No. 839,586. PATENTED DEC. 25, 1906.

H. HELLMAN & L. C. BAYLES.

ROCK DRILL.

APPLICATION FILED MAY 31, 1904

3 SHEETS—SHEET 1.

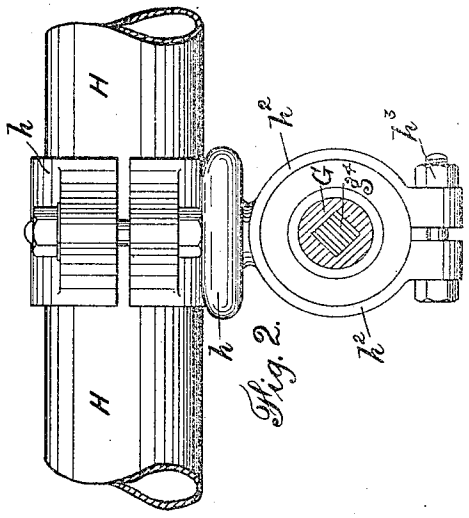

Fig. 2.

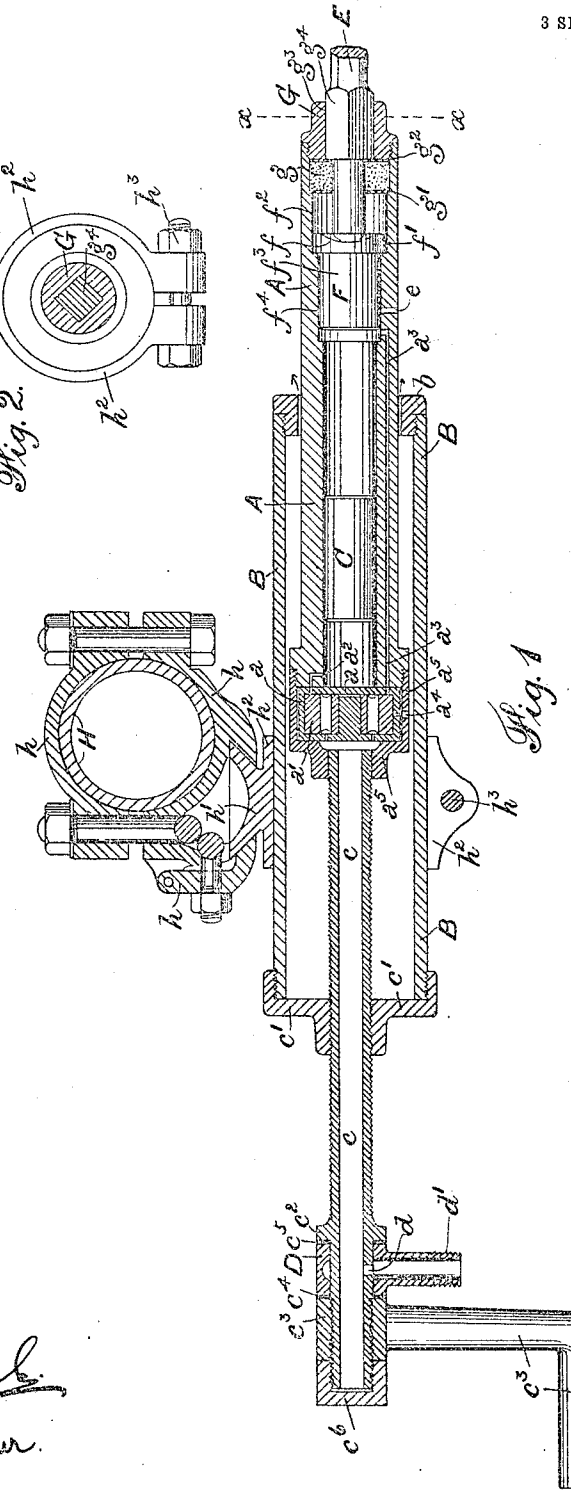

Fig. 1.

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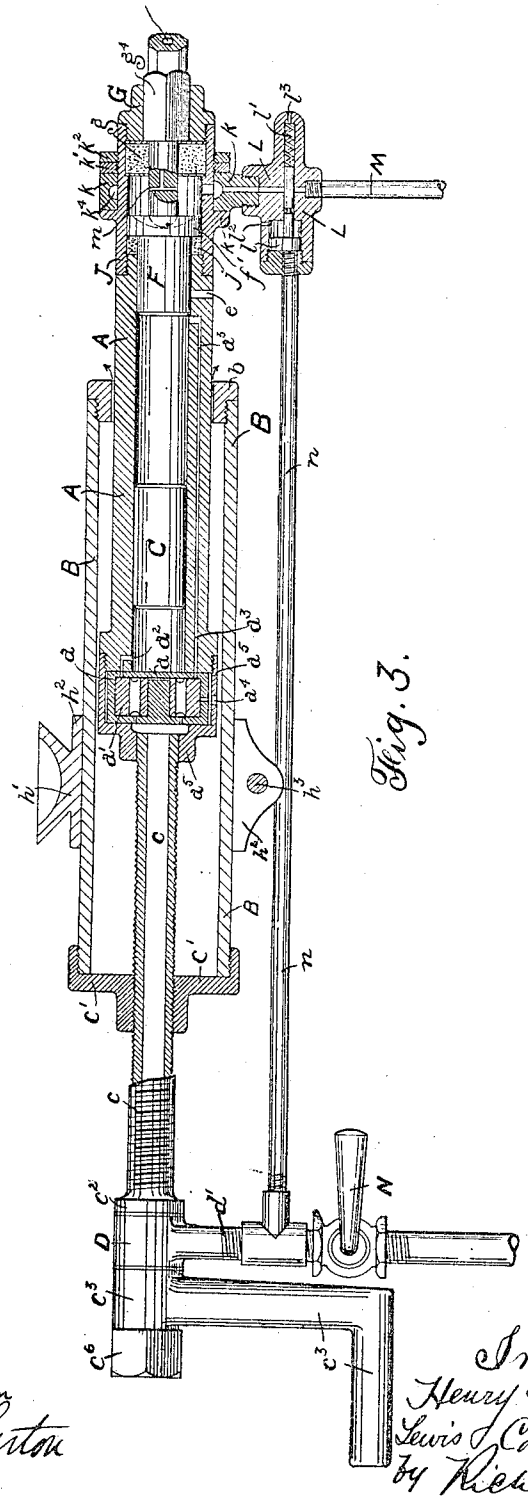

Fig. 3.

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3 SHEETS—SHEET 3

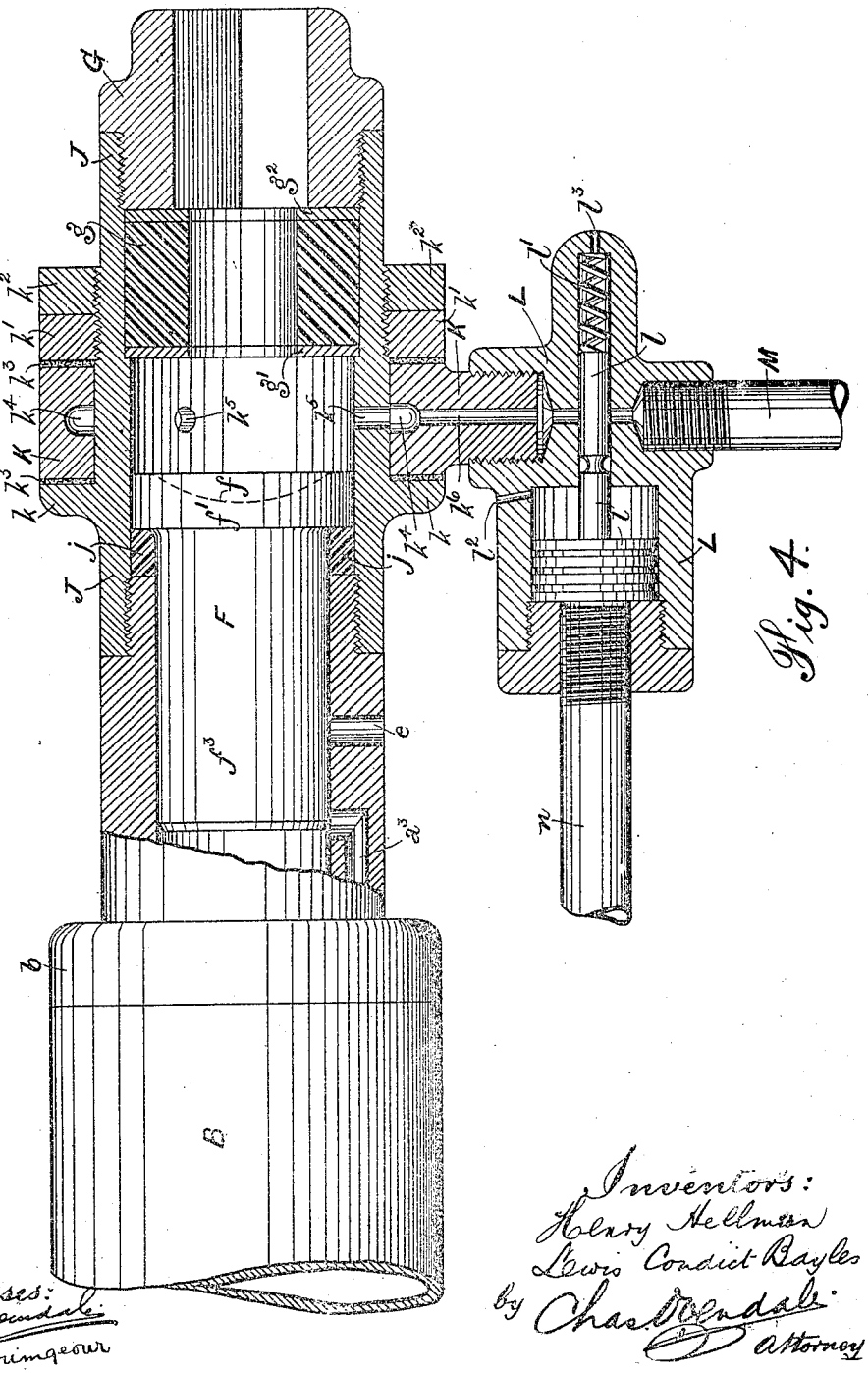

Fig. 4.

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UNITED STATES PATENT OFFICE.

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

ROCK-DRILL.

No. 839,586. Specification of Letters Patent. Patented Dec. 25, 1906.

Application filed May 31, 1904. Serial No. 210,519.

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, of which the following is a specification.

This invention consists of improvements in and in connection with rock-drills or rock-drilling machines employed in mines, quarries, and the like for the formation of holes for blasting or breaking the rock by explosive charges.

It relates more particularly to that class of drill or machine used for small and comparatively short holes or such as are required for "stoping," "plug-and-feather," or like work.

The more important objects of our invention are, first, to provide a light drill capable of drilling holes of the required size and depth and one which will be so simple and durable in construction as not to require the constant attention of a skilled mechanic; secondly, to provide mechanism whereby the cutting-tool or bit is revolved or rotated at the same time that it is advanced; thirdly, to provide a drilling-machine which will cease to operate if the operator or runner fails to keep the machine fed forward as fast as the bit cuts into the rock; fourthly, to provide a mechanism by means of which the drilling-machine may be set at the desired distance from the working face, although the column upon which it is mounted may be separated from the working face by a greater or lesser distance, varying within certain limits, and, fifthly, to provide means whereby a supply of water or air may be injected into the bore-hole at or in proximity to the cutting-face of the bit to allay or remove the dust created when the machine is brought into operation and for simultaneously shutting off the water or air supply when the machine is put out of operation. These several objects are attained by means of the improvements hereinafter described.

The improvements constituting the present invention will now be described in detail by aid of the accompanying drawings, wherein—

Figure 1 illustrates the machine in longitudinal section in conjunction with the means for mounting it on the column, shaft-bar, or other support. Fig. 2 is a sectional end elevation of Fig. 1 on line X X. Fig. 3 is an elevation, partly in section, of the machine, illustrating the means for controlling the supply of water or air to be injected into the bore-hole. Fig. 4 is a section of a part of the front portion of the machine shown in Fig. 3 drawn to an enlarged scale.

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

The machine comprises the power-cylinder A, which is slidably mounted in an outer cylindrical casing B. The front end of the cylinder A extends beyond the front end of the protecting-casing B, in the end of which casing B is provided a cap or bushing *b*, which fits loosely around the cylinder A. The cap *b* may be screwed into the forward end of the casing B, as shown, or be otherwise firmly secured thereto, so as to act as a support and guide for the power-cylinder A. At the rear end of the power-cylinder A, inside the casing B, is located a valve box or chest *a*. The valve arrangement illustrated in Fig. 1 is the same as that used in an axial valve chipping or riveting machine, of which *a'* represents the axial valve and *a* the valve box or chest. Any other suitable construction of valve motion may be employed in place of that shown in the drawings. The working of the valve shown is well understood.

a^2 represents the port by which the motive fluid enters the rear end of the power-cylinder A, and a^3 represents the port by which the motive fluid enters the other or forward end of said cylinder, and a^4 represents the exhaust-port. These ports are controlled by means of the valve *a'* to alternately admit the motive fluid to either side of the piston C, which is thereby reciprocated inside the power-cylinder A. The piston C may be of any form adapted to the valve motion and arrangement of ports. Fig. 1 shows a suitable standard design of piston C.

The feed-screw *c*, which serves for feeding the drilling-bit forward as the hole deepens, works through a feed-nut *c'*. The feed-nut *c'* may be either constructed as shown similar to a reducing pipe-coupling and be screwed or otherwise secured round the outside of the rear end of the casing B or it may take the form of a bushing fitted and secured in the rear end of said casing.

The inner end of the feed-screw *c*, inside

the casing B, is rigidly fixed in a boss formed on the end of the valve-box cap a^5. The feed-screw c is hollow and communicates with the interior of the valve-chest a and serves for introducing the motive fluid into it. The end of the feed-screw may, instead of being attached to the valve-box cap, be secured to the cylinder A; but we prefer the arrangement shown and described. The feed-screw c, working through the nut c', acts as a support for the rear end of the power-cylinder A.

The power-cylinder A, fitting loosely the cap or bushing b, permits the motive fluid exhausting through the port a^4 to escape from the interior of the casing B.

On the outer end of the feed-screw c is formed an annular projection or shoulder c^2. On the feed-screw, in rear of the shoulder c^2, is arranged a swivel D, from which the motive fluid passes into the interior of the hollow feeding-screw c through the aperture d. The end of the feed-screw c beyond the end of the swivel D is formed with an external screw-thread. Over the end of the feed-screw c is screwed a crank c^3, which serves for rotating the feeding-screw c to screw it through the feed-nut c' to move the drill forward or backward.

c^4 c^5 are packing-rings between the shoulder c^2 and the swivel D and between the swivel and the crank c^3.

Over the outer extremity of the feeding-screw c is screwed a cap c^6, which closes the end of the feed-screw c and serves to retain the crank c^3 and swivel D in position on the end of the screw c. The motive fluid may be led into the swivel D and thence into the hollow feeding-screw c by means of a hose or other suitable pipe fixed on the screwed portion d' of said swivel. The connection between the hose and the swivel may be fitted with a valve M for regulating the admission of the motive fluid to the machine.

The feed-screw c being connected to the valve-box cap a^5 advances or recedes the valve-box a and with it the power-cylinder A and drilling-bit E, according to the direction of rotation of the crank c^3. At the same time as the forward extremity of the feed-screw c is rigidly attached in the valve-box cap the cylinder and with it the drill-bit are rotated in unison with the screw c.

In the forward end of the power-cylinder A and beyond the port a^3 is placed what we may designate a "shank-cap" F. At the end of its forward stroke the piston C strikes or impinges upon the inner end of the shank-cap F, which in turn transmits the force of the blow to the drill steel or bit E. In the front of the shank-cap F is formed a recess f, into which projects the inner extremity of the shank of the bit E. The enlarged front cylindrical portion f' of the shank-cap F works in a counterbore f^2 in the forward end of the power-cylinder A, while the rear cylindrical portion f^3 works in another counterbore f^4 in the power-cylinder.

Into the forward end of the cylinder A is screwed or otherwise secured a cap G, and inside the cylinder A, next the cap G, is arranged a rubber or other suitable buffer g. Protecting-rings g' g^2 are arranged in the power-cylinder A at either side of the rubber buffer g. The drill-bit E reciprocates through a hole g^3, formed through the front of the cap G. The hole g^3 is made square and that portion g^4 of the shank of the drill E which is located in the hole g^3 is also made square in shape, so that when the power-cylinder A is rotated to feed forward the drill the drill-bit E is compelled to move in unison with the power-cylinder. The cylindrical inner end of the drill-shank projects through a hole in the protecting-rings g' g^2 and buffer g into the recess f in the shank-cap F. Should the drill E from any cause permit the shank-cap F to be pushed forward by the piston C sufficiently far, it will come into contact with the protecting-ring g', so that the buffer g will receive the blow.

It will be obvious that the hole in the cap G and the part g^4 of the drill-shank may be made of any polygonal section, triangular or of other form, instead of square to insure the rotation of the drill-bit E with the cylinder A, or the drill-bit may be fixed in the end of the cylinder by means of a key or pin and slot to obtain the same result.

In the wall of the cylinder A beyond the inlet-port a^3 is formed a port e, over which the inner end of the shank-cap F is normally seated, so that said port is closed so long as the bit is kept fed up to its work. If the cutting extremity of the drill-bit E is not in contact with or close to the rock when the piston C strikes the shank-cap F, the cap F will be driven forward against the buffer g and will be followed up by the piston C. The shank-cap F will then uncover the port e and permit the motive fluid admitted into the cylinder A through the port a^3 to leave the cylinder by the port e. This will prevent the piston C being moved in its rearward or back stroke, and the machine will thereupon cease to operate until such time as the shank-cap F is pushed backward or the machine fed forward to cause the shank-cap F to overlap the port e and close it, whereupon the motive fluid acting on the forward end of the piston will propel it on its rearward stroke and the machine be again brought into operation.

The outer cylinder or casing B is securely mounted on a column, shaft-bar, or other suitable support H.

h is a clamp of ordinary construction secured to the column H and adapted to receive the cone h', to which is united the split sleeve h^2. The sleeve h^2 is shaped to fit the casing B and the ends of the sleeve are tight-

ened by means of a bolt h^3. By tightening the bolt h^3 the sleeve h^2 clamps and securely holds the protecting-casing B, and by slackening the bolt h^3 and releasing the sleeve h^2 the protecting-casing B is thereby freed and may be moved forward or backward in the split sleeve h^2 as may be desired. This is an important feature of the present invention and a great improvement over the existing methods of mounting drills. It permits the operator to mount his drill at the correct distance from the rock-face to get the full length or range of feed provided the column is set within a foot of the correct distance from the working face. With the present method of mounting drills any variation from the correct distance between the column and working face shortens the available feed by that amount.

In the working of rock-drills it is often impossible to set the column at precisely the desired distance from the rock-face, and the operator is frequently compelled to change the bit after drilling only a short distance, and it not infrequently becomes necessary to take down and reset the column before drilling the second hole, as the rock-face projects slightly where the second hole is to be started or a bit as short as is necessary is not obtainable. This difficulty is obviated by the method of mounting above described, which permits the drill to be easily advanced toward or withdrawn from the working face.

In Figs. 3 and 4 we illustrate, in conjunction with the drill, the means for providing a water or air supply at or in proximity to the extremity of the drill-bit to allay or remove the dust or pulverized rock created when the machine is running. In these views the part f^3 of the shank-cap F is located and works in the bore of the cylinder A and the supply-port a^3 and exhaust-port e open into the bore of the cylinder and not into a counterbore, as shown and described with reference to Fig. 1. In this case the piston C will overrun and close the port a^3 when the drill-bit E is not kept up against the rock and the shank-cap F is driven forward. When the piston C overruns the port a^3, there will be some leakage around the piston C and the bore of the cylinder A, which in the case of a worn piston or cylinder will be sufficient to return the piston on the back stroke, and so open the port a^3. The port e will permit the free escape of any air which may leak from the port a^3 around the piston C, and so prevent the leakage reversing the piston. On the forward end of the power-cylinder A is screwed a piece J, which forms a counterbore in which the large end f'' of the shank-cap F is located. j is a packing-ring between the head f' of the shank-cap F and the end of the cylinder A. A swivel or loose collar K is arranged round the piece J and secured thereon between the shoulder k on the one side and a nut k' and lock-nut k^2, screwed on the piece J, at the other side of the swivel K. k^3 represents packings round the piece J at either side of the swivel. k^4 is an annular recess formed round the inside of the swivel, and k^5 represents three (more or less) holes formed in the wall of the piece J, communicating with the annular recess k^4 and placing the chamber between the head f' of the shank-cap F and the protecting-ring g' in communication with the recess k^4. G is the cap screwed into the forward end of the piece J, and g the packing and buffer ring, which is fitted with protecting-rings g' g^2 at each end and forms a practically water-tight joint round the shank of the drill. To the swivel or loose collar K is attached a valve-box L. In the valve-box L is arranged a valve l, which on the one side works against a spring l'. The valve-box L is connected to a source of water or air supply by a pipe M. The valve-box L is also connected with the motive-fluid-supply pipe preferably between the valve N and the point of admission of the fluid to the machine by means of a pipe n. The pipe n communicates with the valve-box L on the opposite side of the valve l, so that the motive-fluid pressure works against the spring l'. When the valve N is operated to admit the motive fluid to the machine, the fluid passes along the pipe n and operates the valve l to allow the water to pass out of the pipe M through the valve l and along the passage k^6 in the swivel to the annular recess k^4 and thence through the holes k^5 into the chamber in front of the shank-cap F, whence it passes into the shank of the drill-bit E, through the hole m, and along the longitudinal hole m' in the drill-bit E to emerge at or near the cutting end thereof. So long as the motive-fluid supply is maintained the spring l' is placed in compression; but when the supply is cut off and the machine put out of operation the spring l' reverses the valve l, and so shuts off the water-supply. l^2 and l^3 are ports for permitting the escape of water from the front of the piston l. Instead of attaching the valve-box L directly to the swivel K it may be located at any other convenient point in the water-supply pipe M and be connected to the swivel or loose collar K by means of a pipe.

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

1. In a rock-drill, in combination, a power-cylinder, a protecting-casing in which the power-cylinder is slidably fitted, a reciprocating piston arranged in the cylinder, means fitted in the forward end of the cylinder for supporting the drill-bit so that the same has longitudinal movement in said means, means for rotating the drill-bit in unison with the power-cylinder, and means for advancing or receding the power-cylinder in its protecting-casing, substantially as described.

2. In a rock-drill in combination, a power-cylinder, a protecting-casing slidably supporting the power-cylinder, a reciprocating piston arranged in said power-cylinder, a shank-cap fitted in the forward end of said power-cylinder, means for supporting the drill-bit in the forward end of the cylinder and for rotating same in unison therewith, means for introducing the motive fluid into the cylinder, said means serving to advance or recede the power-cylinder in its protecting-casing, and a split sleeve embracing the protecting-casing adjustable longitudinally thereof, substantially as described.

3. In a rock-drill, in combination, a protecting-casing, a power-cylinder, a reciprocating piston fitted in the interior thereof, means for introducing the motive fluid into the cylinder, said means serving to support the rear end of the cylinder and for advancing and receding the cylinder in its protecting-casing, means for supporting the protecting-casing adjustable longitudinally thereof, a shank-cap fitted in the forward end of the cylinder which serves to receive and transmit the blow of the piston to the drill-bit on the forward stroke, means for supporting the drill-bit in the forward end of the cylinder and for compelling the bit to rotate in unison with said cylinder, substantially as described.

4. In a rock-drill, in combination, a power-cylinder, a reciprocating piston working therein, a valve-box and valve fitted on or in the rear end thereof, a protecting-casing in which the cylinder is slidably mounted, a hollow feed-screw, a cap or cover fitted on the rear end of the protecting-casing through which the feed-screw works to advance or recede the power-cylinder, said hollow feeding-screw serving to lead the motive fluid into the valve-box, means for rotating said feeding-screw, and means for introducing the motive fluid into the screw, substantially as described.

5. In a rock-drill, in combination, a power-cylinder, a reciprocating piston working therein, a piston arranged and adapted to reciprocate in said cylinder, a shank-cap fitted in the forward end of the cylinder which serves for receiving and transmitting the impact of the piston to the drill-bit, means fitted in the forward end of the cylinder for supporting the drill-bit and for compelling it to rotate in unison with the power-cylinder, a hollow feed-screw which serves for introducing the motive fluid into the cylinder and for advancing and receding the power-cylinder in its supporting-casing, means for rotating the feeding-screw, means for introducing the motive fluid into the screw, and means for supporting the drill adjustable longitudinally of the protecting-casing, substantially as described.

6. In a rock-drill, in combination, a power-cylinder, a reciprocating piston fitted therein, means for reciprocating said piston, a shank-cap fitted in the forward end of the power-cylinder for receiving and transmitting the impact of the piston to the drilling-bit on the forward stroke, a cap fitted to the forward end of the power-cylinder for supporting the shank of the drill-bit and shaped internally to compel the drill-bit to rotate in unison with the power-cylinder while permitting the drill-bit to move longitudinally of the axis of the power-cylinder, substantially as described.

7. In a rock-drill, in combination, a power-cylinder, a reciprocating piston, means for alternately admitting the motive fluid to either side of said piston, a shank-cap fitted in the forward end of the power-cylinder for receiving and transmitting the impact of the piston to the drilling-bit on the forward stroke, means for supporting the shank of the drill-bit in the extremity of the cylinder beyond the shank-cap, an escape-port formed in the power-cylinder which is normally closed by the shank-cap and which port permits the free escape of any motive fluid entering the forward end of the cylinder should the shank-cap be moved forward by the piston owing to the drilling-bit not being kept fed up to its work to throw the machine out of operation, substantially as described.

8. In a rock-drill, in combination, a power-cylinder A, a reciprocating piston C fitted therein, means for admitting the motive fluid to either side of said piston, a sliding shank-cap F fitted in the forward end of the cylinder and formed with an enlarged front portion f', a cap G fitted in the end of the power-cylinder A formed with a polygonal hole through the center, a drill-bit E formed with a portion of its shank of polygonal section corresponding with the hole in the cap G and the extremity of circular section against which the enlarged front portion f' of the shank-cap is adapted to strike, and means for rotating the power-cylinder A and with it the drill-bit E, substantially as described.

9. In a rock-drill, in combination, a power-cylinder A, a piston C arranged therein, a shank-cap F fitted in the front of the cylinder A to receive and transmit the impact of the piston C to the drill-bit E on the forward stroke, the power-cylinder having an escape-port e which permits the motive fluid to escape from the front of the piston in the event of the shank-cap being moved forward owing to the drilling-bit not being kept fed up to its work, a cap G fitted in the forward extremity of the cylinder A formed with a central hole g^3 of polygonal section, a drill-bit E formed with a portion g^4 of polygonal section corresponding to the hole g^3, and an elastic packing-ring g fitting round the cylindrical part of the shank inside the cap G and acting as a buffer to the shank-cap F, substantially as described.

10. In a rock-drill, in combination, a

power-cylinder A, a reciprocating piston C, a shank-cap F, a drill-bit E the shank of which is shaped to compel it to rotate with the cap G in which it is supported, a cap G, a casing B, caps c' b fitted at the ends thereof, a hollow feed-screw c working through the cap c' to advance or recede the drill and to rotate the bit in unison with the cylinder A, a swivel D for introducing the motive fluid into the feed-screw c, and means for rotating the screw c, substantially as described.

11. In a rock-drill, in combination, a power-cylinder A, a reciprocating piston C fitted therein, a shank-cap F, the power-cylinder having an escape-port e in the cylinder A normally closed by the shank-cap, a cap G fitted in the forward end of the power-cylinder, a drill-bit E formed with a part g^4 of polygonal section fitting the cap G, and a cylindrical part projected into a recess f in the front of the shank-cap, a feed-screw c communicating with the rear end of the cylinder, a casing B supporting the cylinder A, a cap c' through which the feed-screw c works, a swivel D for introducing the motive fluid into the hollow feed-screw, means for rotating the feed-screw to advance or recede the power-cylinder A and to rotate the same and with it the drill-bit E, a split sleeve h^2 adjustable longitudinally of the casing B and means for mounting the drill, substantially as described.

12. In a rock-drill, a power-cylinder, a reciprocating piston therein, means for operating said piston by compressed fluid, a drill-tool having its shank extending into a chamber within the cylinder and having a longitudinal bore communicating by a transverse passage with said chamber, a shank-cap located between the piston and shank of the drill-tool, said shank-cap being adapted to receive the impacts of the piston and to transmit same to the drill-tool, said shank-cap being constructed with an enlargement at its forward end, and means consisting of a resilient and relatively stationary packing-ring located at the rear of and next the head or annular enlargement on the shank-cap in conjunction with which it operates to prevent the passage of the water from the chamber into the bore of the cylinder beyond said chamber, and means for supplying water to said chamber, substantially as described.

13. In a rock-drill, in combination, a power-cylinder, a protecting-casing in which the cylinder is slidably mounted, means for advancing and receding the power-cylinder in the casing, means for supporting the drill-bit in the forward extremity of the power-cylinder said means insuring the rotation of the bit in unison with the power-cylinder, means for receiving and transmitting the impact of the piston to the shank of the drill-steel, a chamber formed round the shank of the drill-steel, a swivel or loose collar in communication with said chamber, means for preventing the water or air passing into the power-cylinder, means for introducing the water or air into the swivel when the motive fluid is admitted to the machine and for simultaneously cutting off the water or air supply when the motive-fluid supply is cut off, substantially as described.

14. In a rock-drill, in combination, a power-cylinder, an extension-piece J secured on the end thereof, a shank-cap F fitted in the forward end of the power-cylinder, an enlargement f', a packing j between the part f' of the shank-cap and the end of the power-cylinder, a swivel K formed with the annular recess k^4, holes k^5 in the piece J placing the interior of the piece J in front of the shank-cap in communication with the recess k^4, means for introducing water or air into the interior of the swivel when the motive-fluid supply is admitted to the machine, means for simultaneously shutting off the water or air supply when the motive-fluid supply is shut off, a drill-bit, means for supporting the shank thereof in the forward end of the piece J the drill-steel being formed with a longitudinal hole and with a hole placing said longitudinal hole in communication with the chamber in front of the shank-cap for introducing a jet of water or air at or in proximity to the cutting end of the drill, substantially as described.

15. In a rock-drill, in combination, a power-cylinder A, a shank-cap F fitted in the forward end thereof formed with the enlargement or head f' and recessed to receive the extremity of the drill-shank, a packing j' between the shank-cap and the end of the cylinder, a piece J fixed on the forward end of the cylinder, a swivel K in communication with the piece J in front of the shank-cap, a valve-box L and spring-controlled valve l arranged therein for admitting water or air to the chamber in front of the shank-cap when the motive fluid is admitted to the machine and for cutting off the water or air supply when the motive fluid is shut off, means for introducing water or air to the valve-box L, a cap G fitted in the front end of the piece J for supporting the drill-bit and compelling it to rotate in unison with the power-cylinder, the drill-bit being formed with holes in communication with a longitudinal hole formed therein placing the chamber in front of the shank-cap in communication with said longitudinal hole for introducing a jet of water or air at or in proximity to the cutting end of the bit, substantially as described.

16. In a rock-drill, in combination, a power-cylinder, a protecting-casing, surrounding the cylinder in which the cylinder is slidably mounted, means for introducing the motive fluid to the cylinder, said means serving for advancing or receding the cylinder in the casing, means for supporting the casing adjustable longitudinally thereof, a

shank-cap fitted in the forward end of the cylinder, an escape-port controlled by said shank-cap adapted to permit the motive fluid to escape from the front of the piston should the shank-cap be moved forward by the piston sufficiently far to uncover said port, a swivel surrounding the forward end of the cylinder, means for introducing the water or air into a chamber formed in front the shank-cap, a water or air supply pipe communicating with the swivel, a valve-box interposed between the water or air pipe and the swivel and a valve arranged therein, said valve being operated by the motive fluid to admit the water or air supply to the swivel when the machine is put into operation, means for reversing the valve when the motive-fluid supply is shut off, a cap fitted in the front of the cylinder for supporting the shank of the drill-bit, said cap being shaped to compel the drill-bit to rotate in unison with the power-cylinder, the drill-bit formed with a longitudinal hole placed in communication with the chamber in front of the shank-cap, and a packing surrounding said shank to prevent the water or air escaping round the shank, substantially as described.

17. In a rock-drill, in combination, a power-cylinder A and its supporting-casing B, a reciprocating piston C, a feed-screw c and feed-nut c' forming the cover of the casing B, a swivel D for admitting the motive fluid to the feed-screw c, means for rotating said feed-screw to advance or recede the power-cylinder, an adjustable split sleeve h^2 and means for mounting the drill, a shank-cap F and the port e controlled thereby, an extension-piece J on the forward end of the power-cylinder, a swivel arranged round the piece J communicating with the chamber formed in the front of the shank-cap, a cap G fitted in the front of the piece J and the packing g inside the piece J beyond the cap G, a drill-bit E with the part g^4 of polygonal section to fit the hole g^3 in the cap G and the cylindrical part projecting through the packing g and abutting the front of the shank-cap, the holes in the drill-bit communicating with the chamber in front of the shank-cap, a water or air supply pipe communicating with the swivel K, a valve-box L between the swivel and said air or water supply pipe, a spring-controlled valve l and a pipe N placing the valve-box L in communication with the motive-fluid-supply pipe so that the valve l is operated to admit the water or air supply to the swivel when the motive fluid is admitted to the power-cylinder, substantially as described.

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

HENRY HELLMAN.
LEWIS CONDICT BAYLES.

Witnesses:
CHAS. OVENDALE,
R. OVENDALE.