H. DEITZ.

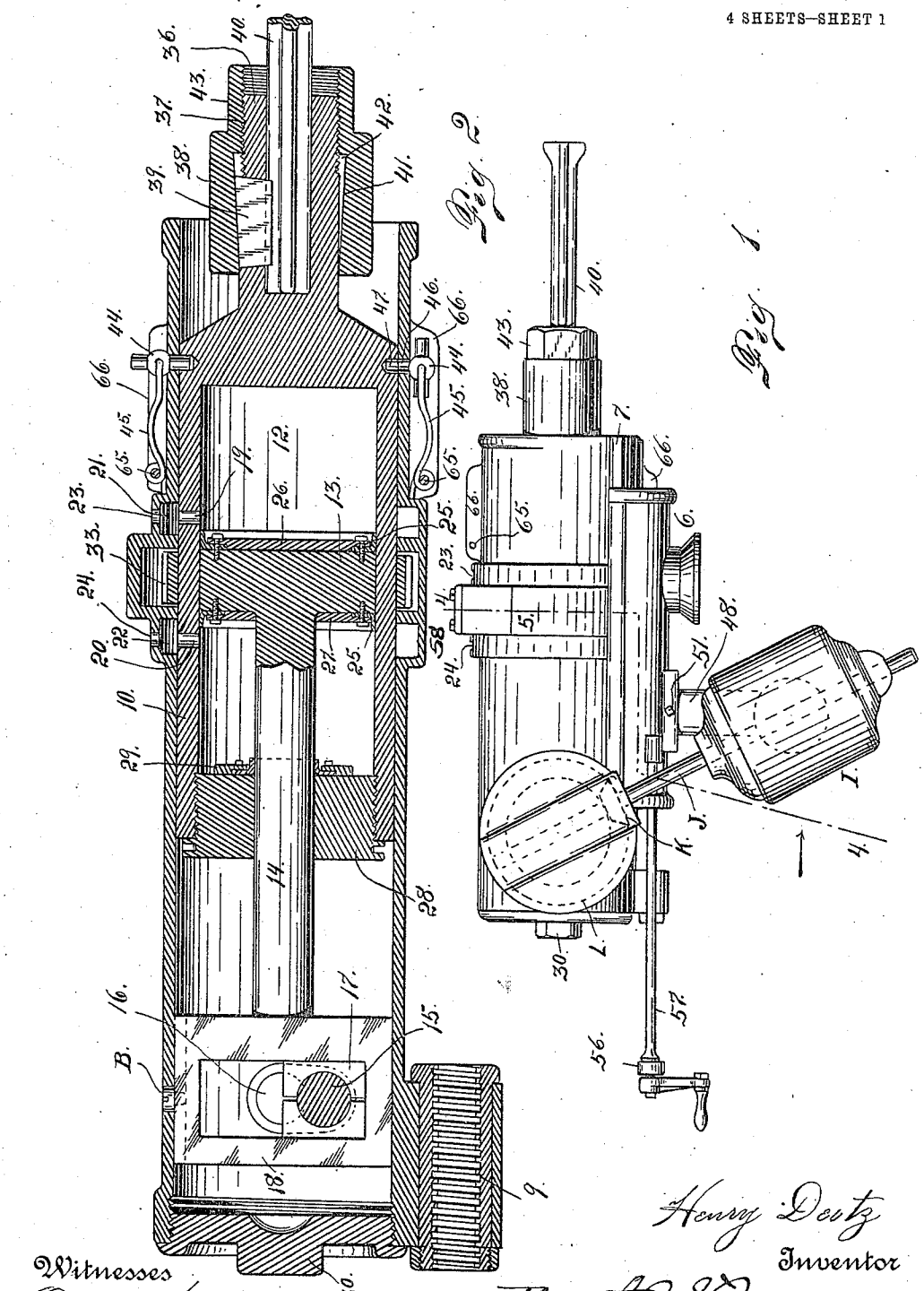
ROCK DRILL.

APPLICATION FILED JUNE 2, 1905. RENEWED FEB. 27, 1909.

1,043,302.

Patented Nov. 5, 1912.

4 SHEETS—SHEET 1



Witnesses

Otto E. Hoddick.

Dena Nelson.

Henry Deitz

Inventor

By [illegible]

Attorney

H. DEITZ.

ROCK DRILL.

APPLICATION FILED JUNE 2, 1905. RENEWED FEB. 27, 1909.

1,043,302.

Patented Nov. 5, 1912.

4 SHEETS—SHEET 2.

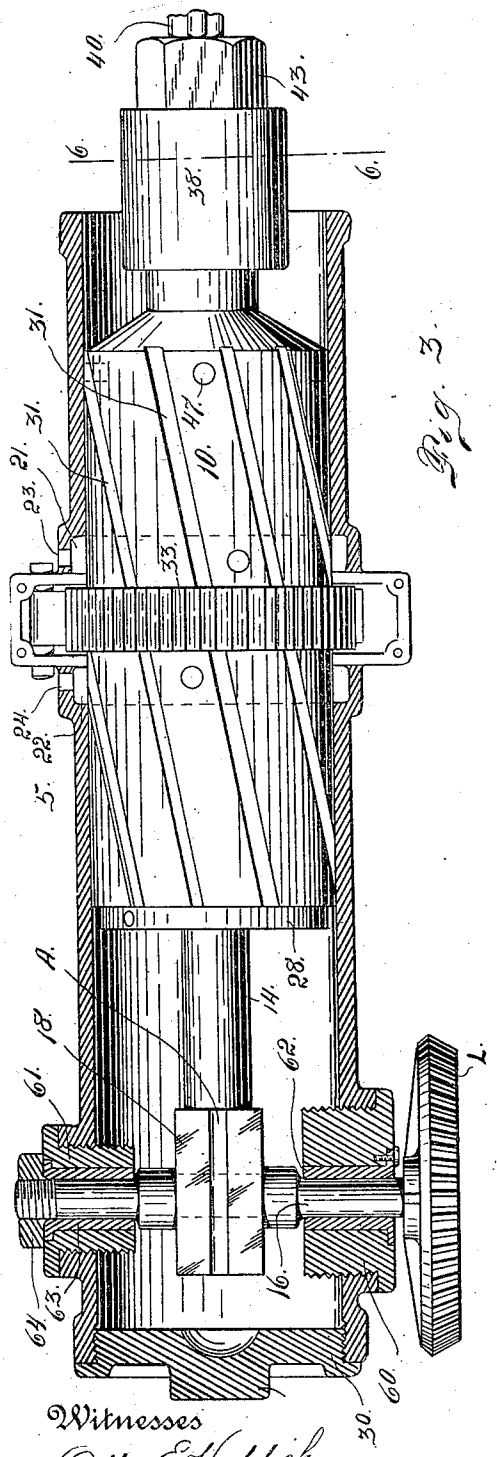


Fig. 3.

Witnesses

Otto E. Hoddick

Dena Nelson.

Inventor

Henry Deitz

By A. W. Brien

Attorney

H. DEITZ.

ROCK DRILL.

APPLICATION FILED JUNE 2, 1905. RENEWED FEB. 27, 1909.

1,043,302. **Patented Nov. 5, 1912.**

4 SHEETS—SHEET 3.

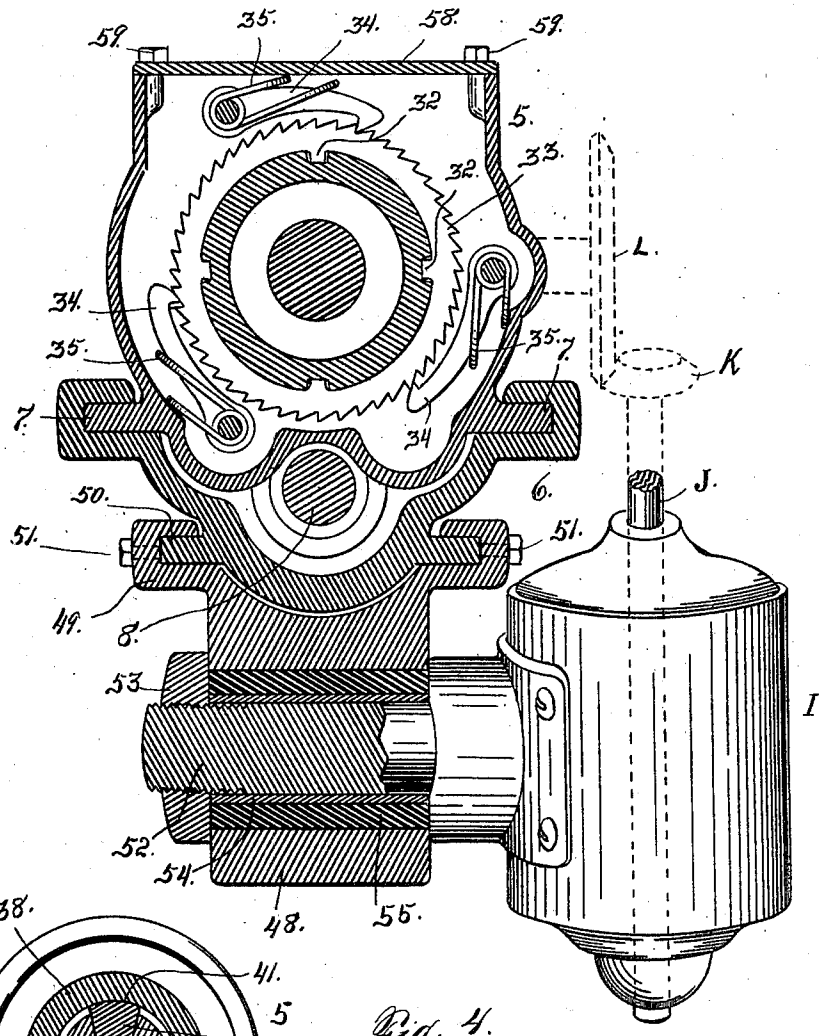


Fig. 4.

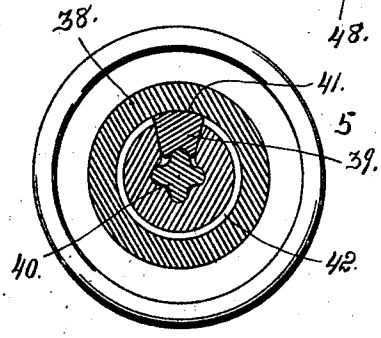


Fig. 5.

Witnesses

Otto E. Hoddick.

Dena Nelson.

Henry Deitz.

Inventor

By A. D. Brien

Attorney

H. DEITZ.

ROCK DRILL.

APPLICATION FILED JUNE 2, 1905. RENEWED FEB. 27, 1909.

1,043,302.

Patented Nov. 5, 1912.

4 SHEETS—SHEET 4.

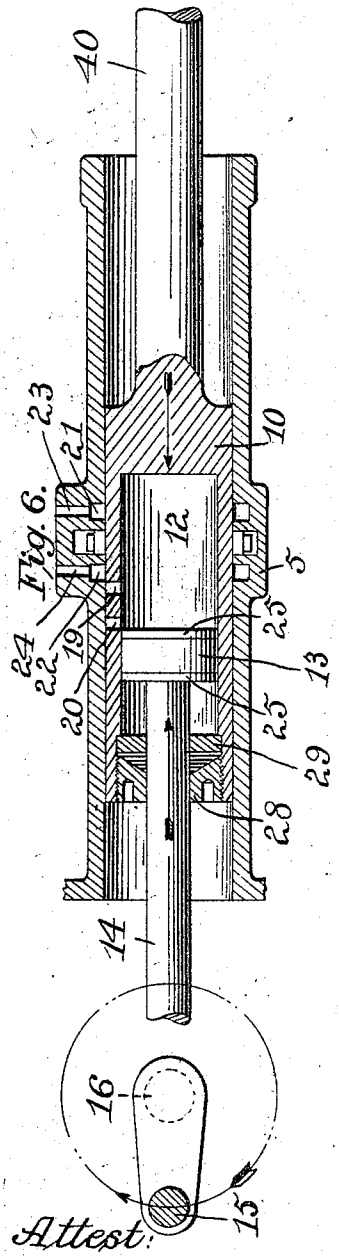


Fig. 6.

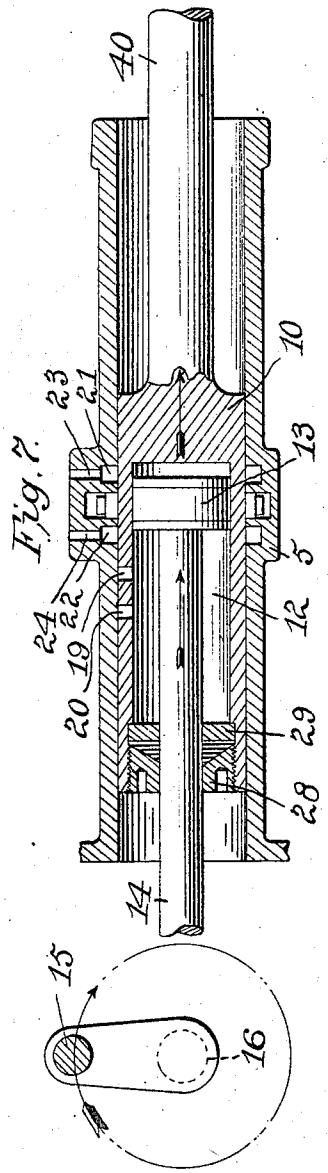


Fig. 7.

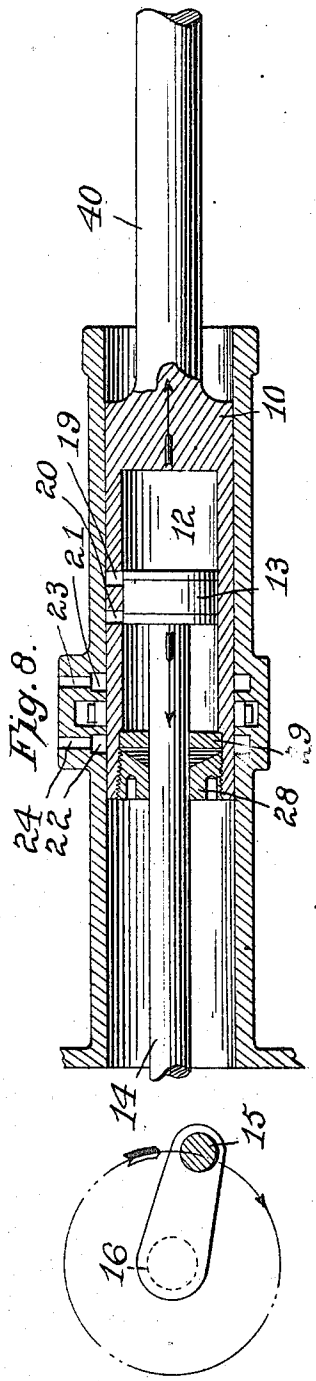


Fig. 8.

Attest:

Edwd L. Tolson.

E. W. Sarton

Inventor:

Henry Deitz,

by Fraser, Middleton, Middleton & Fraser

Atty's

UNITED STATES PATENT OFFICE.

HENRY DEITZ, OF DENVER, COLORADO.

ROCK-DRILL.

1,043,302. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed June 2, 1905, Serial No. 263,365. Renewed February 27, 1909. Serial No. 480,469.

To all whom it may concern:

Be it known that I, HENRY DEITZ, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rock-Drills; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rock drills. In my improved construction the reciprocating drill member is provided with an air chamber ported to prevent the formation of a vacuum, but in the opposite extremities of which the air is compressed by a piston located in said chamber and connected with an actuating pitman rod or stem.

My improved construction forms a combined air compressor and drill.

The initial forward stroke of the reciprocating member is obtained by compressing the air in the forward extremity of the said chamber by virtue of the forward stroke of the piston. During the rearward stroke of the piston the air cushion in the rear end of the chamber imparts the rearward movement to the reciprocating drill member, but while the latter is still moving rearwardly by virtue of its momentum the piston begins its forward stroke, and the movement of the two elements in opposite directions, results in powerfully compressing the air in the forward end of the air chamber, and the expansion of this air drives the reciprocating drill member forward, causing it to strike a quick and powerful blow. This is a new principle in the operation of percussive tools.

Having briefly outlined my improved construction, as well as the main function which it is intended to perform, I will proceed to describe the same in detail, reference being made to the accompanying drawing in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a side elevation of my improved drill. Fig. 2 is a vertical longitudinal section taken through the same, parts being shown on a larger scale. Fig. 3 is a view looking downwardly, with the casing sectionized, the section being taken at right angles to Fig. 2. Fig. 4 is a section taken on the line 4—4 Fig. 1. Fig. 5 is a cross section taken on the line 6—6 Fig. 3 looking toward the left. Figs. 6, 7 and 8 are views of the nature of diagrams showing the position of the parts at different periods in the operation of the device.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable casing slidably mounted on a guide shell 6, the casing being provided with laterally projecting tongues 7 engaging guide grooves formed in the shell. The casing is shifted on the guide shell through the instrumentality of a feed screw 8 threaded in a nut 9 connected with the rear extremity of the casing.

Mounted within the guide shell is a cylindrical drill holder 10 provided with a chamber 12 in which is located a piston 13 provided with a rod or stem 14 whose rear extremity is connected with a yoke 18 actuated by a crank shaft 16. The crank 15 of this shaft engages a two part box 17 vertically slidable in the yoke which is mounted to reciprocate in the casing in the rear of the hollow drill holder. It is evident as the crank shaft is rotated, the crank operating within the yoke, will impart a reciprocating movement to the piston 13. As this piston reciprocates within the chamber 12, the air cushions in the opposite ends of the said chamber. When the piston is centrally located within the chamber 12 as in Fig. 2, the air on opposite sides of the piston within the chamber 12 is at normal atmospheric pressure, since both ends of the chamber are in communication with the atmosphere through the instrumentality of ports 19 and 20, circumferential chambers 21 and 22 and ports 23 and 24. However, as the piston moves past the port 19 or 20 as the case may be, the air cushions in the one extremity or the other of the chamber. In order to prevent the air within the chamber 12 from escaping from one end of the chamber 12 to the other or from passing the piston within the chamber, the piston is provided on opposite sides with packing rings 25 held in place by plates 26 and 27 secured to the opposite faces of the piston.

The chamber 12 of the hollow drill holder is closed at the rear by a screw plug 28 through which the piston rod passes, the rod being surrounded by a packing washer 29

to form an air tight joint around the piston stem. The rear extremity of the casing is closed by a screw plug 30.

The hollow drill holder 10, is provided exteriorly with a number of spirally arranged grooves 31, adapted to engage interiorly projecting lugs 32 formed on the ratchet 33, the latter being engaged by pawls 34 mounted on the casing and acted on by springs 35. These pawls lock the ratchet against rotation in one direction as will be readily understood, while they allow rotation in the opposite direction. The function of the ratchet and pawls in connection with the spirally grooved exterior of the hollow portion of the drill holder, is to rotate the latter or impart the necessary partial rotations to the drill holder, as the latter is reciprocated. By virtue of the construction just described, as the drill holder is moved rearwardly or toward the left referring to Figs. 1, 2 and 3, the action of the ratchet lugs engaging the spiral grooves of the drill holder, is to impart a partial rotation to the latter, while during the forward movement, the drill holder moves in a straight line without rotation, and the ratchet turns in a manner that will be readily understood.

The forward extremity of the drill holder is reduced in size as shown at 36 and exteriorly threaded as shown at 37 to receive a locking sleeve 38 which coöperates with a key 39, to hold the drill 40 in place. The rear part of the sleeve 38 is provided with tapering walls 41 which increase in size from the rear extremity of the sleeve, to a shoulder or offset 42. The threaded part of the sleeve is located forward of this shoulder. The sleeve is applied to the forward reduced extremity of the drill holder before the drill 40 is inserted in the socket or chuck. Then as the drill bit is inserted, the key 39 is forced outwardly against the tapering wall of the chuck. If it is desired to tighten the bit within the chuck through the instrumentality of the key 39, the sleeve 38 which is fashioned to receive a wrench as shown at 43, is turned in a direction to move the chuck sleeve forwardly, whereby there is a wedging action between the sleeve and the key, the latter being beveled to harmonize with the taper of the rear portion of the chuck sleeve.

In order to prevent the drill holder turning during the manipulation of the chuck sleeve, the casing is provided with spring-actuated locking devices 44 which are adapted to turn on the forward extremities of the springs 45. When it is desired to lock the drill holder against rotation, these locking pins 44 are adjusted to enter openings 46 formed in the casing and adapted to register with the recesses 47 formed in the forward extremity of the drill holder. This locking position is illustrated at the upper part of Fig. 2, while at the lower part of the same figure the locking pin is thrown in the inoperative position.

In the construction shown in the drawing the yoke 18, the piston head 13 and the stem 14 are formed integral. This necessitates the forming of the plug 28 in two pieces, in order to apply it to the stem 14. This feature is indicated by cross hatching in Fig. 2 of the drawing. The upper part of the yoke 18 is provided with a guide groove A which is engaged by a screw B inserted in the casing. This screw acts as a guide to the yoke and its connections during its reciprocating movement.

As shown in the drawing a motor I is employed to rotate the crank shaft through the instrumentality of a shaft J, and gears K and L the latter being fast on the crank shaft. As shown in the drawing the motor is supported by a depending bracket 48 connected with the guide shell by means of bearings 49 on the bracket, engaging lugs 50 on the shell. This bracket is held in place on the shell by means of set screws 51 threaded in the bearings of the brackets. The frame of the motor is provided with a spindle 52 passing through an opening formed in the bracket and secured thereto by a nut 53. The spindle is surrounded by a steel bushing 54, the latter being in turn surrounded by a rubber bushing or sleeve 55, the latter serving to take up the vibrations incident to the drilling operation and prevent them from being communicated to the motor. This is an important feature in apparatus of this class since excessive vibration is destructive to the motor construction and it is therefore advisable to avoid this vibratory action and prevent the latter as far as possible from being transmitted or communicated to the motor.

The feed screw 8 is journaled in a cross head 58 connected with the guide shell by rods 57 one only being shown (see Fig. 1). This is the ordinary construction, and detail explanation and illustration are therefore not believed necessary.

In order to permit the insertion of the ratchet 33 within the casing, the latter is provided with a removable cap 58 held in place by bolts 59. The crank shaft is journaled in removable bearings 60 and 61 provided with bushings 62 and 63. These bearings are threaded into the casing. The bearings 60 are of sufficient diameter to permit the removal of the crank shaft from the casing when the nut 64 has been unscrewed. When this is done the drill holder, the piston and yoke may all be removed from the rear extremity of the casing by taking out the plug 30. In this case it will of course be necessary that the pins 44 be disengaged from the drill holder.

When it is desired to remove a drill bit

40, a wrench is applied to the part 43 of the bushing sleeve, and the latter is turned to move it rearwardly on the chuck extremity of the drill holder. This loosens the key 39 sufficiently to permit the easy removal of the drill bit and the insertion of another, after which the sleeve 38 is turned to tighten the key on the drill bit.

The spring 45 connected with the locking pins 44 are coiled around pins 65 made fast in elongated lugs 66 cast integral with the casing and between which the springs 45 are located.

From the foregoing description the use and operation of my improved drill will be readily understood. As soon as the motor shaft J is set in motion, the rock shaft will be rotated imparting a reciprocating movement to the piston and consequently to the drill holder through the instrumentality of the mechanism heretofore described.

Attention is called to the fact that in case the drill bit is stuck in the hole, the continuation of the rotary movement of the crank shaft, will not result in breaking any of the parts of the mechanism, since the reciprocation of the piston within the hollow drill holder, will simply act on the air cushions in the opposite ends of the drill holder chamber. This is an important feature in construction of this class. The key 39 is bifurcated or grooved on its inner edge to straddle one of the ribs or projections of the cruciform drill bit.

Fig. 6 shows the piston on its full backward stroke, just starting forward in the direction of the arrow; the momentum of the reciprocating drill bar causing it to continue rearwardly until the piston has traveled one half of its stroke forward as shown in Fig. 7, at which point the momentum of the reciprocating drill bar has been overcome; the full compression of the air in chamber 12 has been accomplished and the reciprocating drill bar travels forwardly in the same direction as the piston, while the piston finishes the last one half of its forward stroke, as shown in Fig. 8, the reciprocating drill bar traveling at a much accelerated speed, due to the expansion of the compressed air in chamber 12. On the rearward stroke, as shown in Fig. 6, the ports 19 and 20 have passed the ports 21 and 22 in the drill casing and have closed again on the body of the casing; thus it will be seen that as the reciprocating drill bar travels rearwardly toward the piston which is traveling forward, the full volume of air inclosed between piston and head of reciprocating drill bar is compressed as shown in chamber 12, Fig. 7. If the drill was running wild and not causing the drill steel to strike the rock, the action at both ends of the stroke would be the same; but in actual drilling work the machine is so fed to the rock that the drill bit will strike at the point of greatest efficiency or when the reciprocating drill bar is at its highest momentum. This must necessarily be at the time the piston reaches port 20 for its return trip. This, of course, necessitates the placing of port 21 at a point so that when the drill bit strikes the rock, the port 19 or 20 must register with port 21 so that no compression will take place in chamber in rear of the piston until the drill bit has struck the rock. This is a point to be determined in actual practice.

The object of the two ports 19 and 20, instead of one, is to prevent any compression taking place in the chamber in rear of the piston before the drill bit strikes the rock, even though the feeding of the machine varies somewhat, the distance between the ports representing the amount of the variation and bearing the proper relation to the width of the head of piston. If they were too close, or just one port, there would be compression in both the back and forward chamber when the piston head was in the center, which condition I wish to avoid. If they are too far apart, relative to the width of the piston head, then the reciprocating drill bar would operate unevenly or jump, which must also be avoided.

In Fig. 8 I show the drill as running wild, but in actual drilling, I stop the reciprocating drill bar against the rock before it reaches its maximum stroke and while one of the ports in the drill bar registers with a port in the case. Fig. 8 also shows the position, approximately when the drill is running wild and the piston has started on the back stroke.

Having thus described my invention, what I claim is:

1. In combination in a drill, a ported outer casing, a rapidly reciprocating drill member therein having an air chamber provided with ports, and a piston moving in the air chamber, said air chamber moving rearwardly by momentum after the piston has reached its rear limit, to compress the air between itself and the piston, substantially as described.

2. In combination in a drill, a rapidly reciprocating drill member having an air chamber, a piston moving in the said chamber, and a casing in which the drill chamber moves, said drill chamber having a pair of ports spaced apart approximately the width of the piston head, and a port in the casing at an intermediate point thereof to register with the ports in the drill chamber, substantially as described.

3. A rock drill comprising a casing, a hollow drill holder mounted to rotate and reciprocate within the casing, a piston located in the chamber of the drill holder, a spring actuated device mounted on the

casing and adapted to engage the drill holder and prevent rotary movement when desired, a yoke slidably mounted in the casing and rigidly connected with the piston, and means for reciprocating the yoke.

4. The combination with a casing, of a hollow drill holder mounted to rotate and reciprocate within the casing, a piston located in the chamber of the drill holder, a spring actuated device mounted on the casing and adapted to engage the drill holder to prevent rotary movement when desired, and a yoke suitably mounted in the casing and rigidly connected with the piston, said yoke having formed in its upper surface a groove, the casing being provided with means for engaging the groove for the purpose of maintaining the yoke in proper alinement during its reciprocating movement.

5. In combination in a drilling machine, a reciprocable cylinder having its ends closed and provided with an air port intermediate its ends, a reciprocable piston therefor, a tool carried by one of said parts, means for reciprocating the other part, and a casing for the cylinder provided with an air port in position to uncover the air port in the cylinder toward the end of the forward stroke thereof.

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

HENRY DEITZ.

Witnesses:
DENA NELSON,
A. J. O'BRIEN.