No. 816,090. PATENTED MAR. 27, 1906.

H. HELLMAN & L. C. BAYLES.

ROCK DRILL OR ROCK DRILLING MACHINE.

APPLICATION FILED AUG. 15, 1904.

2 SHEETS—SHEET 1.

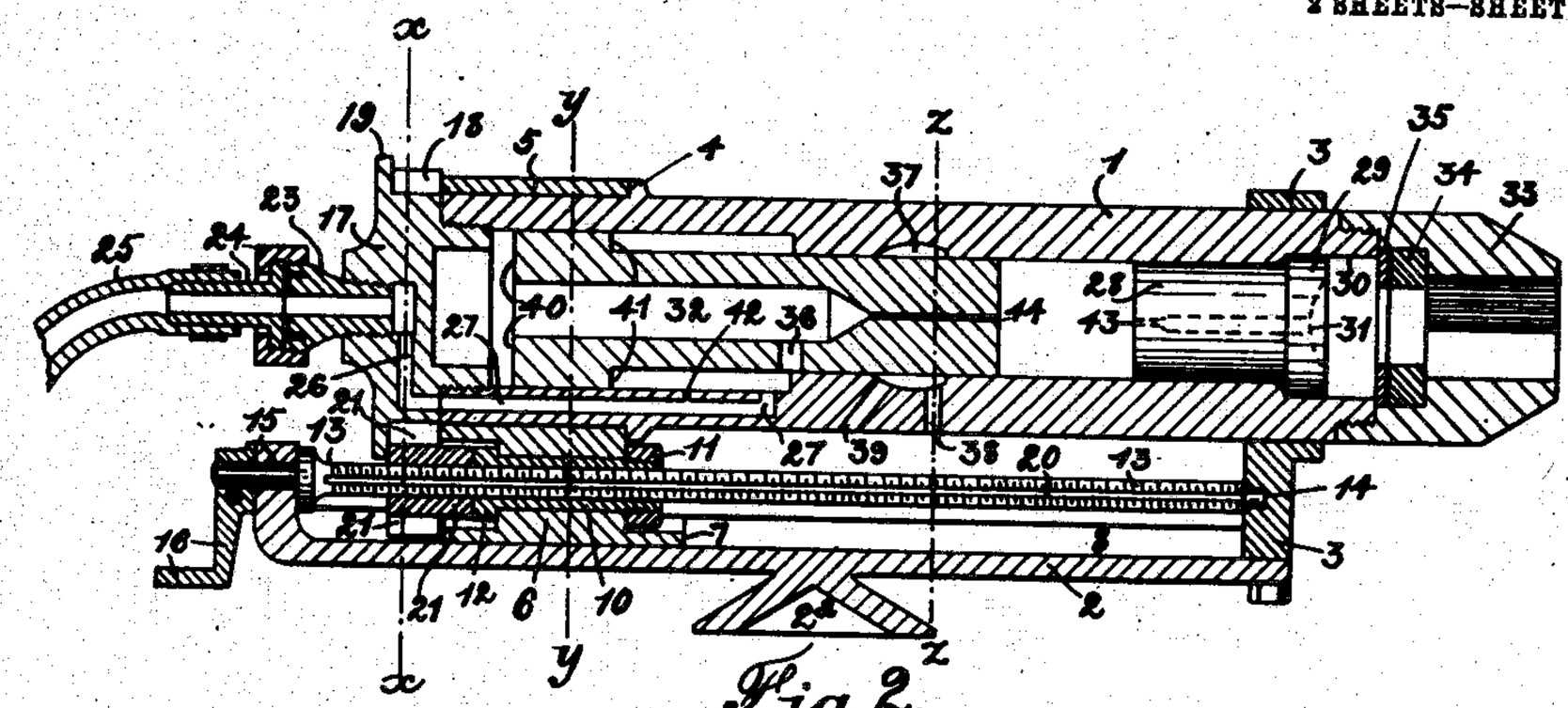


Fig. 2.

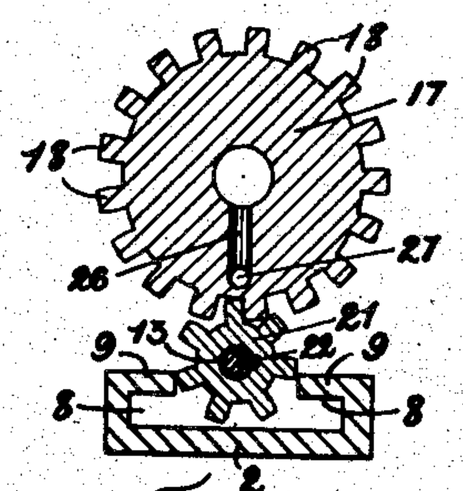


Fig. 3.

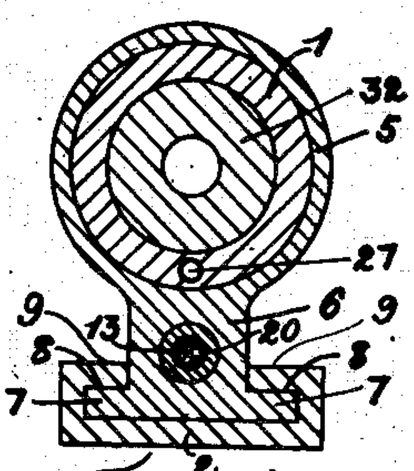


Fig. 4.

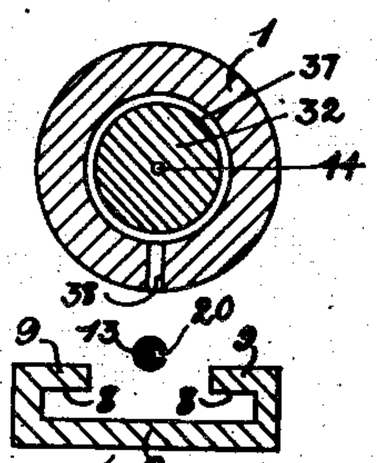


Fig. 5.

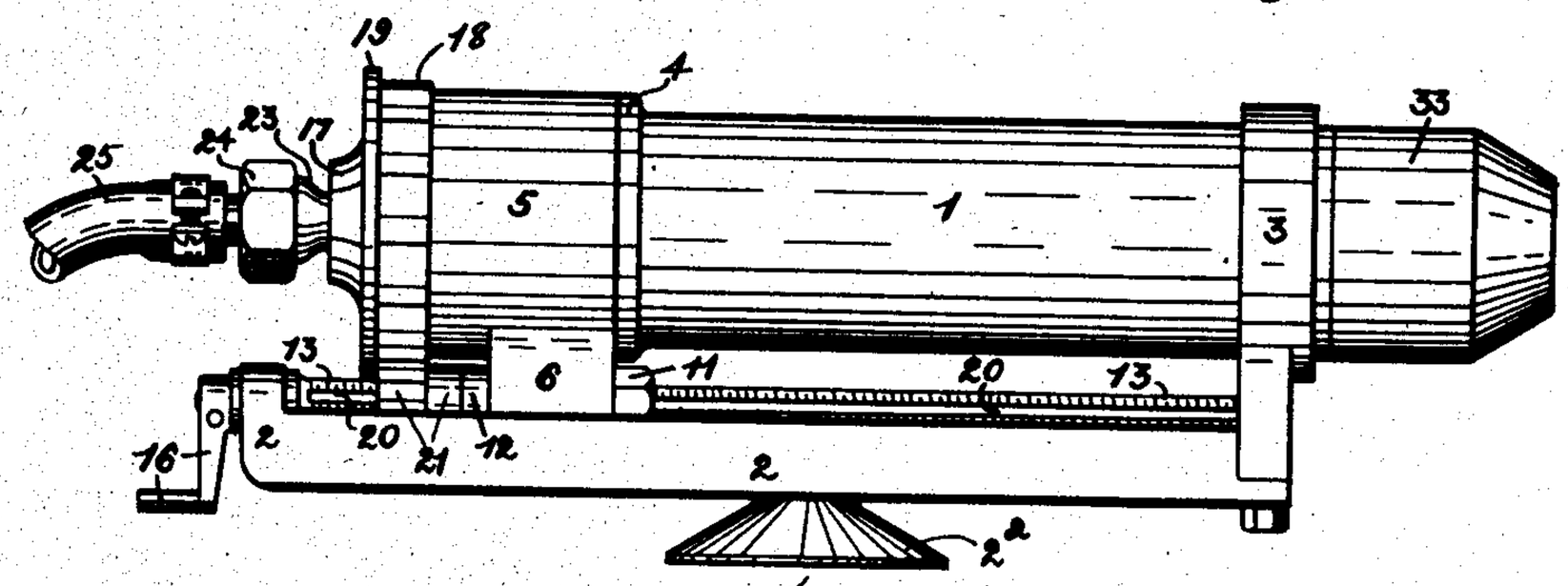
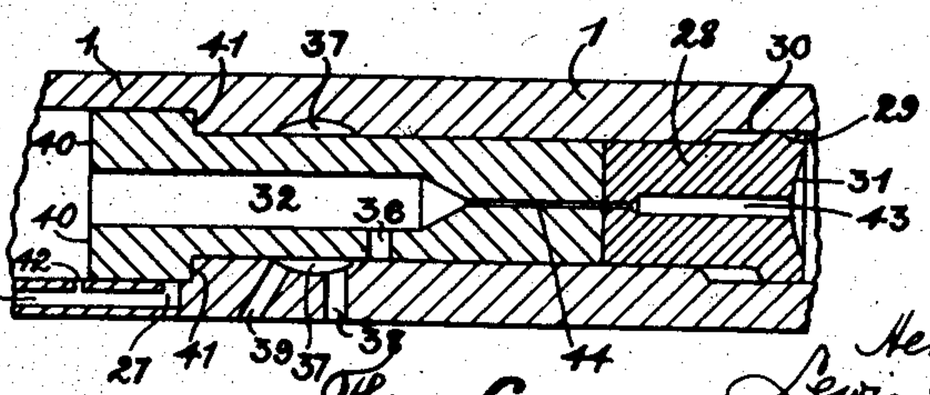


Fig. 1.



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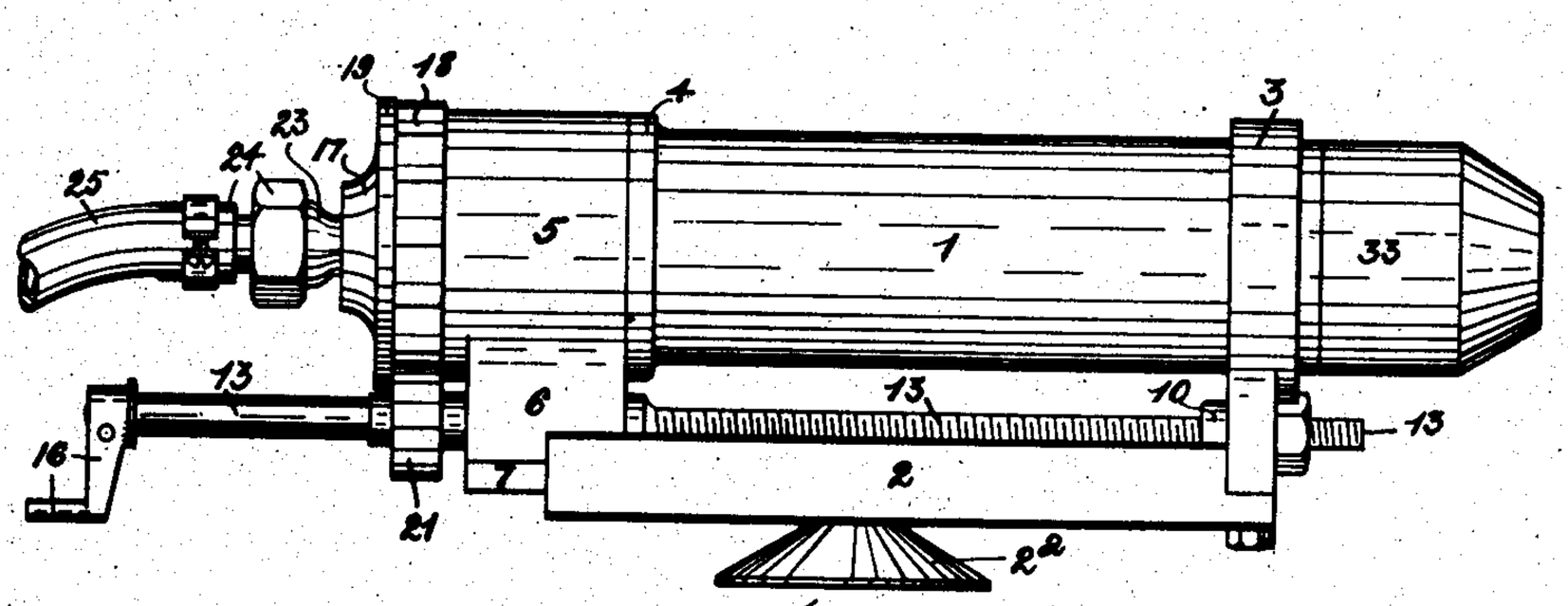

Fig. 7.

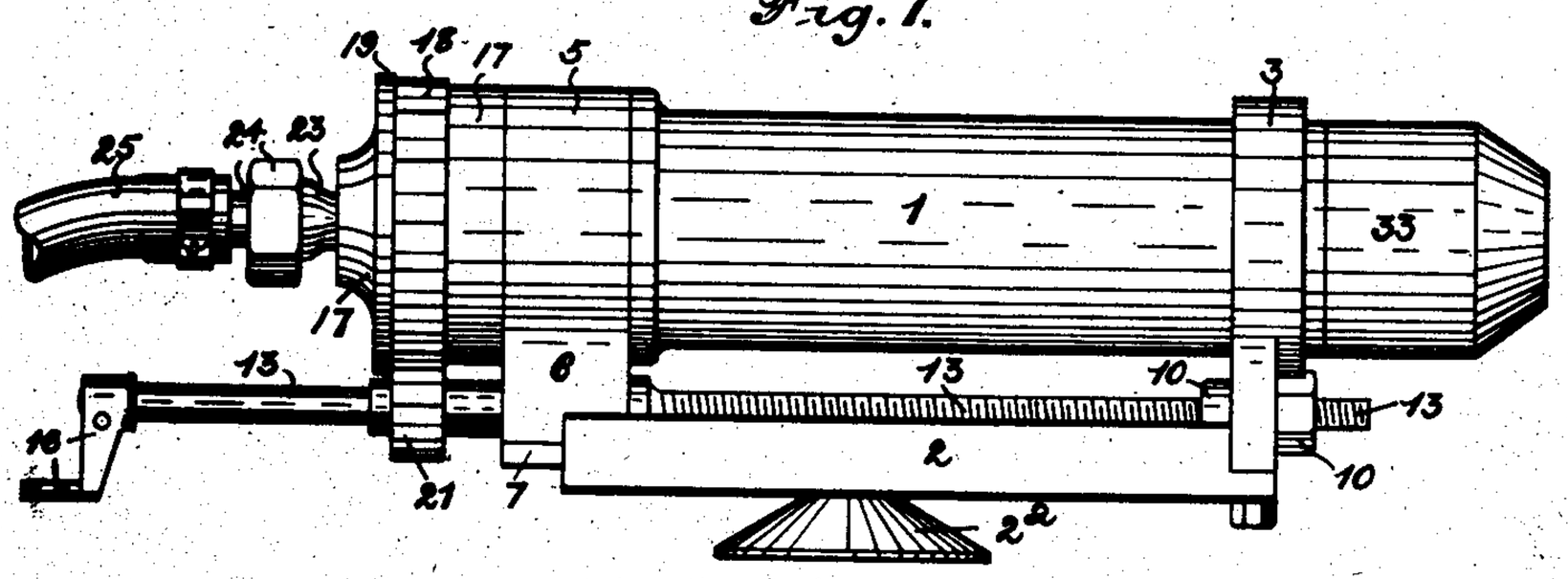

Fig. 10.

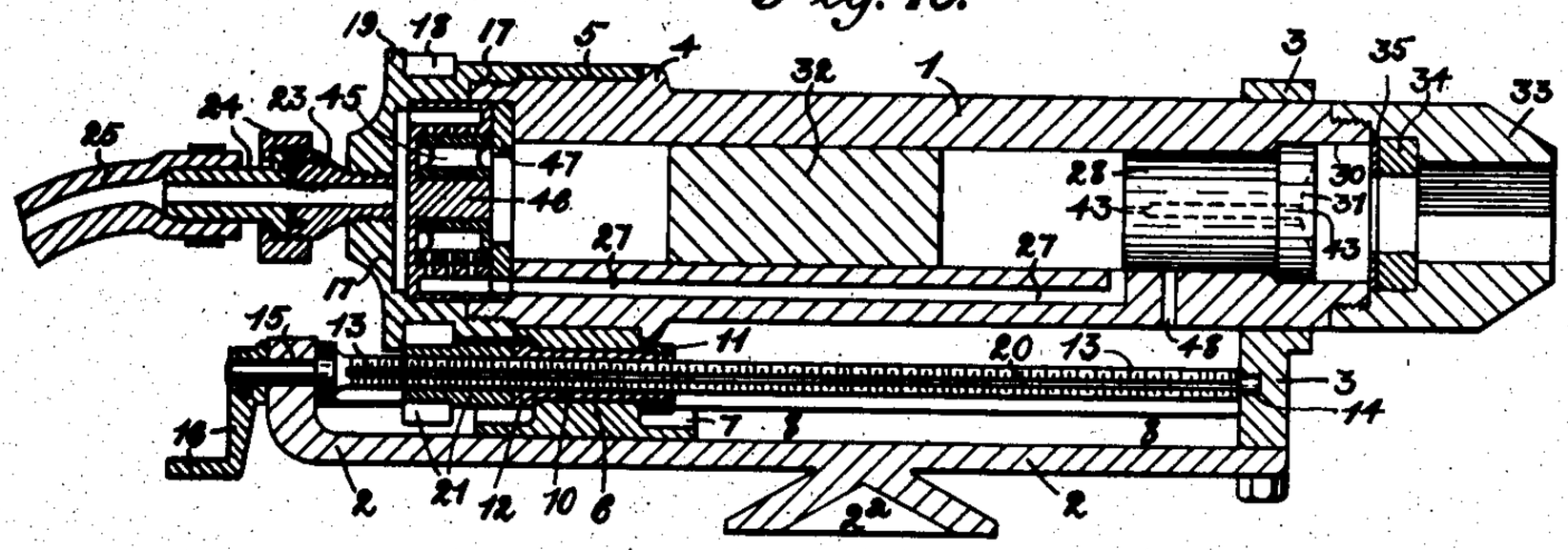

Fig. 8.

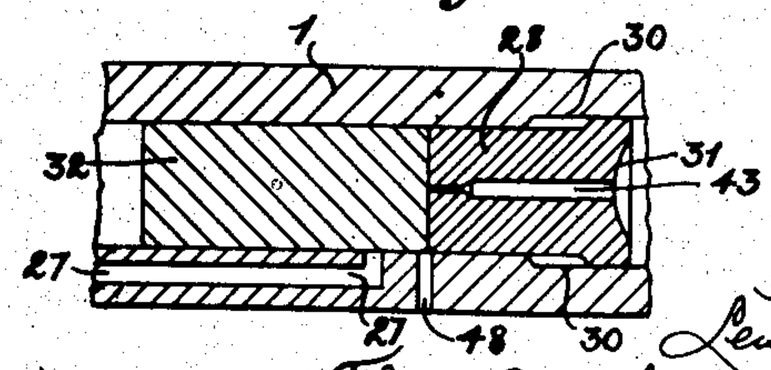

Fig. 9.

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UNITED STATES PATENT OFFICE.

HENRY HELLMAN AND LEWIS CONDICT BAYLES, OF JOHANNESBURG, TRANSVAAL.

ROCK-DRILL OR ROCK-DRILLING MACHINE.

No. 816,090. Specification of Letters Patent. Patented March 27, 1906.

Application filed August 15, 1904. Serial No. 220,698.

To all whom it may concern:

Be it known that we, HENRY HELLMAN and LEWIS CONDICT BAYLES, citizens of the United States, residing at Johannesburg, Transvaal, have invented certain new and useful Improvements in Rock-Drills or Rock-Drilling Machines, of which the following is a specification.

These improvements have reference to rock-drilling machines or engines, and are applicable to machines in which a valve is employed for controlling the admission of the compressed air or other actuating gaseous fluid to the cylinder on the principle of an axial-valve chipping or riveting machine or to a machine in which a valve is dispensed with and the piston or equivalent reciprocating member itself controls the admission of the motive fluid to said cylinder on the principle of a valveless chipping-hammer, as well as to other similar types of such machines.

The improvements constituting our present invention relate, first, to means for mounting or securing the cylinder of the machine or engine in its supporting shell or cradle; secondly, to means for feeding the machine or for traversing the cylinder longitudinally of said shell or cradle; thirdly, to means for rotating the cylinder, and with it the drilling-bit or cutting-tool; fourthly, to means for introducing the actuating or motive fluid into the cylinder, and, fifthly, to the general construction and arrangement of the machine or engine, as hereinafter described, and more particularly pointed out in the appended claims.

A rock-drilling machine or engine embodying the features of this invention is of compact, simple, and light construction and is capable of being readily manipulated under all ordinary circumstances.

To simplify and facilitate the description of the several improvements, we append drawings thereof, in connection with which we will describe said improvements in detail.

In the drawings, Figure 1 is a side elevation of a complete machine or engine designed to operate without a valve; Fig. 2, a longitudinal section of the same; Fig. 3, a transverse section on line *x x*, Fig. 2; Fig. 4, a transverse section on line *y y*, Fig. 2; Fig. 5, a transverse section on line *z z*, Fig. 2. Fig. 6 is a longitudinal section of a portion of the drill-cylinder, showing the position the piston assumes when under certain circumstances the machine is automatically put out of operation. Fig. 7 represents a side elevation of the machine shown in Figs. 1 to 6, illustrating a slight modification; Fig. 8, a longitudinal section of a machine or engine in which a valve is employed for controlling the admission of the actuating fluid. Fig. 9 is a longitudinal section of a portion of the cylinder, showing the position the piston assumes when under certain circumstances the machine is automatically put out of operation. Fig. 10 is a side elevation of the machine shown in Figs. 8 and 9, illustrating a slight modification.

Similar characters of reference indicate the same or similar parts in the several figures of the drawings.

Referring to the machine or engine illustrated in Figs. 1 to 6, the drill-cylinder (indicated at 1) is mounted in and slidably supported by the shell, cradle, or carriage 2. To the forward end of the shell or cradle 2 is bolted or otherwise secured the forward guide 3 for the drill-cylinder 1. The shell or cradle 2 may be formed or provided with the cone 2^a for mounting it in the ordinary or any other convenient manner or with any other suitable device for the same purpose. Round the drill-cylinder 1, in proximity to the rear end thereof, is formed an annular projection 4, and encircling the cylinder at the rear of said projection 4 is a loose sleeve 5. The loose sleeve 5, as shown in Figs. 1, 2, and 4, is constructed with a downward extension 6, formed with longitudinal ribs or wings 7, which fit into and are free to slide in guideways 8, formed longitudinally of the shell or cradle 2. The longitudinal member 2 of the shell or cradle is constructed with the longitudinal inward projections 9, which form a box-slot in which the ribs or wings 7 are free to slide. (See Figs. 3, 4, and 5.) In the lower portion 6 of the loose sleeve 5 is arranged a bushing formed with an internal thread, which constitutes the feed-nut 10. A nut 11, screwed over the front end of the bushing 10, serves to secure the latter in position between it and the head or flange 12, formed at the other end. Arranged longitudinally of the shell or cradle 2 is the feed-screw 13. It is shown located in bearings 14 15 in the front guide 3 at one end and in the end of the shell or cradle 2 at the other. At

the rear extremity of the feed-screw 13 is secured the crank 16, which is provided for rotating the screw 13 in either direction to traverse the cylinder 1 longitudinally in the shell or cradle 2. The feed-screw 13 is preferably formed with a square thread, the thread in the feed-nut 10 being made to correspond. On the rear end of the cylinder 1 is screwed or otherwise fixed the cap or cover 17. This cover 17 is formed with circumferential teeth 18 (see Fig. 3) and at the rear of the teeth 18 with a flange or shroud 19. The feed-screw 13 is formed with a longitudinal groove or feather-way 20, and arranged on said screw 13 is a small toothed wheel or pinion 21. This pinion 21 is constructed so that it is capable of sliding longitudinally of the feed-screw 13, but is prevented rotating independently on said screw. This is accomplished by fixing in the center of the pinion 21 a feather-key 22, which projects into and traverses the longitudinal feather-way 20 in the feed-screw 13. The pinion 21 meshes or gears with the teeth 18, formed round the cap or cover 17 inside the flange 19. It will now be perceived that when the feed-screw 13 is rotated by the crank 16 the sleeve 5, supporting the rear end of the cylinder 1, is traversed longitudinally in the guideways 8 in the cradle 2, which sleeve 5 carries with it and advances or recedes the cylinder 1, according to the direction of rotation of the screw 13. Simultaneously the pinion 21 is rotated and gearing with the teeth 18 on the cover 17 rotates the cylinder 1 in the sleeve 5 and front guide 3, respectively. As the cylinder 1 is advanced the flange 19 on the cap 17 moves the pinion 21 forward along the screw 13. The feed and rotation of the cylinder 1 are thus accomplished by the one operation of rotating the screw 13. In the cap or cover 17 is screwed a nipple 23, which is connected, by means of the screw-union 24, to the actuating-fluid-supply pipe 25. The nipple 23 communicates with a port 26, formed in the cap 17, which latter port 26 communicates with a port 27, formed longitudinally of the cylinder 1, along which the actuating fluid is conducted into the cylinder 1. The drilling-bit (not shown in the drawings) is carried by the front end of the cylinder 1. In the drawings we show an arrangement for receiving and transmitting the impacts of the reciprocating piston to the drill-bit, which is described in an application for patent filed by us under Serial No. 210,519 on the 31st of May, 1904. Although we prefer to adopt this construction, we wish it to be understood that any other suitable arrangement may be used in substitution therefor. The "shank-cap" or impact-piece 28 is projected into the bore of the cylinder 1 and formed with an enlarged forward extremity 29, which fits into a counterbore 30 in the front end of the cylinder 1. The impact-piece 28 is formed with a recess 31 in the front end, into which the extremity of the drilling-bit or cutting-tool is projected. As the piston 32 reciprocates in the cylinder 1 it impinges upon the inner end of the impact-piece 28, which transmits the blow to the drill or bit. On the front end of the cylinder 1 is fixed the front head 33, and between the front head 33 and the end of the cylinder 1 are located a resilient or flexible ring 34 and a protecting ring or washer 35, of metal. The hole 31 in the front head 33 may be made of square or of any suitable polygonal section to fit a part of corresponding square or polygonal section formed on the shank of the drill or bit to insure the rotation of the drill-bit in unison with the drill-cylinder. Other means may be provided to accomplish this. The actuating fluid, which passes along the port 27 into the power-cylinder 1, passes from the latter into the interior of the piston 32 through the port 36. 37 is an annular recess in the interior of the cylinder, and 38 39 are ports opening to the exterior of said cylinder. The recess 37 and ports 38 39 constitute the exhaust-ports, through which the operating fluid may escape from the piston 32 when it is moved sufficiently far to place the interior of the piston in communication with the recess 37 through the port 36. The ports 38 39 are, as shown, preferably formed at opposite sides of the recess 37, so that when the cylinder 1 is passing through the front guide 3 one or other of the ports 38 39 will always be open.

The operation of the piston 32 in the working of the machine or engine may be briefly described as follows: The operating fluid is continuously admitted into the cylinder 1 through the port 27. In Fig. 2 the piston 32 is shown in the position it assumes at or about the end of the rearward stroke, at which time the port 36 is open or partially open. The operating fluid then passes into the interior of the piston 32 and acting on the rear surface 40 impels it on its forward and percussive stroke. The parts are so adjusted that the piston 32 impinges upon the inner extremity of the impact-piece 28 simultaneously or approximately simultaneously with the placing of the interior of the piston 32 in communication with the exhaust-ports 38 39 or when the port 36 is in communication with the annular recess 37 inside the power-cylinder 1. The pressure being now considerably lowered inside the piston 32, the air at the initial pressure acting on the annular surface 41, formed by the enlarged rear end of the piston 32, moves the piston through its rearward stroke. The piston 32 in its rearward movement acquires sufficient momentum to carry the inlet-port 36 back sufficiently far to allow the motive fluid to pass through the port 36 to impel it on its forward stroke.

With the object of automatically putting the machine out of operation in the event of

the cutting end of the bit not coming into contact with the rock or bottom of the hole being drilled a small port 42 is formed between the main supply-port 27 and the interior of the power-cylinder 1. In Fig. 6 the piston 32 is illustrated in the position it will assume under these circumstances. When it impinges upon the rear end of the impact-piece 28, it drives it forward in the bore of the cylinder 1 until the rear end of the piston 32 overruns the small port 42. When in this position, the piston 32 closes the main supply-port 27 and also closes the port 36 to exhaust-(See Fig. 6.) The piston 32 is maintained in this position by the air which escapes to the back of the piston through the port 42. By feeding the machine or moving the power-cylinder 1 forward the cutting end of the bit comes into contact with the rock-face and pushes the impact-piece 28 in a rearward direction in the cylinder 1. The impact-piece 28 at the same time moves the piston 32 backward in the cylinder 1 until the main supply-port 27 is uncovered by the piston 32, which allows the motive fluid to act on the annular surface 41, and so return the piston 32 to the rear end of the cylinder 1. For the purpose of passing a jet or quantity of the operating fluid through the impact-piece and, if desired, through the drill or bit in order to prevent the overheating of the same and at the same time to blow away the cuttings from between the cutting edges of the bit and the bottom of the hole a hole 43 is formed through the impact-piece 28, longitudinally thereof and communicating with a hole formed longitudinally of the drill-bit. A small aperture 44 is formed longitudinally of the piston 32, which allows a quantity of the motive fluid to pass from the interior of the piston 32 into the cylinder 1 at the front of the piston 32 and rear of the impact-piece 28, whence it passes through the hole 43 in the impact-piece 28 and then through the drill or bit to the cutting edges of the latter.

In Fig. 7, illustrative of a modification of the arrangement shown in Figs. 1 to 6, the cylinder 1 is slidably supported in the forward guide 3 and loosely carried at the other end by the sleeve 5, which is constructed to slide in the longitudinal and central member 2 of the shell or cradle in a similar manner to that described with reference to Figs. 1 to 6. The rotation of the cylinder 1 is in like manner effected through the medium of the pinion 21, revolubly mounted on the rear end of the feed-screw 13, gearing the teeth 18, formed round the cap or cover 17, closing the rear end of the cylinder 1. Instead of journaling the feed-screw 13 in the front guide 3 and rear end of the shell or cradle 2 it is in this case journaled in and carried by the lower end 6 of the sleeve 5 and the feed-nut 10 is fixed in the front guide 3. As the screw 13 is rotated by means of the crank 16 it works through the stationary feed-nut 10, and so traverses the cylinder 1 longitudinally of the shell or cradle 2.

Referring to the arrangement illustrated in Figs. 8 and 9, illustrating the improvements applied in the construction of a machine or engine in which the admission of the actuating fluid to the cylinder is controlled by means of a valve, 45 represents the valve, which is located in a valve-box 46, arranged at the rear end of the cylinder 1. The valve may be of any ordinary or suitable construction—as, for example, similar to the valve of an axial-valve chipping or riveting machine. In a recess in the rear end of the cylinder is arranged a ring 47, and next the ring 47 is arranged the valve 45 and valve-box 46. The valve 45 operates to admit the fluid alternately through the center of the ring 47 to the rear end of the cylinder 1 and piston 32 and along the port 27 to the forward end of the cylinder 1. 17 is the cap or cover for the rear end of the cylinder 1, which incloses the valve-box 46, which cap 17 is constructed with the teeth 18 and flange 19 similar to the preceding construction, and 23 is the nipple, 24 the screw-union, and 25 the actuating-fluid-supply pipe, which serve for conducting said fluid into the valve-box 46. 2 is the shell or cradle, formed with the cone 2^a, and 3 the front guide, in which the cylinder 1 is slidably mounted. The feed-screw 13 in this arrangement, as in Figs. 1 to 6, is journaled at 14 in the front guide 3 and at 15 in the rear end of the shell or cradle 2. It is formed with a longitudinal feather-way 20, on which slides the pinion 21, fitted with the feather-key to rotate the cylinder 1, and the feed-nut 10 is carried by the sleeve 5, which latter is also shaped to slide in the guideways 8, formed in the longitudinal member of the shell or cradle 2. The front head 33, resilient pad 34, protecting-ring 35, and impact-piece 28 are also of the construction illustrated in Figs. 1 to 6.

Fig. 9 illustrates the position the piston 32 assumes when it drives the impact-piece 28 forward as a result of the cutting end of the drill or bit not coming into contact with the rock or bottom of the hole being drilled. In this position any fluid leaking round the piston 32 from the port 27 escapes from the front of the piston 32 through the port 48, and so prevents such leakage from impelling the piston 32 on its rearward stroke until the impact-piece 28 is driven back in the cylinder 1 by feeding the machine forward or otherwise.

In Fig. 10 we illustrate the machine shown in Figs. 8 and 9, but arrange the feed-nut 10 in the forward guide 3 instead of in the sleeve 5 and journal the feed-screw 13 in the sleeve 5, (similar to Fig. 7,) so that the feed-screw 13 moves with the cylinder and is traversed longitudinally of the shell or cradle 2 by screwing it through the stationary feed-nut 10.

What we claim as our invention, and desire to protect by Letters Patent, is—

1. A rock-drilling machine or engine comprising in combination a drill-cylinder carrying the percussive apparatus, a shell or cradle provided with a forward guide in which said cylinder is slidably mounted, a loose sleeve encircling said cylinder constructed to slide in guideways formed in said shell or cradle, a feed-nut carried by said sleeve, a feed-screw stationarily carried by said shell or cradle, and means for rotating the screw to traverse the sleeve and with it the cylinder longitudinally of the shell or cradle.

2. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying percussive apparatus, a shell or cradle provided with a front guide in which said cylinder is slidably and rotatably mounted, a sleeve encircling said cylinder, connections for giving a slidable engagement between the sleeve and the shell, and connections comprising a rotatable shaft, for advancing and retracting the cylinder aforesaid, and gearing between said shaft and the cylinder, for rotating the latter, upon rotation of the shaft aforesaid.

3. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying percussive apparatus, a shell or cradle with which said cylinder is slidably and rotatably mounted, connections for advancing and retracting the cylinder, comprising a feed-shaft which rotatably engages a part carried by the cylinder, and gearing between said shaft and cylinder for rotating the latter upon rotation of the feed-shaft aforesaid.

4. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying the percussive apparatus, a shell or cradle in which said cylinder is slidably mounted, a feed-nut carried by said shell or cradle, a feed-screw revolubly carried by the cylinder working through the feed-nut to move the cylinder longitudinally of the shell or cradle, and gearing between the cylinder and feed-screw for rotating the cylinder by the rotation of the feed-screw.

5. In a rock-drilling machine or engine, in combination a drill-cylinder carrying the percussive apparatus, a cap or cover fitted at the rear end thereof said cover being formed with circumferential teeth, a shell or cradle in which said cylinder is slidably mounted, a feed-screw, a nut for traversing the cylinder longitudinally of its shell or cradle, a pinion carried by said feed-screw, means for compelling said pinion to rotate with said screw while permitting it to slide longitudinally thereof and means for maintaining the pinion in gear with the circumferential teeth on the cap or cover.

6. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying the percussive apparatus, a cap or cover fitted at the rear end thereof said cover being formed with circumferential teeth, a shell or cradle in which said cylinder is slidably mounted, a feed-nut and a feed-screw working therethrough for traversing the cylinder longitudinally of its shell or cradle, a pinion carried by said feed-screw formed with a feather-key engaging a feather-way formed longitudinally of the feed-screw so that the pinion is compelled to rotate with said screw and permitted to slide longitudinally thereof, means for maintaining said pinion in gear with the circumferential teeth on the cap or cover and means for rotating the screw to feed the drill and at the same time rotate the cylinder, substantially as described.

7. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying percussive apparatus, a cap or cover fitted at the rear end thereof, said cover being formed with circumferential teeth, a shell or cradle in which said cylinder is slidably mounted, a sleeve revolubly supporting the rear end of said cylinder and provided with ribs or wings which traverse guideways formed in the shell or cradle, a feed-nut and a feed-screw working therein for traversing the cylinder longitudinally of its shell or cradle, a pinion carried by said feed-screw formed with a feather-key and engaging a feather-way formed longitudinally of the feed-screw so that the pinion is compelled to rotate with said screw, and formed to slide longitudinally thereof, means for maintaining said pinion in gear with the circumferential teeth on the cap or cover, and means for rotating the screw to feed the drill and at the same time rotate the cylinder, substantially as described.

8. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying the percussive apparatus, an impact-piece located in the front end of said cylinder which serves to receive and transmit the impacts of the percussive apparatus to the drill or bit, means for compelling the drill or bit to rotate in unison with the cylinder, a shell or cradle in which the cylinder is slidably mounted, means for mounting said shell or cradle, a sleeve in which the cylinder is revolubly supported at the rear end, a feed-screw and a feed-nut for moving the cylinder longitudinally of its supporting-casing and gearing carried by the feed-screw and cylinder for rotating the latter when the screw is rotated to feed the drill, substantially as described.

9. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying the percussive apparatus, an impact-piece located in the front end of said cylinder which receives and transmits the impacts of the percussive apparatus to the drill or bit said piece being formed with a longitudinal hole to permit a quantity of the actuating fluid to pass therethrough from the cylinder, means for compelling the drill or bit to rotate in unison with the cylinder, a shell or cradle formed with a

front guide in which the cylinder is slidably mounted and constructed to form longitudinal guideways, means for mounting said shell or cradle, a sleeve in which the cylinder is revolubly supported at the rear end, said sleeve being constructed with longitudinal ribs or wings traversing the guideways in the shell or cradle, a feed-screw formed with a longitudinal feather-way and a feed-nut operating in conjunction with the feed-screw for moving the cylinder longitudinally of the shell or cradle, a cap or cover fitted at the rear end of the cylinder formed with circumferential teeth and with a flange at one side of said teeth, a pinion carried by the feed-screw fitted with a feather-key sliding in the longitudinal feather-way in said screw so that the pinion is compelled to rotate with the screw and permitted to slide longitudinally thereof, means for rotating the screw to move the cylinder longitudinally of the shell or cradle and to simultaneously rotate said cylinder and means for introducing the motive fluid into said cylinder, substantially as described.

10. In a rock-drilling machine or engine, in combination, a drill-cylinder carrying percussive apparatus, a shell or cradle provided with a front guide in which said cylinder is slidably and rotatably mounted, a sleeve encircling said cylinder, connections for giving a slidable engagement between the sleeve and the cradle, a cap at the rear of the cylinder and provided with circumferential gear-teeth for which the aforesaid sleeve acts as a shroud, a pinion engaging said teeth and connections for rotating the pinion.

In witness whereof we have hereunto set our hands in the presence of two subscribing witnesses.

HENRY HELLMAN.
LEWIS CONDICT BAYLES.

Witnesses:
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R. OVENDALE.