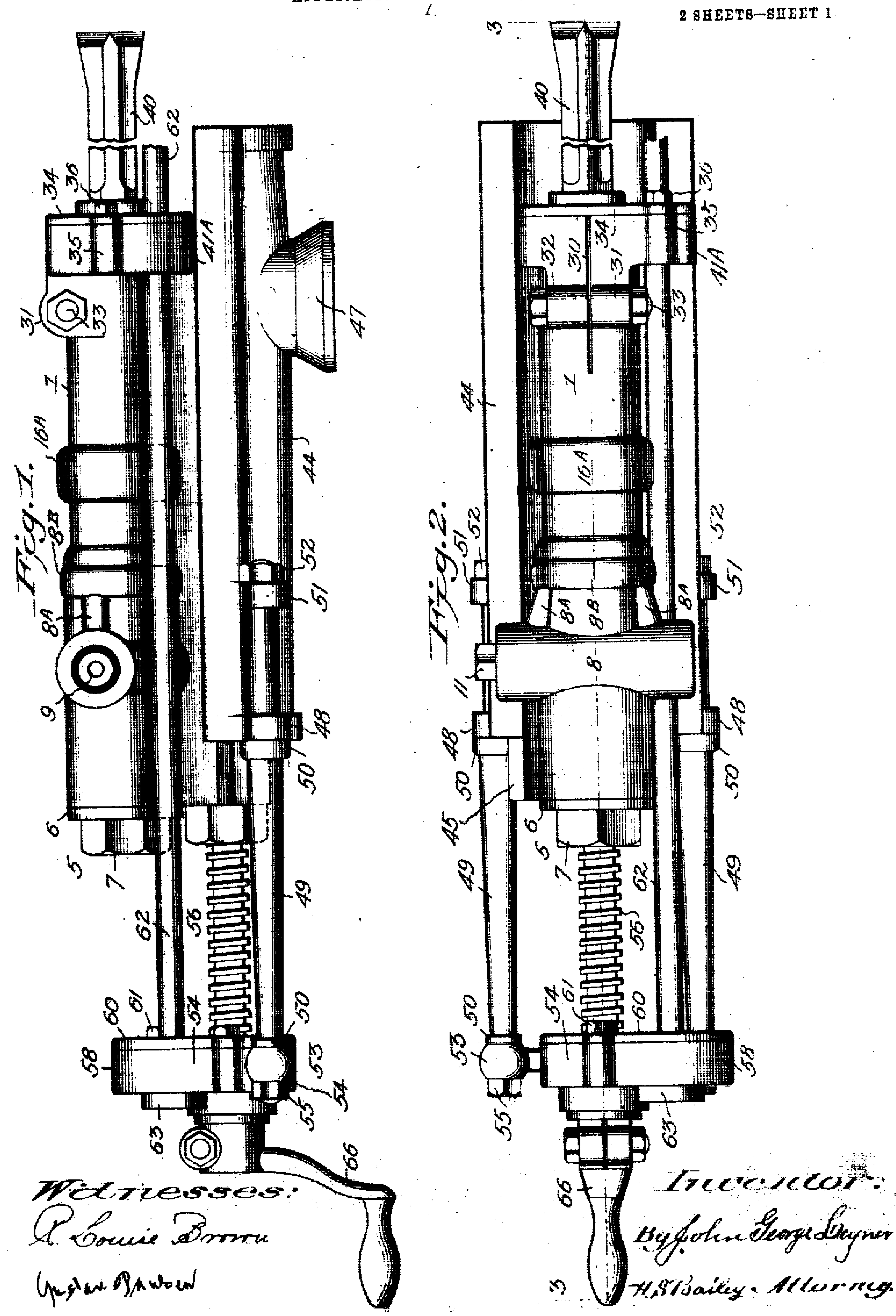
No. 815,299. PATENTED MAR. 13, 1906.

J. G. LEYNER.

ROCK DRILL.

APPLICATION FILED AUG. 1, 1905.

2 SHEETS—SHEET 1.



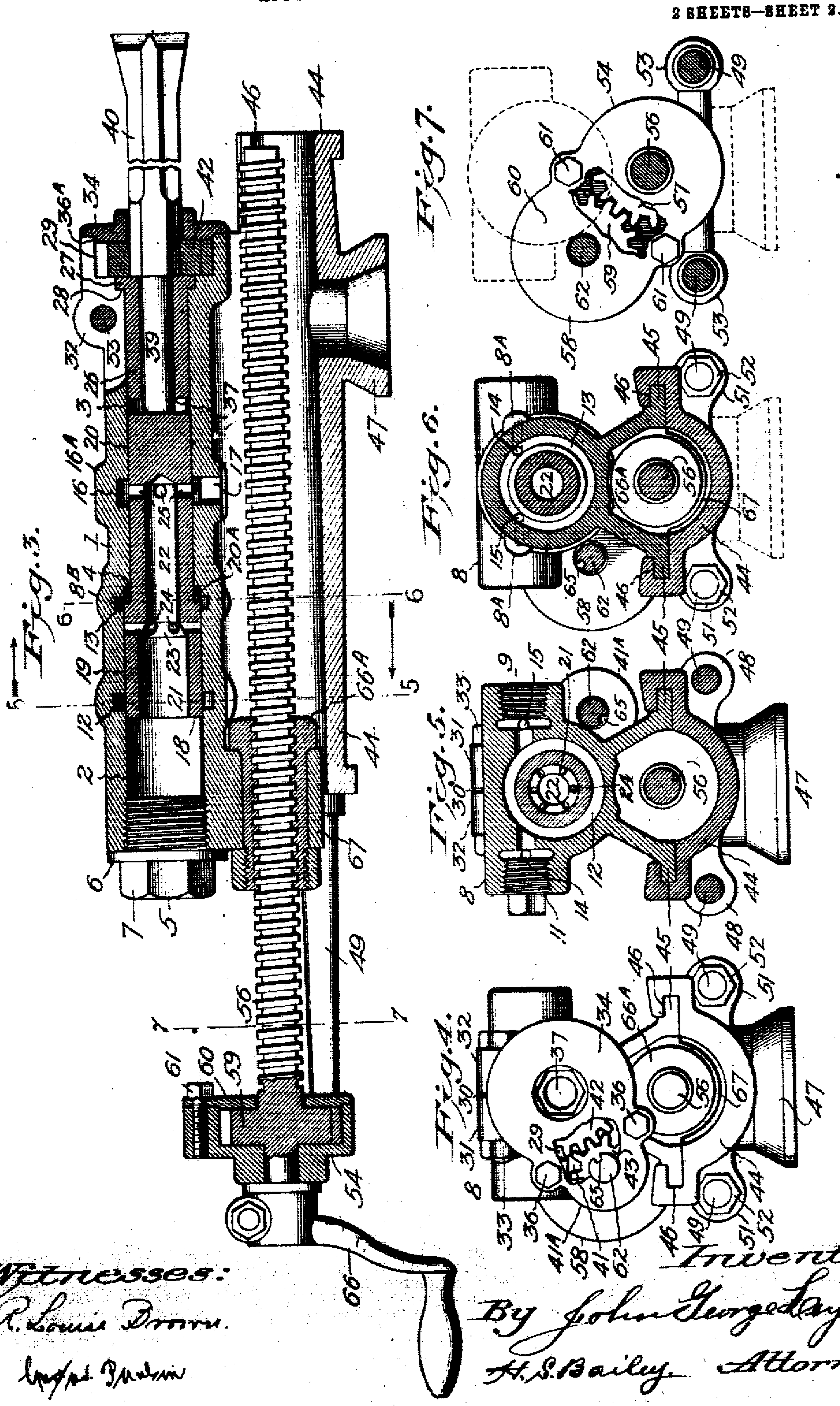
No. 815,299. **PATENTED MAR. 13, 1906.**

J. G. LEYNER.

ROCK DRILL.

APPLICATION FILED AUG. 1, 1905.

2 SHEETS—SHEET 2.



Witnesses:

R. Louise Brown.

[illegible]

Inventor:

By John George Leyner

H. S. Bailey. Attorney.

UNITED STATES PATENT OFFICE.

JOHN GEORGE LEYNER, OF DENVER, COLORADO.

ROCK-DRILL.

No. 815,299. Specification of Letters Patent. Patented March 13, 1906.

Original application filed June 24, 1904, Serial No. 213,988. Divided and this application filed August 1, 1905. Serial No. 272,175.

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-Drill, of which the following is a specification.

My invention relates to improvements in rock-cutting drill-bit-rotating mechanisms for hammer-piston rock-drilling engines; and the objects of my invention are, first, to provide a rock-drilling engine having a manually-operated drill-bit feeding and rotating mechanism; second, to provide a feed-screw drill-bit-rotating mechanism for hammer-piston rock-drills; third, to provide a small simple light-weight rock-drilling engine that can be reciprocally fed in a supporting-shell that is adapted to be supported by a stoping bar or tripod and in which the rock-cutting drill-bit is rotated and fed by the rotation of the feed-screw. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of my improved feed-screw drill-bit-rotating rock-drilling engine. Fig. 2 is a plan view thereof. Fig. 3 is a central vertical longitudinal sectional view on the line 3 3 of Fig. 2. Fig. 4 is a front end elevation of Fig. 1, the drill-bit being removed and a portion of the cylinder-head being broken away to show the gears, which effect the rotation of the drill-bit. Fig. 5 is a vertical transverse sectional view taken on the line 5 5 of Fig. 3. Fig. 6 is a similar view taken on the line 6 6 of Fig. 3; and Fig. 7 is a vertical transverse sectional view on line 7 7 of Fig. 3, showing the drill-operating gears at this end of the engine, a portion of the cap of the casing in which they are located being broken away for this purpose.

Similar numerals 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 larger of which, 2, extends into it from its rear end for the greater portion of the length of the piston-hammer's stroke, where it terminates in a square shoulder 4 at the beginning of the smaller bore 3, which continues from the shoulder to the front end portion of the cylinder. The entrance to the rear end of the cylinder-bore is threaded, and the cylinder is provided with a cylinder-head 5, which comprises a flange portion 6, with a projecting hexagon-nut portion 7 on its outside and a hub portion on its inside, which is threaded to screw into the threaded bore of the cylinder until the flange bears tightly against the end of the cylinder. At a short distance from the rear end of the cylinder 1 I form on the cylinder a transverse cylindrical boss portion 8, in which are formed circular air-inlet apertures 9, the entrances of which are threaded to receive the threaded connecting end of a hose, which is used to connect the cylinder to a supply of compressed air. The air-hose may be connected to either side of the boss, and a plug 11 is screwed into the air-inlet aperture to which the air-hose is not connected. These air-inlet apertures connect 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 two port-holes 14 and 15, that are bored through the shell of the bosses 8 at converging oblique angles through projecting ribs 8^A, that extend along the sides of the cylinder and connect the bosses with a circumferential rip 8^B, which surrounds the cylinder over the port 13. The entrances to the port-holes 14 and 15 are plugged up tight after they are drilled. At substantially the same distance from the port 13 that the inlet-port 12 is from the port 13 a circumferential exhaust-port 16 is formed in the cylinder. This exhaust-port is open to the atmosphere through a hole 17, which extends through the bottom of the shell of the cylinder into it. A circumferential rib 16^A is formed on the periphery of the cylinder over the port 16. In the bore of the cylinder I reciprocally mount a piston-hammer 18, the peripheral surface of which is made in two diameters 19 and 20 to fit the two diameters of the cylinder's bore. The piston-hammer is provided with an axial bore of two diameters 21 and 22, which extend into it from its rear end to within a short distance from its front end. The larger bore 21 of this axial aperture is at the rear-end portion of the piston-hammer, and it extends from the rear end of the piston-hammer to within a short distance of the shoulder. At the junction of the two diameters on the outside of the piston-hammer it connects with the smaller bore 22 by a beveled shoulder 23.

th ugh the lower edge of the periphery of ..ch a plurality of port-holes 24 are formed that extend radially through the shell of the piston-hammer. These port-holes form the air-inlet ports to the interior of the piston-hammer. A plurality of exhaust-port holes 25 also radiate from the inner end of the smaller diameter of the axial aperture 22 through the shell of the piston-hammer. In the front end of the cylinder's bore I place a long drill-bit-holding sleeve 26, which is provided with a slightly-enlarged collar portion 27, which fits into a stepped counterbore 28, formed in the edge of the cylinder's bore, and a large counterbore 29, that extends into the end of the cylinder. I secure the sleeve in the end of the cylinder by clamping the end of the cylinder to it. This clamp I form by cutting a groove 30 through the end of the cylinder, and on opposite sides of the groove I form lugs 31 and 32, through which I insert a bolt 33, which when tightened clamps the end of the cylinder to the sleeve, securing it rigidly in the end of the cylinder. The front end of the cylinder is provided with a cylinder-head 34, which is bolted to lateral lugs 35, formed on its sides by cap-screws 36. A step 36ᴬ is formed on the cylinder-head that projects into the counterbore. The drill-holding sleeve is provided with an axial aperture 37, which is adapted to receive loosely the shank end 39 of a rock-cutting drill-bit 40, which extends through the sleeve into the reciprocal path of the piston-hammer, which strikes directly on its end, as will be described more fully hereinafter. I preferably make the terminal end of the drill-bit that extends through the drill-bit-holding sleeve and the hole in this sleeve round, although it may be given a polygonal form, if desired. The large counterbore aperture 29, formed in the forward end of the cylinder, intersects a smaller counterbore 41, which is formed slightly below and at one side of the counterbore 29 in a lug 41ᴬ and intersects it so that the two counterbores form a continuous chamber of the same depth in the end of the cylinder. In this two-part connecting-chamber I place in mesh with each other a spur-gear 42 and a pinion 43. The gear 42 contains a polygonal-shaped hole of preferably hexagon form through its center and is rotatably mounted in the upper counterbore 29, which forms its supporting-bearing and fits loosely on the shank of the drill-bit, which is thus free to be inserted in or withdrawn from it, but is rotated by the gear whenever it is rotated as the hexagon aperture locks the gear to the drill-bit. The gear 43 fits rotatably in the counterbore 41 of the cylinder. This drill-bit 40 may be made with any desired number or arrangement of rock-cutting lips. The shank may be of any desired form of cross-section from the rock-cutting lips up to its rotating gear 42, where some form of polygonal surface is formed in it, and the axial aperture in the gear is made to correspond with it, in order to loosely key the gear and drill-bit together, so that the drill-bit will be rotated by the gear.

The cylinder 1 is supported in a shell 44 by means of guideways 45, which are depended below the cylinder and extend outward from it on opposite sides of it. These guideways fit in slideway-recesses 46, formed in the opposite sides of the supporting-shell. On the bottom of the shell a depending circular inverted dovetailed hub 47 is formed that is adapted to be adjustably clamped to a stoping-bar or to a tripod, either of which I do not illustrate. This circular hub enables the shell and cylinder to be pivotally adjusted in any desired position in any suitable stoping-bar or tripod. The rear end of the shell at its sides is provided with projecting lugs 48, to which one end of a pair of rods 49 are bolted. These rods are provided with collars 50 close to their opposite end, and their ends are threaded and project through the lugs 51, and nuts 52 are screwed on them against the lugs and clamp them rigidly to the lugs. The opposite ends of these rods extend through lugs 53, formed on opposite sides of a bearing-block 54, which is rigidly clamped to them by nuts 55, threaded to their ends. This bearing-block is provided with a central aperture of two diameters, the smaller aperture of which receives the terminal end of the feed-screw 56, which projects through it far enough to receive a crank-handle 66, which is keyed or otherwise secured to it in any suitable manner. In the larger diameter of this central aperture in the bearing-block 54 a gear 57 is rotatably seated. This gear is secured to the feed-screw and may be made integral with it, if desired. The bearing-block is provided with a circular chamber 58, which is formed at one side of the central aperture and intersects it, and a gear 59 is rotatably seated in this chamber in mesh with the gear 57. A cap 60 is bolted to the inner side of the block by cap-screws 61. A rod 62 extends through the center of the gear 59 and also through an aperture in the cap and through the block into a hub portion 63, formed on the rear side of the block to form a bearing for its rear terminal end. The gear 59 may be secured in any suitable way to the rod 62, or may, if desired, be made an integral part of it. The rod 62 extends from the bearing-block 54 to a short distance beyond the front end of the cylinder and passes through the projecting lug 41ᴬ and gear 43.

The gear 43 is provided with an axial aperture that fits loosely over the rod 62, and a feather-key is secured to it that fits loosely and slidably in a keyway or spline 65, formed in the rod. This arrangement permits me to arrange the gears in the bearing-block 54 and at the drill-bit to give any desired number of rotations or a proportion of a revolution to the drill-bit relative to a revolution of the feed-screw. The feed-screw 56 is threaded to a nut 66^A, which is secured to a depending lug 67, formed on the rear end of the cylinder.

The operation of my improved rock-drill-rotating device is as follows: My improved rock-drilling engine and its supporting-shell are mounted on any suitable stoping-bar in a tunnel, stope, drift, or shaft of a mine in operative relation to rock, and 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 into the inlet-port 12 and through the lateral ports 14 and 15 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-port into and through the plurality of radial ports 24 into the interior of the piston-hammer and to the rear end, cushioning it just before it strikes the cylinder. The air then again enters the inlet-port 9 and the reciprocal stroke is repeated. The piston-hammer strikes the end of the rock-cutting drill-bit each time it is struck by the piston-hammer, and the operator rotates the crank-handle and 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, and the rotation of the feed-screw rotates the gear 57, which rotates the gear 59, and the rod 62, which rotates the gear 43, and the gear 43 rotates the gear 42, which rotates the drill-bit. Consequently the drill-bit is rotated by the feed-screw at the same time it is being fed forward into rock during the operation of the hammer-piston. The drill-bit is simply inserted or pushed into its gear and sleeve and rests loosely in them in striking relation to the reciprocal path of the piston-hammer, and the cylinder must be fed by the operator to hold the drill-bit constantly against the rock, and my piston-hammer drill-bit-rotating device possesses the vital and essenial feature of enabling the operator not only to do this in the most desirable manner, but the gear-rotating mechanism is so sensitive that it transmits from the rock-cutting lips through the drill-bit and gears and the feed-screw to the hand of the operator full knowledge of the character of the rock the drill-bit is cutting in, as every tremble and vibration of the drill-bit is distinctly felt by the hand of the operator and as the vibrations of the drill-bit are very distinctly different when drilling in rock of different degrees of hardness and of seamy and talcky and soft rock the operator is in positive direct physical touch with the cutting-points of the drill-bit, every blow of which against the bottom of the hole is telegraphed to his hand, and he can govern the rotation of the drill-bit and its feed into the rock according to the conditions of the rock he is drilling in.

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

1. In a rock-drilling engine, a cylinder, a supporting-shell in which said cylinder is mounted, a piston-hammer reciprocally mounted in said cylinder, a drill-bit loosely supported in said cylinder, in the reciprocal path of said piston-hammer, a polygonal surface on said drill-bit, a gear loosely mounted on said drill-bit and rotatably journaled in said cylinder, a gear in mesh with said drill-bit gear, a rod slidably keyed to said gear, a feed-screw operatively connected to said cylinder and shell, and means including gearing connected to said feed-screw and said rod for simultaneously rotating said rod and feed-screw.

2. In a rock-drilling engine, a cylinder, a supporting-shell in which said cylinder is slidably mounted, a piston-hammer, reciprocally mounted in said cylinder, a drill-bit supported in said cylinder in the reciprocal path of said piston-hammer, a gear rotatably mounted in said cylinder and provided with a polygonal-shaped axial aperture, surrounding the entrance to said drill-bit, a polygonal-shaped surface on said drill-bit adapted to register loosely in the aperture in said gear, a second gear rotatably journaled in said cylinder and arranged in operative mesh with said drill-bit's gear, a rod slidingly keyed to said second gear, a feed-screw operatively connected to said cylinder and shell, and means including gearing, connected with said feed-screw and said rod whereby rotation of said feed-screw effects rotation of said drill-bit.

3. In a rock-drilling engine, an operative cylinder and hammer-piston and a supporting-casing, a feed-screw operatively connected to said cylinder and casing to feed said cylinder therein, a drill-bit in said cylinder, a rod mounted in said cylinder, a keyway in said rod, a gear surrounding said drill-bit, a second gear in mesh with said drill-bit's gear, a feather-key secured to said second gear and projecting loosely into said keyway of said rod, and means including a gearing arranged between said feed-screw and rod, whereby rotation of said feed-screw effects rotation of said rod and drill-bit.

4. In a rock-drilling engine, a cylinder, a rock-cutting drill-bit, a supporting-shell, a motive-fluid-controlled hammer-piston for striking said drill-bit, and a feed-screw arranged to feed said cylinder in said shell, a gear on said feed-screw, a second gear in mesh with the gear on said feed-screw, a rod secured at one end to said second gear, and suitable connections between the opposite end of said rod and drill-bit whereby rotation

of said feed-screw and rod effects rotation of said drill-bit.

5. In a rock-drill, the combination of a cylinder arranged to support a drill-bit, a piston-hammer reciprocally mounted in said cylinder to strike said drill-bit, a supporting-shell in which said cylinder is slidably mounted, a feed-screw rotatably mounted in said shell and threadedly connected to said cylinder, a gear mounted on said drill-bit, a gear on said feed-screw, a second gear rotatably supported by said shell, and in mesh with said feed-screw's gear, a rod secured at one end to said second gear, and extending to the forward end of said shell, and a gear slidably feathered to said rod and in operative mesh with said drill-bit's gear, whereby rotation of said feed-screw effects rotation of said drill-bit.

6. In a rock-drill, the combination of a cylinder, a drill-bit supported by said cylinder, a piston-hammer reciprocally mounted in said cylinder to strike said drill-bit, and a supporting-shell in which said cylinder is slidably mounted and provided with a rearwardly-extending portion adapted to rotatably support a feed-screw and its operative crank, a gear on said drill-bit, a second drill-bit gear rotatably mounted in said cylinder in mesh with said drill-bit's gear, and arranged to impart rotative movement to said drill-bit when it is rotated, an axial aperture in said second gear, a feather-key in said aperture, a feed-screw rotatably mounted in said shell and threaded to said cylinder, a gear rotatably seated in the rearwardly-extending portion of said shell and mounted on said feed-screw, a second gear rotatably seated in said rearwardly-extending portion of said shell and arranged in rotative mesh with the gear on said feed-screw, a rod secured at one end to said second-named gear, and extending to the forward end of said shell loosely through said drill-bit gear, and a keyway in said rod into which said feather-key of said second drill-bit gear extends loosely, as set forth.

7. In a rock-drilling engine, the combination of a cylinder, a piston-hammer, a drill-bit having a gear housed in said cylinder and mounted loosely on said drill-bit, with a supporting-shell in which the said cylinder is slidably mounted, a feed-screw threaded to said cylinder and rotatably mounted in said shell, a gear housed in said shell and secured to said feed-screw, a rod rotatably mounted at one end in said shell and rotatably mounted at its opposite end in said cylinder, a gear housed in said shell and secured at one end of said rod, arranged in mesh with the gear on said feed-screw, and a gear housed in said cylinder in mesh with said drill-bit gear, and feathered slidably on said rod, substantially as described.

8. In a rock-drilling engine, the combination of a cylinder, a piston-hammer, a drill-holding chuck, a drill-bit-rotating gear, a drill-bit removably and loosely mounted in said chuck loosely inserted within said gear, and a second gear rotatably mounted in said cylinder in mesh with said drill-bit-rotating gear, a rod extending loosely through said second-named gear, a keyway in said rod, a key feathered to said second-named gear to slide in said keyway, a supporting-shell in which said cylinder is slidingly mounted, a feed-screw rotatably mounted in said shell and threaded to said cylinder, and means connected with said feed-screw for rotating said rod, substantially as described.

9. In a rock-drilling engine, the combination with a cylinder, a piston-hammer, and a drill-bit, of a supporting-shell in which the said cylinder is slidably mounted, a bearing-block secured to said shell, a feed-screw provided with a gear rotatably mounted in said bearing-block, a nut threaded to said feed-screw and secured to said cylinder, a rod rotatably mounted in said bearing-block at one end and rotatably and slidably mounted in said cylinder, a gear secured to said rod, in mesh with the gear on said feed-screw, and means connected with said rod and said drill-bit whereby rotation of said feed-screw effects rotation of said drill-bit.

10. In a rock-drill, a cylinder having a piston-hammer and a revoluble drill-chuck, a support upon which said cylinder is slidably mounted, a feed-screw in engagement with said cylinder and support, chuck-rotating means eccentrically mounted with respect to said feed-screw and geared thereto, and means whereby rotation of said feed-screw effects rotation of said chuck, substantially as described.

11. In a rock-drill, a cylinder having a piston-hammer and a revoluble drill-chuck, a support upon which said cylinder is slidably mounted, a feed-screw in engagement with said cylinder and support, a rod extending longitudinally of said cylinder and geared to said feed-screw, and means whereby rotation of said feed-screw effects rotation of said chuck, substantially as described.

12. In a rock-drill, a cylinder having a piston-hammer and a revoluble drill-chuck, a support upon which said cylinder is slidably mounted, a feed-screw in engagement with said cylinder and support, a rod longitudinally slidable with respect to said feed-screw and geared thereto, and means whereby rotation of said feed-screw effects rotation of said chuck, substantially as described.

13. In a rock-drill, a cylinder having a piston-hammer, a support upon which the cylinder is mounted, a drill-bit, feeding means in engagement with said cylinder and support, longitudinally-slidable means eccentrically mounted with respect to said feeding means for rotating said drill-bit, and gearing whereby rotation of said feeding means effects rota-

tion of said drill-bit, substantially as described.

14. In a rock-drill, a cylinder having a piston-hammer, a support upon which the cylinder is mounted, a drill-bit, feeding means in engagement with said cylinder and support, a longitudinally-slidable rod eccentrically mounted with respect to said feeding means for rotating said drill-bit, and gearing whereby rotation of said feeding means effects rotation of said drill-bit, substantially as described.

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

JOHN GEORGE LEYNER.

Witnesses:

R. LOUISE BROWN,

GUSTAV RAWSEN.