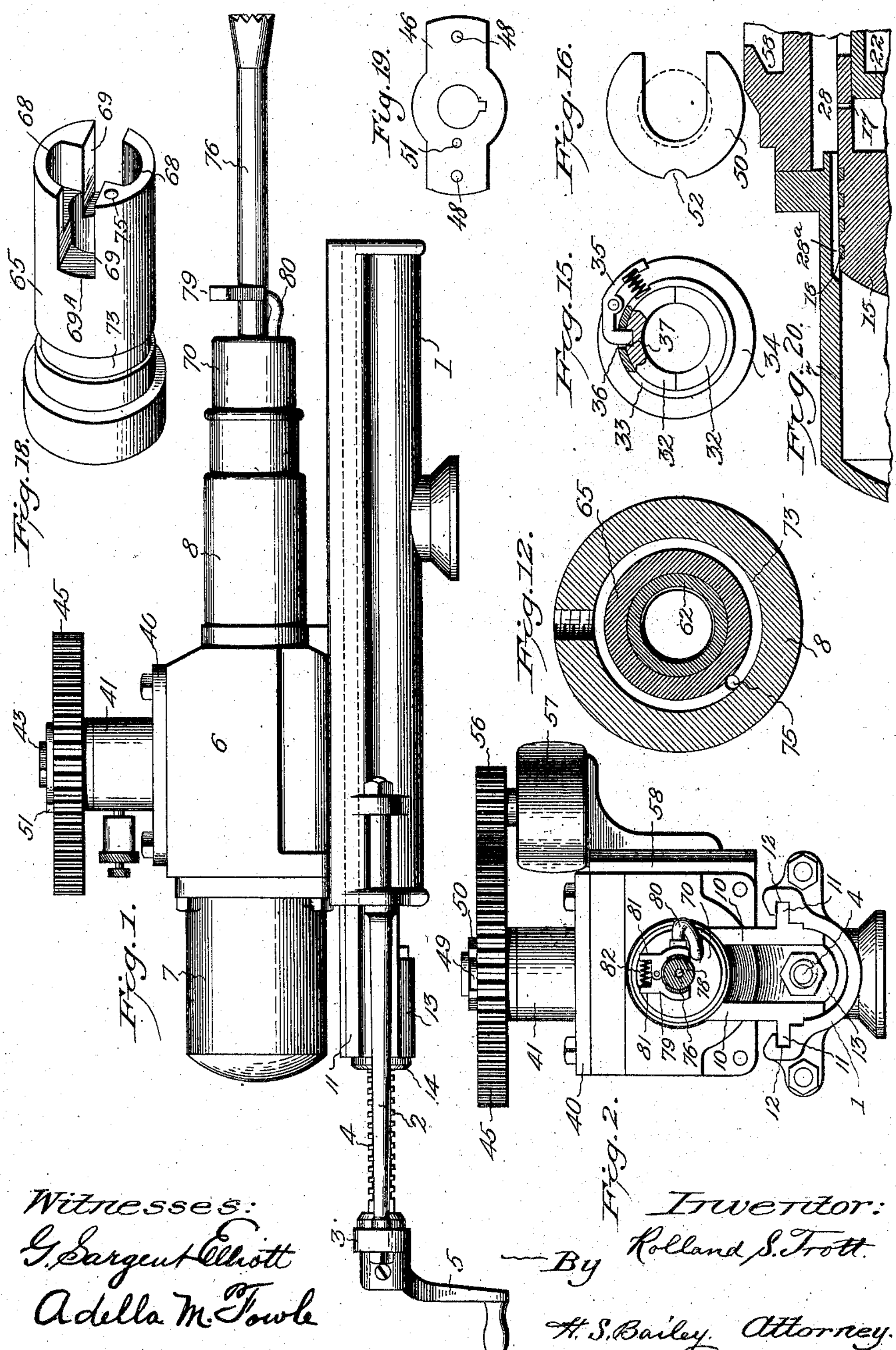
R. S. TROTT.

ROCK DRILL.

APPLICATION FILED JULY 27, 1907.

981,036. Patented Jan. 10, 1911.

3 SHEETS—SHEET 1.

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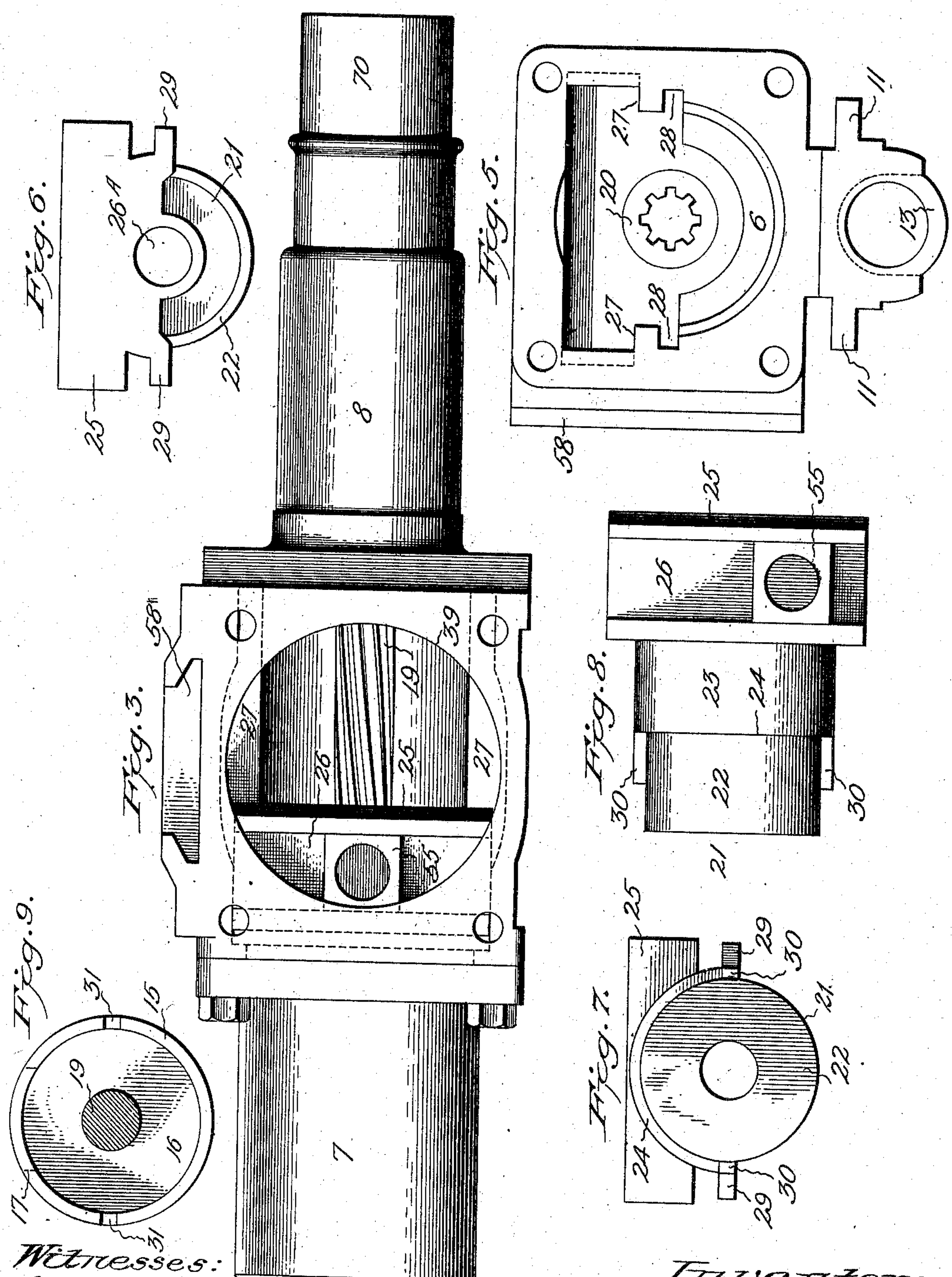


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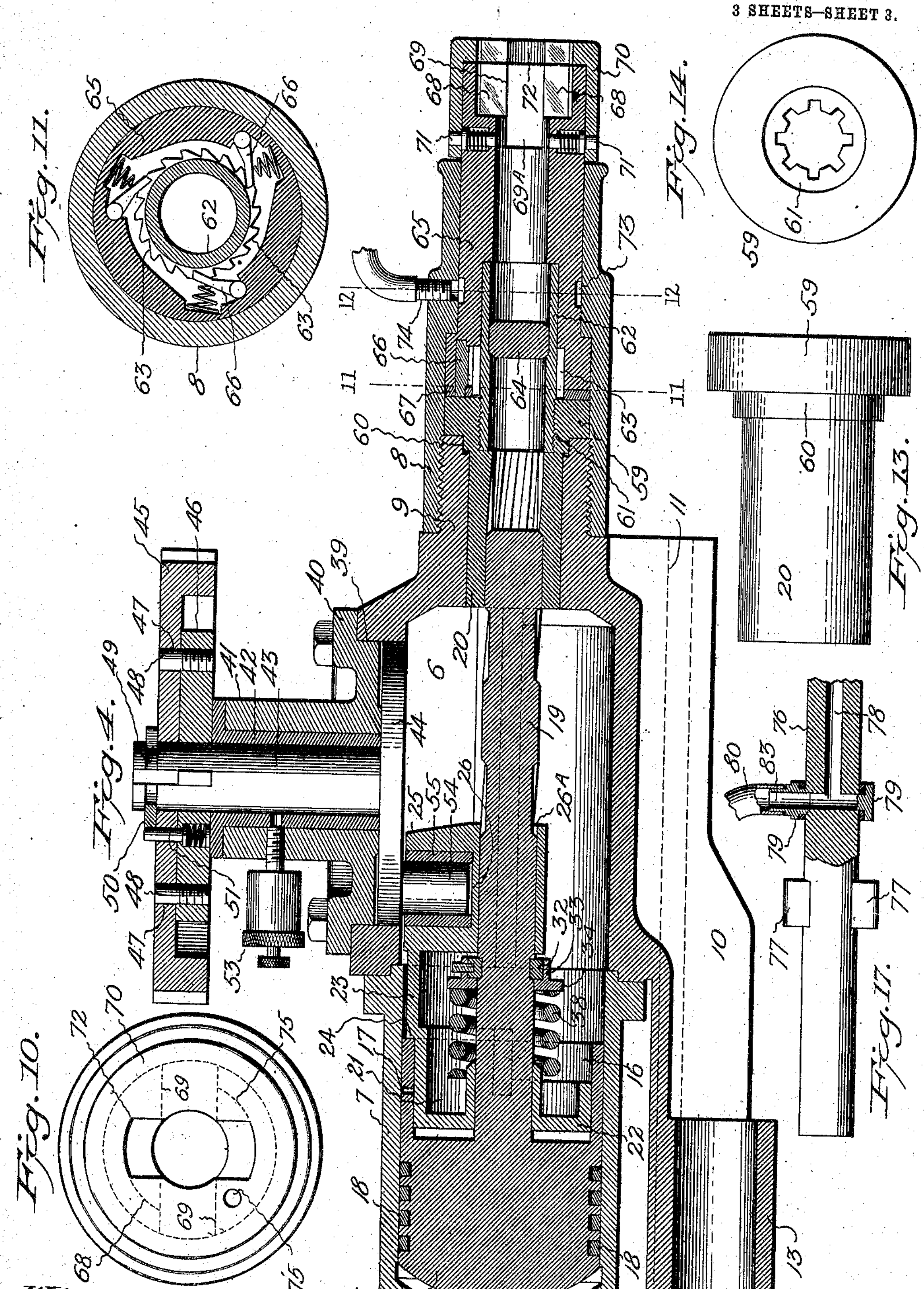


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# UNITED STATES PATENT OFFICE.

ROLLAND S. TROTT, OF DENVER, COLORADO.

ROCK-DRILL.

981,036. Specification of Letters Patent. Patented Jan. 10, 1911.

Application filed July 27, 1907. Serial No. 385,865.

*To all whom it may concern:*

Be it known that I, ROLLAND S. TROTT, 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.

This invention relates to electrically operated, rock drilling engines.

The objects of the invention are, first to provide an engine of this character, having a detachable motor which is arranged to operate a hammer piston through the medium of a crank shaft, which is so connected to said hammer piston as to be capable of making a complete revolution, irrespective of the distance traveled by the said hammer piston on its forward stroke, the said engine being mounted in the usual supporting shell, and fed back and forth in the usual manner. Second, to provide a rock drilling engine of this character, having a removable motor which operates a crank shaft, which is connected to a drill-striking hammer piston through the medium of a plunger, which has a forward movement independently of the hammer piston, said hammer piston being moved rearward by said crank shaft and plunger to compress a body of air between it and the end of its cylinder, and forward by the body of compressed air, air being admitted between the plunger and hammer piston, as the plunger completes its forward stroke, which air cushions the return stroke of the plunger relatively to the hammer piston. These and other objects which will be fully set forth hereinafter, are accomplished by the mechanism illustrated in the accompanying drawings, in which:

Figure 1, is a side elevation of the improved rock drilling engine mounted in the usual supporting shell. Fig. 2, is an end elevation of the same. Fig. 3, is an enlarged plan view of the engine detached from the supporting shell, the motor and crank shaft bearing being removed. Fig. 4, is an enlarged longitudinal, vertical sectional view through the engine. Fig. 5, is an enlarged end elevation of the engine, the cylinder being removed. Fig. 6, is an enlarged front elevation of the piston operating plunger. Fig. 7, is an enlarged rear elevation of the same. Fig. 8, is an enlarged plan view of the plunger, showing the slideway in which the crank pin box travels. Fig. 9, is an enlarged front elevation of the hammer piston, the rifle bar which forms an integral part of the same being in section. Fig. 10, is an enlarged front elevation of the cap which fits upon the end of the drill holding chuck, showing the water port therein, the chuck being shown in dotted lines. Fig. 11, is an enlarged transverse, sectional view on the line 11—11 of Fig. 4, showing the pawl and ratchet mechanism by which the drill chuck is turned. Fig. 12, is an enlarged transverse, sectional view on the line 12—12 of Fig. 4, showing a water channel, and the communicating water port which extends out through the chuck cap. Figs. 13 and 14 are enlarged side and end elevations respectively, of the rifled sleeve which is rotated by the rifle bar to effect the rotation of the drill bit. Fig. 15, is an enlarged front elevation of a removable abutment or shoulder, which is clamped upon the rear portion of the rifle bar, to confine a cushioning spring for the piston-operating plunger. Fig. 16, is an enlarged plan view of the latch plate which secures the driven gear upon the crank shaft of the engine. Fig. 17, is an enlarged sectional view on smaller scale of a portion of a drill bit with the coupler attached. Fig. 18, is an enlarged perspective view of the drill holding chuck, and Fig. 19 is a plan view of the arm secured to the outer end of the crank shaft, to which the gear wheel by which said shaft is driven, is secured. Fig. 20 is a sectional view of a portion of the cylinder and casing, showing one of the grooves by which air is admitted to the cylinder.

Referring to the accompanying drawings, the numeral 1, designates a supporting shell, which is of the style in general use. This shell is provided with the usual brace rods 2, which support the cross bar 3, in which one end of the feed screw 4, is rotatably mounted, said end being extended through the cross bar to receive a crank handle 5.

My improved drilling engine is mounted to slide back and forth in the shell 1, being fed by the screw 4, in the usual manner. The casing of this engine, which incloses the operating parts, comprises a chamber 6, which will henceforth be designated as a crank chamber, a cylinder 7, which is bolted to the rear end of the crank chamber, and a chuck supporting sleeve 8, which is screwed upon a threaded hub 9, which projects from the forward end of the crank chamber. Upon the under side of the crank casing are formed depending parallel plates 10, having laterally extending guides 11, which lie within slideways 12, formed in the shell 1. These plates terminate at their rear ends in a hub 13, which receives the usual threaded nut 14 (Fig. 1), through which the feed screw 4 passes, this construction being commonly employed in rock drilling engines. It will thus be seen that by turning the crank handle, the engine will be fed back and forth in the shell.

Within the cylinder 7, is mounted a piston 15, the forward end of which is provided with a cylindrical chamber 16, which extends into the piston a suitable distance, and an inlet slot or port 17, is formed through the wall of this chamber, the purpose of which will appear hereinafter. The periphery of the piston is formed with the usual circumferential grooves, which receive packing rings 18, and a forwardly extending circular bar 19 projects from the axial center of the front end of the piston. From about midway of its length, to its forward end, this bar is rifled or formed with spirally-extended ribs, and this portion of the bar passes through a rifled sleeve 20, which is rotatably mounted in the hub 9 on the forward end of the crank chamber.

Upon the rear portion of the rifle bar 19, and within the chamber 16, of the piston, is mounted a cylindrical plunger 21, of the form shown in Figs. 6, 7 and 8. This plunger comprises a circular hubbed portion 22, which normally lies within the chamber 16 of the piston, a semi-circular portion 23 of slightly greater diameter, which forms a shoulder 24, at its junction with the circular portion, and a slide block 25, having a slideway 26 which extends at right angles to the rifled bar, and lies within the crank chamber. An axial, unrifled bore $26^A$, is formed through a projection in the under side of the slide block 25, through which the rifled bar passes, and the said slide block is longer than the diameter of the semi-circular portion 23, and its extended ends rest upon slideways 27, which are formed upon the flat vertical sides of the crank chamber, and extend the entire length of the same, the lower half of this chamber being semi-circular in form, as shown in Fig. 5. Slightly below the slideways 27, and parallel with them, are grooves or guideways 28, which receive guides 29, formed on the end of the slide block 25, and these guides and guideways prevent rotation of the plunger during its reciprocating movement. The circular portion 22 of the plunger, is formed with lateral guides 30, which lie within slots or guideways 31, formed in the forward end of the piston, and this construction prevents rotation of the piston during its reciprocating movement.

A circumferential groove is formed in the rifled bar, adjacent to the rear side of the slide block 25, and a ring composed of two semi-circular members or halves 32, is placed within the groove, and the half rings are held together by a band 33, which is formed on an apertured disk 34, which is slipped upon the rifled bar. A spring-actuated dog 35, is pivoted to the front side of the disk 34, and this dog has a depending end which passes through a hole 36, in the band 33, and into a recess 37, in one of the half rings 32. Thus, when the band is slipped over the rings and secured by the dog, the rings are held in the groove, which prevents them from moving endwise in either direction, and the disk 34 will form an abutment or shoulder which, in the present instance, is designed to hold a cushioning spring 38, when struck, and compressed by the forward movement of the plunger, as will be more fully explained hereinafter.

A circular opening 39, is formed in the top of the crank chamber, and a cap 40, having a circular shouldered projection which extends a slight distance into the opening, is bolted upon the top of the crank chamber. This cap has an upwardly projecting axial hub 41, which is preferably provided with a babbitt lining 42, and a shaft 43, having a crank disk 44, at its lower end, extends up through the babbitted hub, and a gear wheel 45, is removably secured to the upper end of the shaft. This wheel may be secured to the shaft in any way which will permit of its being easily and quickly secured and removed, but I preferably secure it in the following manner: To the upper end of the shaft is keyed an arm 46, which rests upon the end of the hub 41, or more strictly speaking, upon a flange forming an integral part of the babbitted lining 42. The gear wheel 45, is in the form of a disk, having a circular recess in its under side, and has an axial aperture through which the end of the shaft projects. The disk portion of the wheel is also provided with diagonally opposite apertures 47, which fit over pins 48, which project from the arm 46, and these pins cause the wheel to turn with the arm. An annular groove 49, is formed in the end of the shaft, in position to be flush with the face of the wheel, when the wheel is in position on the shaft and arm, and a latch plate 50, in the form of a yoke, as shown in Fig. 16, is slipped into the recess 49, and prevents the wheel from becoming detached from the arm.

The latch is held against accidental displacement by a spring pin 51, which extends from a recess in the arm, up through the wheel, and engages a notch 52, in the edge of the latch. When the pin is pressed down, so as to disengage the notch, the latch may be withdrawn from the groove in the shaft, and the wheel lifted off.

A grease cup 53, having a threaded stem, is screwed into a threaded hole in the hub 41, and a registering hole is formed in the babbitt, which will permit the lubricant to flow to the crank shaft.

A crank pin 54, projects from the under side of the crank disk 44, and this pin fits into a block 55, which is adapted to slide in the slideway 25, as the crank shaft revolves, and the shaft is driven by a pinion 56, which meshes with the wheel 45, the said pinion being secured upon the shaft of an electric motor 57, which is supported in a bracket 58, on the side of the crank chamber.

The rifled sleeve 20, has a flange head 59, which rests against the end of the hub 9 of the crank chamber, and adjoining the flange head is an annular step 60, which lies within a counterbore in the end of the hub. The head 59, has a threaded counterbore 61, extending into it a suitable distance, and a sleeve 62, having a circular row of ratchet teeth 63, formed around its periphery, is screwed into the threaded counterbore. The bore of this sleeve is of two diameters, the bore of smaller diameter being next to the rifled portion of the sleeve 20, and of slightly greater diameter than the rifled bar. The shoulder formed at the junction of these two bores forms a stop for a drill-striking block 64, which is struck by the end of the rifled bar, and thus driven against the end of the drill bit.

A chuck 65, comprising a cylindrical block having a flange head at one end, and a bore of two diameters, is slipped over the end of the ratchet sleeve 62, its flange head abutting against the flange head of the rifled sleeve 20, and the end of the chuck flange head is recessed to receive a plurality of spring pressed pawls 66, which engage the ratchet teeth 63, on the said sleeve 62; these pawls are held in the flange head by an apertured disk 67, and the pawls are pivoted in the said disk and in the end of the chuck. The sleeve 8, which screws upon the threaded hub 9, of the crank chamber, is formed with a bore of two diameters. The larger bore incloses the flange heads of the rifled sleeve and of the chuck, and the shoulder formed by the two bores, abuts against the said chuck head, and holds it upon the ratchet sleeve, but so as to permit it to turn within the said sleeve 8.

The chuck projects beyond the end of the sleeve 8, and in its end are formed diametrically opposite semi-circular recesses 68, which are concentric with its axis, and which terminate in abutment shoulders 69, formed by the diametrically opposite sides of a slot 69A, which extends across the end of the chuck, and farther into the chuck than the said recesses 68. A cap 70, is secured upon the end of the chuck by spring pins 71, and this cap has an elongated opening 72, which stands at right angles to the slot 69A of the chuck.

A peripheral water channel 73, is formed around the chuck, which is connected by a pipe or hose 74, with a supply of water, and a port 75, extends from this channel out through the end of the chuck and through the cap 70.

A drill bit 76, having laterally projecting lugs 77, adjacent to its rear end, is inserted in the chuck through the opening 72 in the cap. These lugs extend into the semicircular recesses 68, in the chuck, and when the drill is given a quarter turn and pushed rearward the lugs will contact with the shoulders 69, and with the end wall of the slot 69A, and as the rotation of the chuck, when in operation, is against the said lugs, they will always stand at right angles to the elongated opening in the cap, and thus prevent the drill from being accidentally detached from the chuck during the drilling operation. A water channel 78, extends from the cutting end of the drill to within a short distance of the lugs 77, or so as to terminate outside of the chuck cap, when the drill is inserted in the chuck. A hole is formed through the shank of the drill, at right angles to the channel 78, and a suitable coupler 79 is clamped upon this hole, and is connected by a hose or pipe 80, with the port 75, in the chuck and cap. This coupler preferably comprises a pair of semicircular arms or jaws, which are hinged or pivoted to each other, so as to be capable of partially encircling the drill shank, and above the pivotal connection the arms have extensions 81, between which a coiled spring 82, is interposed, which presses the arms toward each other and consequently upon the drill shank. One of the jaws has an apertured tit 83, which communicates with the hole in the drill shank, and is connected to the hose or pipe 80, as shown.

The operation of the improved electrically operated rock drilling engine is as follows: The crank shaft 43, is operated by the motor pinion 56, and gear wheel 45, and assuming that the piston is at the limit of its forward stroke, the crank pin 54, on its rearward movement, will throw the plunger 21 rearward through the medium of the crank pin block 55 in the slideway 26. The piston is carried with the plunger, and as it moves rearward, the air is compressed between its rear end and the end of the cylinder 7, the degree of compression being determined by the space between the end of the cylinder and the end of the piston, when the piston is at the limit of its rearward movement. As the crank pin passes its dead center line, the compressed air in the rear end of the cylinder drives the piston forward with great force, and the rifled bar strikes the block 64, which imparts the force of the blow to the drill bit. The rifled bar, as a rule, strikes the block, as the crank pin approaches the dead center line, and its movement is thereby arrested, but the crank shaft and pin continue their movement, and the further movement of the pin, to and beyond the dead center line, partially withdraws the plunger from the chamber 16, in the end of the piston, and as the plunger uncovers the port 17, in the said chamber, air is admitted between the end of the plunger and the end of the chamber, and as the pin continues its rotation, the plunger will be driven back into the chamber 16, and the air, which was admitted through the port 17, will cushion the blow of the plunger against the piston, and relieve the plunger, as well as the crank shaft and pin, of the jar and strain which would otherwise result. When starting the engine, before there is any compressed air back of the piston, the plunger moves forward until it strikes the spring 38, which draws the piston forward also, the shock of the contact being absorbed by the said spring, but when the engine is running at full speed, the spring will not come into use, as the compressed air behind the piston will force it forward without need of forward pull from the plunger. The cylinder is replenished with air at each forward stroke of the piston, through grooves $28^A$ in the sides of the cylinder, which form continuations of the guideways 28, and which are uncovered by the rear end of the piston, as the rifled bar strikes the block 64. The lugs 77, on the drill, abut against the end of the slot $69^A$ of the chuck, and prevent the drill from entering too far into the chuck, and thereby stop the piston too soon on its forward stroke. Thus, the piston is driven rearward by the motor-driven crank shaft, and forward by the air which was compressed within its cylinder, on its rearward stroke, and the force of the blow delivered by the piston and its rifled bar is determined by the area space in which the air is compressed.

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

1. In a rock-drilling engine as specified, the combination with a casing, having a cylinder at one end, and a chuck rotatably mounted at the opposite end, having an axial drill bit receiving bore, of a piston mounted in the cylinder; a drill striking bar on said piston in line with the axial bore of the chuck; a plunger mounted on said bar in normal contact with the piston, but movable independently of the piston; means including a crank shaft for driving said plunger and piston rearward to compress a body of air in the cylinder, whereby the piston is driven forward, and means operated by the drill striking bar, for rotating the drill holding chuck.

2. In a rock drilling engine as specified, the combination with a casing having a cylinder at one end, a sleeve on the other end supporting a rotatable chuck having a drill receiving axial bore, of a piston in said cylinder, having an axial chamber in its forward end; a drill-striking bar extending from the base of said chamber in line with the axial bore of the chuck; a plunger on the bar which normally lies within the chamber of the piston, and is provided at its forward end with a slideway; a crank shaft mounted in the top of the casing, having a pin which enters the slideway; and means for operating the crank shaft to drive the piston rearward and compress a body of air in the cylinder, whereby the piston is driven forward, said plunger being movable independently of the piston.

3. In a rock drilling engine as specified, the combination with a casing, a cylinder at one end of the casing, and a drill receiving chuck rotatably mounted at the opposite end of the casing, having an axial bore, of a crank shaft mounted in the top of the casing, having a crank pin projecting into the casing, a piston in the cylinder, having an axial chamber in its forward end; a drill striking bar projecting centrally from the base of said chamber, in line with the axial bore of the chuck; a plunger on the said bar which normally lies within the piston chamber but is movable independently of the piston; a slide block on the end of the plunger having a slideway at right angles to the bar, an apertured block in the slideway which receives the said crank pin; and means for operating the shaft to drive the piston rearward and compress a body of air whereby the piston is driven forward.

4. In a rock drilling engine as specified, the combination with a casing, a cylinder and a rotatable chuck in axial line with the cylinder, having an axial bore; of a piston in said cylinder, having an axial chamber in its forward end, provided with an air inlet opening; and diametrically opposite guide slots; a drill striking bar projecting from the base of said chamber in line with the axial bore of the chuck; a plunger in said chamber mounted to slide on the drill striking bar, having guides which lie in the guide slots; slideways on opposite sides of the casing; a slide block on the forward end of the plunger, the ends of which rest upon the slide-ways, said block having a slideway at right angles to the axis of the cylinder; a crank shaft mounted in the top of the casing, having a crank pin which projects into the plunger slideway, and means for operating said shaft to drive the piston rearward and compress a body of air whereby the piston is driven forward, said plunger being partially withdrawn from said piston chamber as the crank pin passes the dead center line on its forward movement, thereby permitting air to enter the piston cham-

ber through its inlet, to cushion the return movement of the crank and plunger.

5. In a rock drilling engine as specified, the combination with a casing, having oppositely positioned slideways, of a cylinder removably secured to one end of said casing; a piston in said cylinder, having an axial chamber in its forward end; a drill striking bar projecting centrally from the base of said piston chamber; a slide block on the bar, guideways on the block which rest within the slideways of the casing, and has a slideway in its upper face; a plunger projecting from the rear of said block, into the piston chamber, said piston chamber having an air inlet which is normally covered by said plunger, and a power-driven crank shaft journaled in the top of the casing, having a crank pin which projects into the slideway of the plunger block, adapted to drive said piston rearward to compress a body of air in the cylinder, whereby said piston is driven forward, said plunger being adapted to move away from the piston as the crank pin passes a dead center line, thereby admitting air to the piston chamber, which cushions the return stroke of the crank, with respect to the plunger, and of the plunger with respect to the piston.

6. In a rock drilling engine as specified, the combination of a casing, a piston mounted therein, having a drill striking bar, said piston having an air cushion chamber in its forward end, provided with an inlet; a plunger mounted on the striking bar so as to be normally within said chamber and close its inlet; a power-driven crank shaft mounted in the top of the casing, having a crank pin; a slideway on the forward end of the plunger into which said pin projects, and drives said piston rearward to compress a body of air in the cylinder whereby said piston is driven forward, when the pressure is released by the pin as it passes the dead center line of its rearward movement, said plunger being moved forward in the piston chamber as the pin passes the dead center line of its forward movement to uncover the inlet and admit air into the chamber whereby the return stroke of the crank relatively to the piston is cushioned.

7. In a rock drilling engine as specified, the combination with a casing and a hammer piston mounted therein; of means for driving said piston rearward to compress a body of air, whereby said piston is driven forward, consisting of a plunger having a movement independently of the piston; a power-driven crank shaft for operating said plunger; and means for cushioning the rear stroke of the plunger relatively to the piston.

8. In a rock drilling engine as specified, the combination with a cylinder and a hammer piston having an axial chamber provided with an inlet, of means for driving said piston rearward to compress a body of air in the cylinder, consisting of a plunger movable in said piston chamber, and normally closing its inlet; a slideway on the end of the plunger; a power-driven crank shaft having a crank pin which travels in said slideway, said plunger having a forward movement in excess of the forward movement of the piston, whereby the inlet in the piston chamber is opened to admit air, which cushions the return movement of the crank pin and plunger, relatively to the piston.

9. In a rock drilling engine as specified, the combination with a casing having diametrically opposite slideways and guideways parallel with said slidways, of a cylinder on one end of the said casing; a piston in said cylinder, having an air cushion chamber in its forward end, provided with an inlet, and with oppositely positioned guide grooves; a drill-striking bar on said piston; a plunger on the drill-striking bar, normally within the piston chamber and closing its inlet, and a power-driven crank shaft for driving said plunger and piston rearward to compress a body of air, whereby said piston is driven forward; guides on the plunger which enter the guide grooves of the piston; a slide block on the plunger which rests upon the slideways of the casing and guides which enter its guideways; a slideway in said slide block, and a crank pin for connecting the crank shaft with the said slideway, said plunger having a forward movement in excess of the forward movement of the piston, whereby the inlet in the piston chamber is uncovered, and air admitted to the said chamber to cushion the return stroke of the crank and plunger relatively to the piston.

10. In a rock-drilling engine as specified, the combination with a cylinder and a piston therein, provided with a drill striking bar, and an axial chamber, having an inlet, of a plunger on said bar, normally within said chamber; a removable abutment on said bar; a coiled spring on the bar between the front side of the plunger and the abutment; and power-driven means for reciprocating said plunger to drive said piston rearward and compress a body of air, whereby said piston is driven forward, said plunger having a forward movement in excess of the forward movement of the piston, whereby the plunger is withdrawn from the piston chamber, and air admitted through the inlet to cushion the return stroke of the plunger relatively to the piston.

11. In a rock-drilling engine, as specified, the combination with a cylinder having a piston therein, provided with a drill-striking rifled bar, and an axial chamber surrounding the rear portion of said bar, which is provided with an air inlet, of a plunger

on said bar normally within said chamber; a removable abutment on said bar, comprising a pair of half rings which lie in a circumferential groove in said bar, and form a ring; a collar having a projecting band which incloses said ring and a spring dog pivoted to said collar, which extends through said band and into a notch in one of said half rings; a coiled spring on said bar between the plunger and the abutment, and power-driven means for reciprocating said plunger to drive said piston rearward and compress a body of air, whereby the piston is driven forward, said plunger having a forward movement in excess of the forward movement of the piston, whereby the plunger is withdrawn from the piston chamber and air admitted through the inlet to cushion the return stroke of the plunger relatively to the piston.

12. In a rock-drilling engine as specified, the combination with a cylinder, a hammer piston therein, a plunger operatively connected with the piston, and a drill holding chuck in axial line with said hammer piston, of a crank shaft for operating said plunger; an arm on the end of the shaft, a gear wheel removably secured to the arm and shaft; means for securing said wheel, and a power-driven pinion in mesh with said gear wheel.

13. In a rock-drilling engine as specified, the combination with a cylinder having a hammer piston therein, a drill-holding chuck in line with said piston, and means for rotating said chuck on the back stroke of the piston, and a plunger adapted to move said piston rearward to compress a body of air in said cylinder, of a crank shaft for operating said plunger; a gear wheel on the outer end of the shaft, and a power-driven pinion in mesh with the gear wheel.

14. In a rock-drilling engine as specified, the combination with a casing, a hammer piston mounted therein, a drill-holding chuck in axial line with the hammer piston, and means for rotating said chuck, of means for driving said piston rearward to compress a body of air, whereby the piston is driven forward, consisting of a plunger having a movement independently of the piston; a crank shaft for operating the plunger; a gear wheel removably secured to the shaft, a power-driven pinion in mesh with the gear, and means whereby the rear stroke of the plunger, with respect to the piston, is cushioned.

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

ROLLAND S. TROTT.

Witnesses:

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