W. E. PORTER.

ROCK DRILL.

APPLICATION FILED MAY 25, 1908.

931,479.

Patented Aug. 17, 1909.

2 SHEETS—SHEET 1.

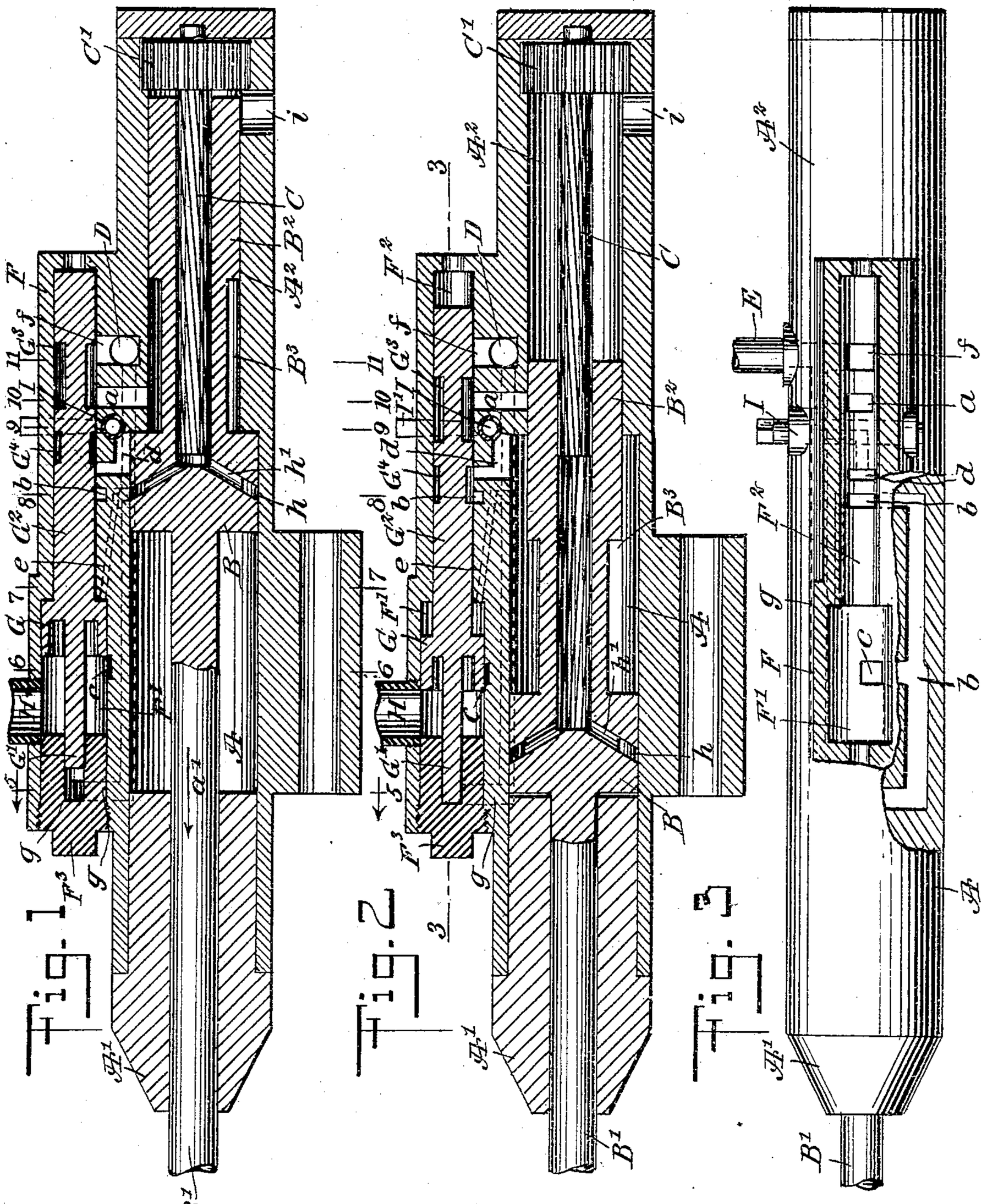

Fig. 1.

Fig. 2.

Fig. 3.

WITNESSES

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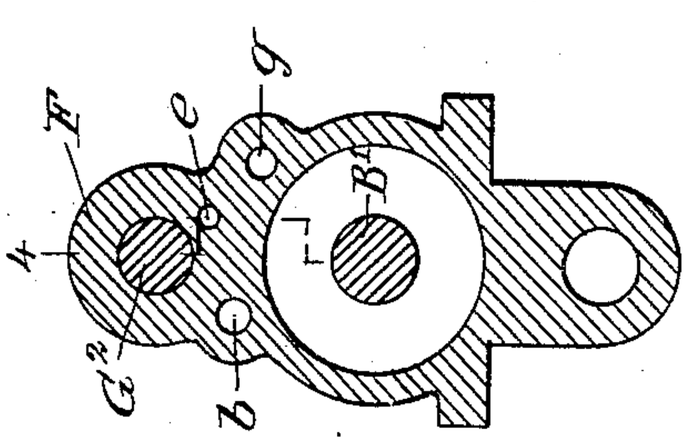

Fig. 7

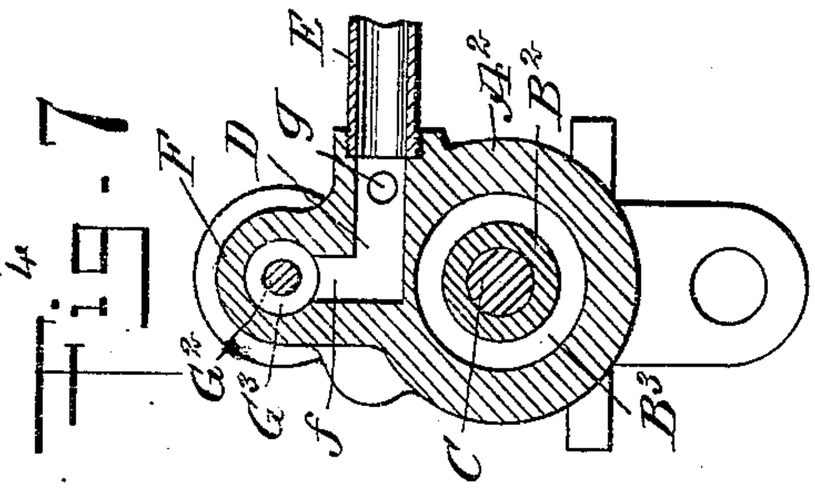

Fig. 11

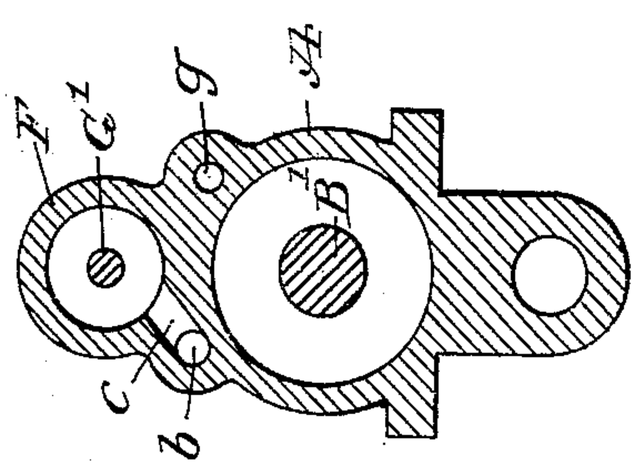

Fig. 6

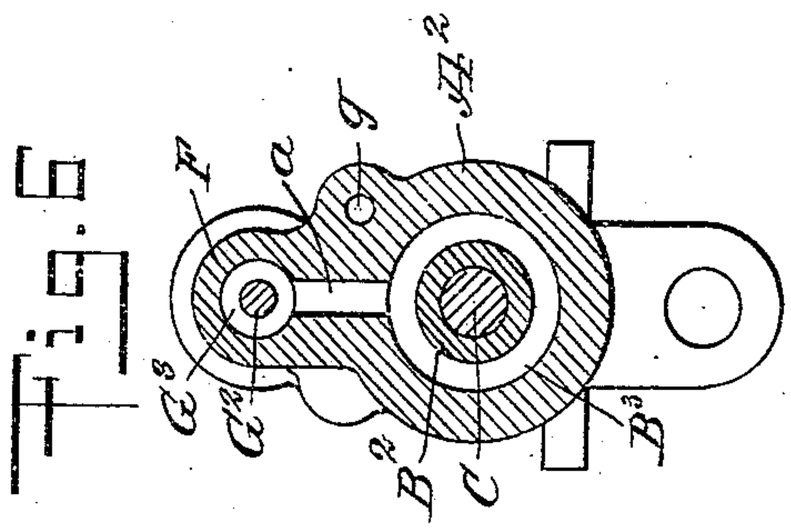

Fig. 10

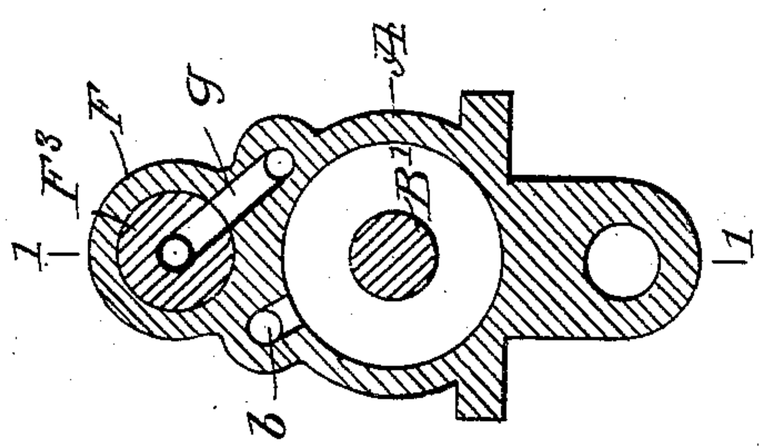

Fig. 5

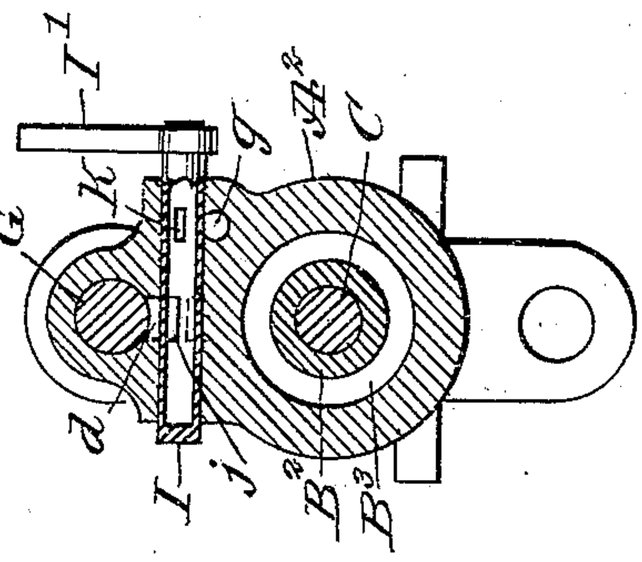

Fig. 9

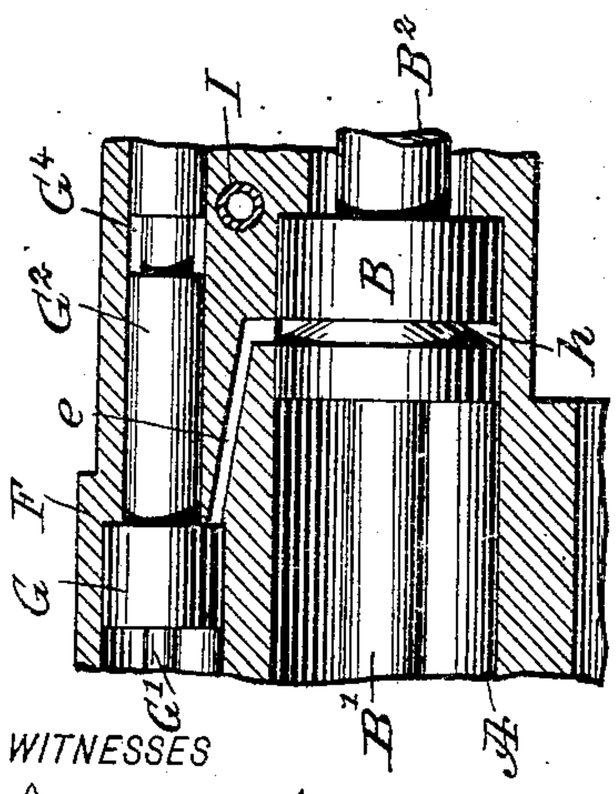

Fig. 4

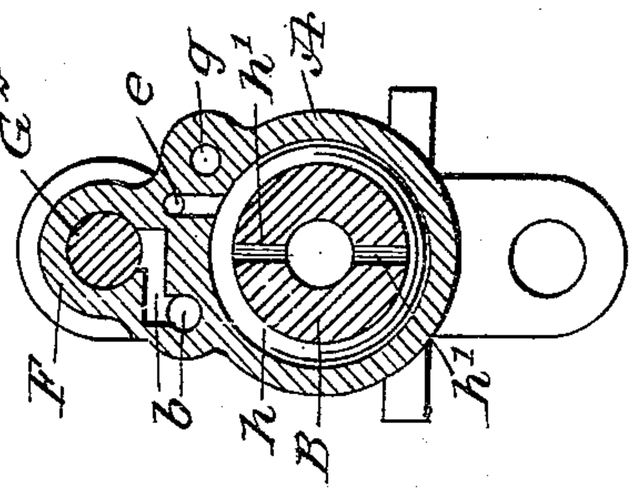

Fig. 8

WITNESSES

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UNITED STATES PATENT OFFICE.

WILLIAM E. PORTER, OF BISBEE, ARIZONA TERRITORY.

ROCK-DRILL.

No. 931,479. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed May 25, 1908. Serial No. 434,785.

To all whom it may concern:

Be it known that I, WILLIAM E. PORTER, a citizen of the United States, and a resident of Bisbee, in the county of Cochise and Territory of Arizona, have invented a new and Improved Rock-Drill, of which the following is a full, clear, and exact description.

The invention relates to fluid pressure rock drills having a reciprocating hammer piston.

The object of the invention is to provide a new and improved rock drill, which is simple, durable and compact in construction, and in which the compressed air or other fluid pressure is utilized to drive the piston ahead, both under initial and expansion pressure, to cushion the driven piston and to return the piston by the exhaust pressure, thus rendering the rock drill very effective and exceedingly economical in the use of the motive agent.

The invention consists of novel features and parts and combinations of the same, which will be more fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a longitudinal section of the improvement on the line 1—1 of Fig. 5; Fig. 2 is a similar view of the same and showing the working parts in a different position; Fig. 3 is a sectional plan view of the same on the line 3—3 of Fig. 2, the piston valve being removed and parts being broken away to show the passage leading to the forward end of the cylinder, Fig. 4 is a sectional side elevation of part of the improvement, on the line 4—4 of Fig. 7; Fig. 5 is a cross section of the same on the line 5—5 of Fig. 1; Fig. 6 is a similar view of the same on the line 6—6 of Fig. 1; Fig. 7 is a like view of the same on the line 7—7 of Fig. 1; Fig. 8 is a cross section of the same on the line 8—8 of Fig. 1; Fig. 9 is a like view of the same on the line 9—9 of Fig. 1; Fig. 10 is a similar view of the same, on the line 10—10 of Fig. 1; and Fig. 11 is a like view of the same on the line 11—11 of Fig. 1.

In the cylinder A is mounted to reciprocate the piston B having its piston rod B′ extending through the head A′ at one end of the cylinder A, to connect with the drill employed for drilling into the rock. From the piston B extends the feed sleeve B^2 in an opposite direction from the piston rod B′, and this feed sleeve B^2 is provided adjacent to the piston B with an annular groove B^3, and the feed sleeve B^2 slides in a bore A^2 connected with the cylinder A and of less diameter than the latter. The sleeve B^2 is engaged by the feed screw C having a ratchet wheel C′ for turning the sleeve B^2 and the piston B in the usual manner.

The live motive agent passes into a chamber D adjacent to the bore A^2, and this chamber D is connected by a pipe E with a suitable source of motive agent supply such as compressed air or the like. In the chest F arranged lengthwise on the cylinder A is formed a cylindrical bore F′ in which reciprocates a piston valve G having a reduced portion G′ at its left-hand side, and a reduced portion G^2 at its right-hand side, and which reduced portion G^2 has annular grooves G^3 and G^4 intermediate of its ends, as plainly indicated in the drawings. The reduced portion G^2 of the piston valve G is mounted to slide in the bore F^2 of the chest F, and the said bore F^2 is open at the right-hand end to the atmosphere, and is connected at the other end with the larger bore F′, provided with an exhaust pipe H leading to the atmosphere. The reduced portion G′ at the left-hand end of the piston valve G slides in a bearing formed in the cap F^3, closing the left-hand end of the chest F.

An admission port *a* opens into the bore A^2 adjacent to the right-hand end of the cylinder A, and into the left-hand end of the cylinder A opens a port *b*, the said ports *a* and *b* opening into the bore F^2 of the chest F. The port *b* is provided with a branch port *c* leading to the bore F′ of the chest F, directly opposite the exhaust pipe H, for carrying the exhaust motive agent to a suitable place of discharge. A port *d* intermediate the ports *a* and *b* connects the cylinder A with the bore F^2 of the chest F and a longitudinal port *e* connects the cylinder A with the enlarged bore F′ of the chest F, at the junction of the bore F′ with the bore F^2, as plainly indicated in Fig. 2. The chamber D connects by a port *f* with the bore F^2, adjacent to the port *a*, and the said chamber D is also connected by a port *g* with the bearing in the cap F^3 and in which the reduced portion G′ of the piston valve G is mounted to slide. In the piston B is formed an annular groove *h* adapted to register with the port *e* at the time the piston B is in the right-hand

end of the cylinder A, and from the said annular groove *h* lead ports *h'* to the fluted bore in the feed sleeve B^2, so that air can exhaust from the right-hand end of the bore F' by way of the port *e*, annular groove *h*, ports *h'* and the feed sleeve bore into the bore A^2, from which leads a port *i* to the atmosphere. A plug valve I is arranged transversely and is provided with ports *j* and *k*, adapted to register with the ports *g* and *d*, to allow live motive agent to pass from the chamber D by way of the port *g*, plug valve I, port *d*, recess G^4 and port *b* (see Fig. 2) to the left-hand end of the cylinder A, to start the machine in case the piston B is at rest at the forward end of its stroke. Use is also made of this valve I for admitting live motive agent to the left-hand end of the cylinder A, in case a drill sticks in the bore hole, especially when the drill passes through cross seams. Normally the valve I is in the inactive position shown in Figs. 1 and 2, and when it is desired to make use of the valve I for the purposes above mentioned, then a quarter turn is given to the valve I by the operator turning the handle I' of the valve from a vertical to a horizontal position.

Now when the several parts are in the position illustrated in Fig. 1, then the reduced portion G^3 of the piston valve G connects the ports *f* and *a* with each other, so that the live motive agent can pass from the chamber D into the right-hand end of the bore A^2 and by way of the reduced portion B^3 the pressure is exerted against the piston B, to force the same from the right to the left into the position shown in Fig. 2. As the piston B advances from the right to the left it passes over the port *d* and the intermediate port *e* and finally uncovers the same, so that the motive agent in the right-hand end of the cylinder A can pass through this port *e* into the bore F', to act on the right-hand end of the piston valve G, to force the latter from the right to the left or to the position shown in Fig. 2, thus disconnecting the ports *j* and *a*, and thereby shutting off the motive agent from the right-hand end of the cylinder A. The motive agent now acts expansively in the cylinder A. When the piston valve G is shifted from the right to the left, as above described, then the ports *d* and *b* are connected with each other by the reduced portion G^2, so that a portion of the motive agent in the right-hand end of the cylinder A can pass to the left-hand end thereof, to act on the left-hand face of the piston B with a view to return the latter to its previous position, it being understood that the area of the piston B at the left-hand face is in excess of the area at the right-hand face thereof. When the piston valve G is in the left-hand position shown in Fig. 2, it closes the port *z*, to confine the pressure in both ends of the cylinder A.

When the piston valve G is shifted as above described, from the right to the left, then the port *c* is closed and the left-hand end of the cylinder A is cut off from the exhaust pipe H and consequently the motive agent remaining in this left-hand end of the cylinder A forms a cushion to prevent the piston B from striking the cylinder head A'. Immediately after the piston B is cushioned, the motive agent previously used to drive the piston B from the right to the left is exhausted from the right-hand end of the cylinder to the left-hand end thereof by way of ports *b* and *d* and groove G^4, the port *c* being closed to the exhaust pipe H by the shifting of the piston valve G from the right to the left. Now the pressure entering the left-hand end of the cylinder A causes the piston B to return to its previous position shown in Fig. 1. When the piston B returns, the port *e* connects with the annular piston groove *h*, to allow the pressure in the right-hand end of the bore F' to escape to the atmosphere by way of the said port *e*, grooves *h*, ports *h'*, bore of the feed sleeve B^2, the bore A^2 and exhaust port *i*. The live motive agent passing by way of the port *g* into the bearing of the cap F^3 acts on the reduced portion G' to shift the valve G back to its position shown in Fig. 1. It is understood that the port *g* allows the motive agent from the chamber D to act at all times against the end of the reduced portion G' of the piston valve G, so that the latter is shifted from the left to the right, back to the position shown in Fig. 1, to again connect the ports *j* and *a* with each other, and the above-described operation is then repeated.

By the arrangement described the compressed air or other fluid pressure is utilized, to drive the piston B ahead, both under initial and expansive pressure, and the piston B is cushioned by a portion of the exhaust motive agent remaining in the left-hand end of the cylinder A, thus preventing injury to the cylinder head A' by the piston B. It will also be noticed that the return stroke of the piston B is produced by a portion of the motive agent directed from the right-hand end of the cylinder A to the left-hand end thereof, to act on the larger area at the left-hand face of the piston B.

The port *e* is sufficiently small, so that the piston B nearly completes its outward stroke before the piston valve G is shifted from the right to the left after the port *e* is uncovered, and the motive agent from the cylinder A can pass by way of the narrow port *e* into the bore F' of the chest F, to force the piston valve G from the right to the left.

By making the annular groove B^3 of more or less length, the motive agent is cut off later or sooner, as the feed sleeve then closes the admission port later or sooner, and hence the motive agent in the rear end of the cylin-

der A acts expansively for a predetermined period, that is, after the port *a* is closed.

By the arrangement described, the live air in the cylinder A can be expanded to any desired degree, so that the total excess pressure on the piston only slightly exceeds the weight of the piston and drill, and the incidental friction, so that all the motive agent is utilized to the fullest advantage and with the greatest economy. It will also be noticed that but little back pressure is had on the working blow, owing to the direct and short travel of the exhaust, and also on account of the expansion of air to a comparatively low pressure previous to exhausting the motive agent, thus causing greater efficiency and economy of the compressed air.

The machine is very simple and durable in construction, and composed of comparatively few parts, not liable easily to get out of order.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A rock drill, comprising a cylinder provided with an outlet port leading to the atmosphere, a piston mounted to reciprocate in the said cylinder and having a feed sleeve extending therefrom, the bore of the feed sleeve communicating with said outlet, the said piston being provided with passages leading from its periphery to the bore of the feed sleeve, a chest, a pressure supply chamber, a piston valve in the said chest, and means controlled by the said piston and the said piston valve to admit live motive agent to the rear end of the cylinder for forcing the piston on the outward stroke, to partly exhaust the motive agent from the forward end of the cylinder, to cushion the piston on the last portion of its outward stroke, to cut off the live motive agent at a given point and to admit the motive agent to the forward end of the cylinder to return the piston, to admit live motive agent to the said chest for shifting the said piston valve by live motive agent, and to exhaust the motive agent for the said chest by way of the piston and its feed sleeve.

2. A rock drill, comprising a cylinder having an admission port, an exhaust port, the said ports connecting with the ends of the said cylinder, a port intermediate the said end ports, a chest into which open the said end ports and the said intermediate port, one end of the chest having an exhaust pipe, a piston valve reciprocating in the said chest and having one end reduced to connect the said cylinder exhaust port with the exhaust pipe, the said reduced end sliding in a bearing in the said chest, the piston valve having its body provided with annular grooves, of which one serves to connect the intermediate port with the exhaust, and a pressure supply chamber connected by a port with the said chest for the other of the annular grooves to connect this port with the said admission port, the said pressure supply chamber being connected with the end of the bearing for the said reduced end of the piston valve, to shift the valve into an admission position, the said piston controlling the said intermediate cylinder port to allow part of the motive agent to shift the valve in a reverse direction.

3. A rock drill comprising a cylinder having an admission port leading to the rear end of the cylinder, a port leading to the forward end of the cylinder, and an intermediate port, a chest into which opens the said cylinder ports, a pressure supply chamber having a port opening into the chest, a piston reciprocating in the said cylinder, and a piston valve reciprocating in the said chest, the said piston valve having its body provided with annular grooves, one of which serves to connect the port of the pressure supply chamber with the admission port and the other serves to connect the said intermediate port with the port leading to the forward end of the cylinder.

4. A rock drill comprising a cylinder having an admission port connecting with the rear end of the cylinder, a port leading to the forward end of the cylinder, an intermediate port, a chest into which opens the said cylinder ports, a pressure supply chamber connected by a port with said chest, an exhaust pipe at the forward end of said chest, the port leading to the forward end of the cylinder having a branch port opening into the chest opposite the exhaust pipe, a piston reciprocating in the said cylinder, a piston valve reciprocating in the said chest and having its body provided with annular grooves, one of said grooves serving to connect the intermediate port with the port leading to the forward end of the cylinder, and the other groove serving to connect the port of the pressure supply chamber with the admission port, the cylinder being provided with a port leading from its rear end to the chest for the passage of the motive agent to act on the piston valve to move said valve to cut-off position, the said port being controlled by the piston, and means whereby the live motive agent from the pressure supply chamber acts on the said piston valve to return the same to the admission position.

5. A rock drill comprising a cylinder having an outlet port in its rear end leading to the atmosphere, a piston mounted to reciprocate in said cylinder and having a feed sleeve extending therefrom, the said piston having an annular groove connected by ports with the bore of the feed sleeve, a chest, a piston valve reciprocating in the said chest and actuated by the motive agent, the said valve controlling the entrance of live motive agent to the cylinder, and arranged to cut off the motive agent and connect the cylinder

ends with each other for the motive agent to return the piston, the said valve also controlling the exhaust of the motive agent from the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest and for the exhaust of the motive agent from the chest, the annular groove of the piston being adapted to register with said port to permit the exhaust motive agent from the chest to pass by way of the piston and its feed sleeve to the said outlet port in the rear end of the cylinder.

6. A rock drill comprising a cylinder, a piston mounted to reciprocate in said cylinder, a chest, a pressure supply chamber, a piston valve in the said chest and having one end reduced, a bearing in the said chest in which the reduced end of the piston valve slides, the said cylinder being provided with ports controlled by the piston valve for admitting live motive agent from the pressure supply chamber to the rear end of the cylinder for forcing the piston on the outward stroke, the said cylinder having ports controlled by the piston valve to permit the motive agent to pass from the rear end of the cylinder to the forward end thereof to return the piston, means controlled by the piston for admitting the motive agent from the rear end of the cylinder to the chest to move the piston valve to cut-off position, the said pressure supply chamber being connected by a port with the bearing for the reduced end of the piston valve to admit the motive agent to said bearing to shift the piston valve to the admission position, and a manually controlled valve provided with ports adapted to register with the port leading to said bearing, and the ports leading to the forward end of the cylinder to allow live motive agent to pass from the pressure supply chamber to the forward end of the cylinder.

7. In a rock drill, a cylinder having an outlet port in its rear end leading to the atmosphere, a piston mounted to reciprocate in said cylinder and having its piston rod extending through the forward head of the cylinder, the said piston being provided with a feed sleeve extending rearwardly and having its bore communicating with said outlet port, the said piston having a peripheral groove communicating with the bore of the feed sleeve, a chest, a valve adapted to reciprocate in said chest, the said valve controlling the passage of the motive agent to and from the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest and the exhaust of the motive agent from the chest, the groove of said piston being adapted to register with said port.

8. In a rock drill, a cylinder, a piston mounted to reciprocate in said cylinder, a chest having an exhaust pipe at one end, the said cylinder having an exhaust port opening into the chest opposite the said exhaust pipe, a piston valve adapted to reciprocate in the said chest, and having a reduced end, a closure for one end of the chest having a bearing formed therein in which the reduced end of the piston valve slides, the said valve controlling the entrance of the live motive agent to the cylinder, and arranged to cut off the motive agent and connect the cylinder ends with each other for the motive agent to return the piston, the said valve also controlling the exhaust of the motive agent from the cylinder, means controlled by the piston for admitting the motive agent to the chest to move the piston valve to cut off position, and means for admitting live motive agent to the bearing for the reduced end of the piston valve to return said valve to the admission position.

9. A rock drill comprising a cylinder, having an admission port leading to the rear end of the cylinder, a port leading to the forward end of the cylinder, and a port intermediate the said end ports, a chest into which opens the said cylinder ports, a pressure supply chamber having a port opening into the chest, a piston reciprocating in the said cylinder and having its piston rod extending through the head at one end of the cylinder for connection with a drill, a piston valve reciprocating in the chest, the piston valve being provided with means for connecting the port of the pressure supply chamber with the admission port and for connecting the said intermediate port with the port leading to the forward end of the cylinder, the said chest being connected by a port with the cylinder for the admission of the motive agent to the chest to move the piston valve to cut-off position, and for the exhaust of the motive agent from the chest, the said port being controlled by the piston, and means whereby the live motive agent from the pressure supply chamber acts on the said piston valve to return the same to the admission position.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM E. PORTER.

Witnesses:

FRANK REYES,

PARKER L. WOODMAN.