J. E. H. GROSE.

ROCK DRILLING MACHINE.

APPLICATION FILED MAY 8, 1907.

937,237.

Patented Oct. 19, 1909.

3 SHEETS—SHEET 1.

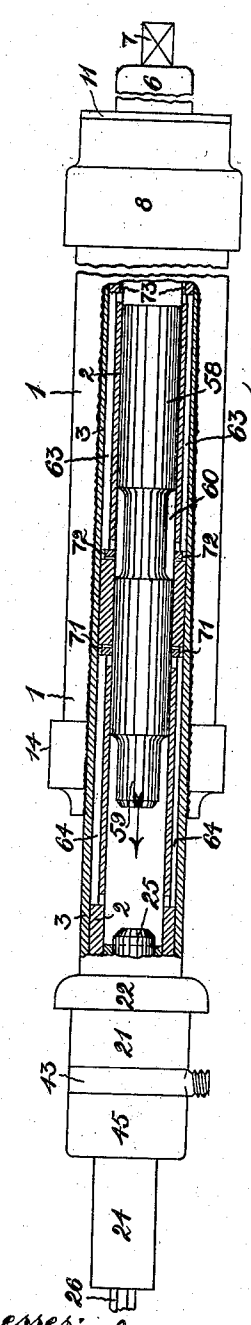

Fig. 2.

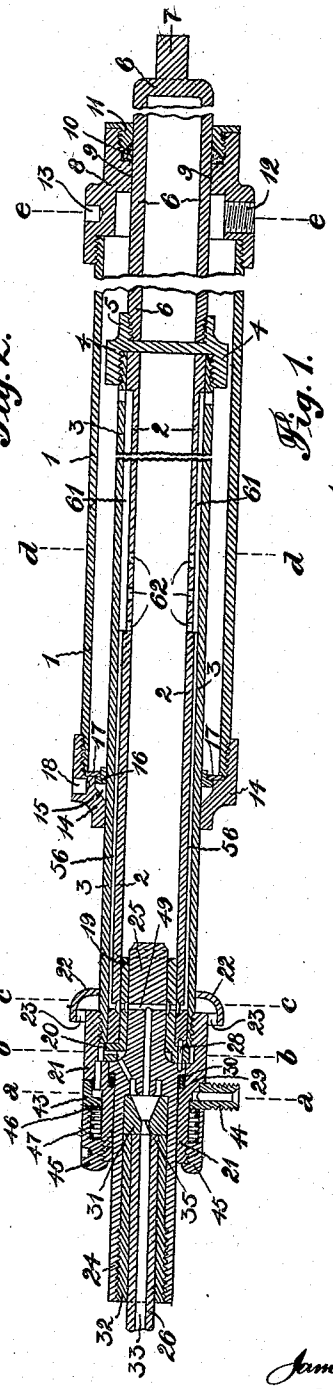

Fig. 1.

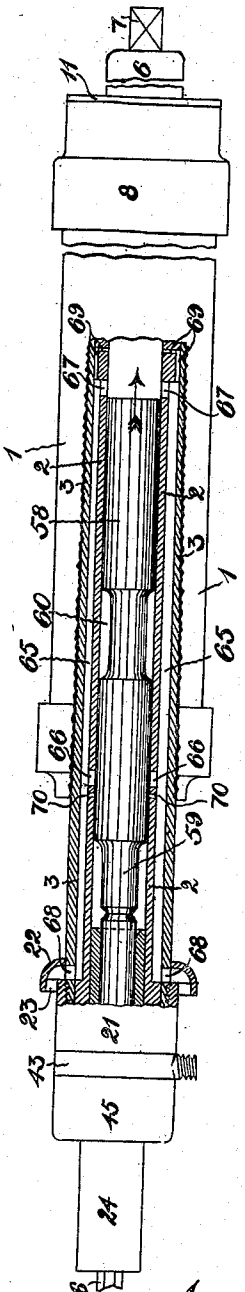

Fig. 3.

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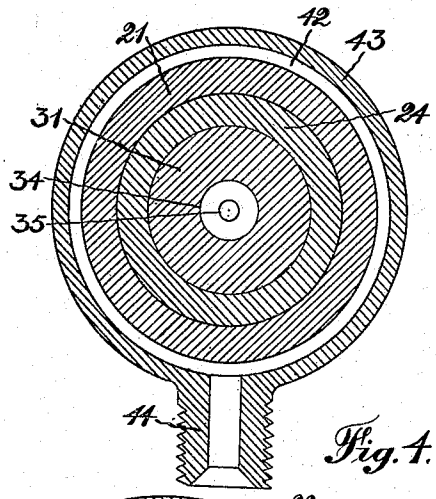

Fig. 4.

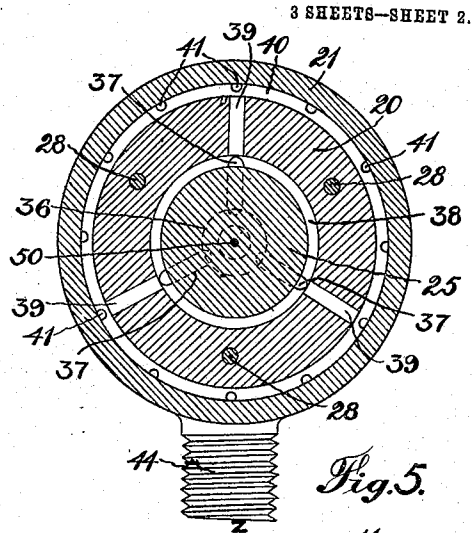

Fig. 5.

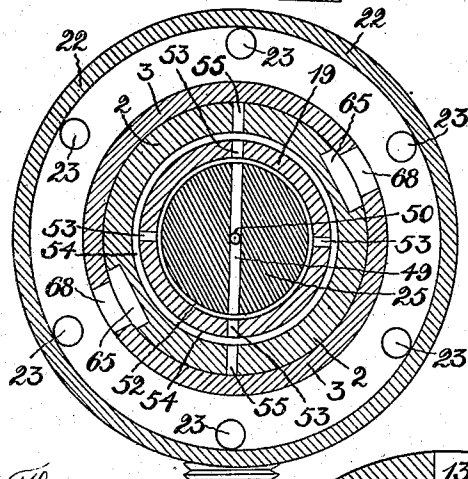

Fig. 6.

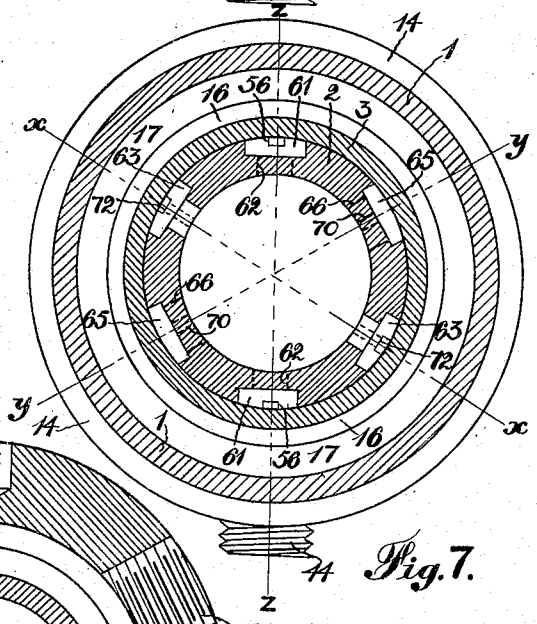

Fig. 7.

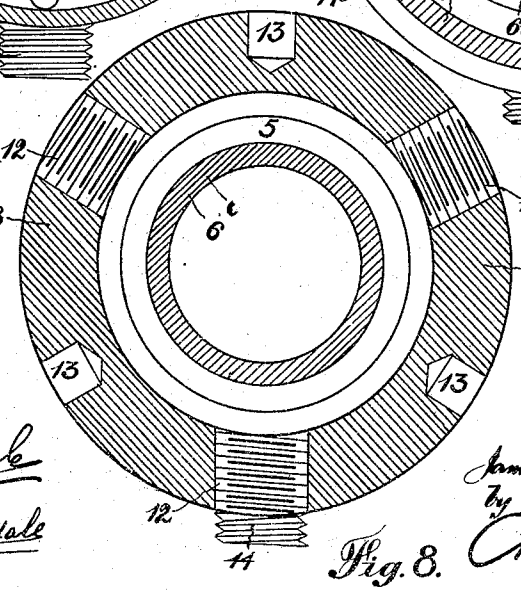

Fig. 8.

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ROCK DRILLING MACHINE.

APPLICATION FILED MAY 8, 1907.

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3 SHEETS—SHEET 3.

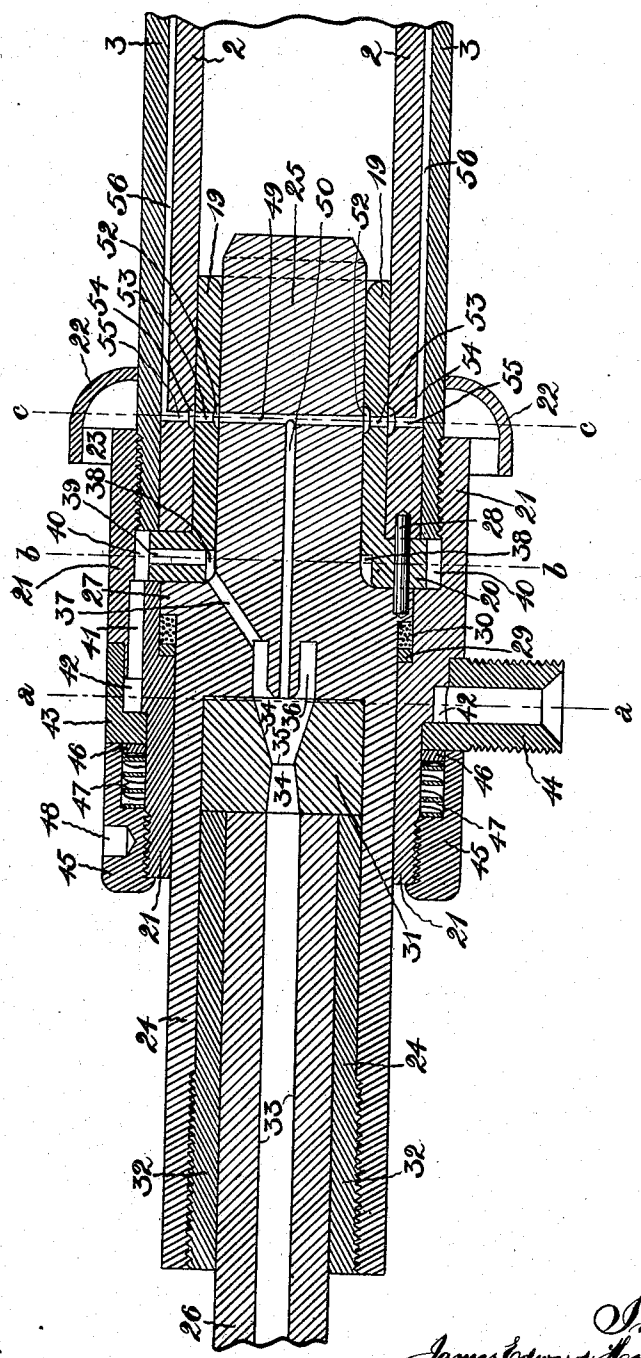

Fig. 9.

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UNITED STATES PATENT OFFICE.

JAMES EDWARD HOSKINS GROSE, OF GERMISTON, TRANSVAAL.

ROCK-DRILLING MACHINE.

937,237. Specification of Letters Patent. Patented Oct. 19, 1909.

Application filed May 8, 1907. Serial No. 372,625.

To all whom it may concern:

Be it known that I, JAMES EDWARD HOSKINS GROSE, a subject of the King of Great Britain, and resident of Germiston, Transvaal, have invented certain new and useful Improvements in Rock-Drilling Machines, of which the following is a specification.

This invention relates to the valveless-piston-hammer type of rock-drill or rock-drilling machine actuated by compressed air or other fluid pressure, and has for its object to simplify the construction and increase the efficiency of such drills or machines.

The invention consists of the several novel features in the construction of the machine as hereinafter fully described and pointed out in the appended claims.

I will at once proceed with a detailed description of the invention by aid of the accompanying drawings, in which—

Figure 1 is a longitudinal section of the machine, on the plane *z*—*z* of Fig. 7. Fig. 2 is a longitudinal section of a portion of the power cylinder on a plane represented by the line *x*—*x* Fig. 7, a portion of the receiver casing being broken away. Fig. 3 is a view similar to Fig. 2 the plane of section of the power cylinder being represented by the line *y*—*y* of Fig. 7. Fig. 4 is a transverse section of Figs. 1 and 9 on the line *a*—*a*. Fig. 5 is a transverse section of Figs. 1 and 9 on the line *b*—*b*. Fig. 6 is a transverse section of Figs. 1 and 9 on the line *c*—*c*. Fig. 7 is a transverse section of Fig. 1 on the line *d*—*d*. Fig. 8 is a transverse section of Fig. 1 on the line *e*—*e*, and Fig. 9 is a longitudinal section of the front end of the machine, drawn to an enlarged scale.

1 represents a cylindrical receiver casing in which the power cylinder is able to move longitudinally in a forward or rearward direction. The power cylinder comprises two tubes or cylinders 2, 3, the one 3 concentrically disposed around the other 2. The outer cylinder 3 may be shrunk or otherwise fixed around the internal cylinder 2.

The external cylinder 3—see Fig. 1—at its rear extremity is constructed with an external screw-thread and over it is screwed a cap 4 formed with an internally screw-threaded cylindrical projection 5 at the back. Into this internally threaded rearward projection 5 is screwed a back guide tube 6. The back guide tube 6 may as shown be closed at its rear extremity, and is provided with a square projection 7 (or it may be a screw-threaded projection) for a handle or crank for rotating the power cylinder through the medium of the back guide tube 6. Screwed over the rear extremity of the receiver casing 1 is a piece 8 which forms a guide for the back guide tube 6 and through which guide 8 said tube may slide longitudinally in either direction within certain limits.

The guide 8 is constructed on the inside, as shown at 9, to make a sliding fit around the guide tube 6 and in the outer end of said guide 8 beyond the annular projection 9 which makes the sliding fit with said tube, is a recess in which is placed suitable packing 10 surrounding the back guide tube 6; 11 is a gland screwed into the open end of the guide 8. In the guide 8 is formed a screw-threaded hole 12 for making connection with the hosepipe which serves for conveying the operating fluid into the receiver casing 1. As shown in Fig. 8 a plurality of such inlets may be provided, any one of which may be used for oiling the machine, and so that the operating fluid supply pipe may be connected to any one as may be most convenient according to the position of the receiver casing 1, the inlets 12 not in use being closed by tight-fitting screw plugs. The rear guide 8 may be also provided with a number of recesses 13 for the reception of a suitable tool for rotating it to screw it on to or off the end of the receiver casing 1.

On to the forward end of the receiver casing 1 is screwed a guide ring 14 through which slides the power cylinder. In an internal recess 15 in the guide ring 14 and surrounding the cylinder is located packing which is retained in position by means of a flanged ring 16 fitting said recess 15. This flanged ring 16 is held in position by means of another ring 17 which as shown is secured between the guide ring 14 and the forward end of the receiver casing 1. The flanged ring 16 serves, in a manner to be hereinafter explained, to close the operating fluid inlet ports to the power cylinder just before the cylinder reaches the end of its forward stroke to automatically put the machine out of operation. The front guide ring 14 is also preferably constructed with recesses 18 similar to the back guide 8, for the reception of a tool for screwing it on to or off the receiver casing 1 when assembling the parts or taking them asunder.

In the forward end of the power cylinder

2 is fitted a bushing 19 formed with an external annular flange 20 at the forward end abutting the end of the cylinder. The forward end of the cylinder is constructed with an external screw-thread, and over it is screwed a cylindrical member 21 forming a front head. The front head 21 at its rear end is constructed with a hollow flange 22 in which are formed a number of holes 23 which constitute the exhaust ports. These exhaust ports 23 are directed toward the front of the machine so that they prevent the sludge as it comes from the bore-hole being thrown on to the machine or operator.

The main exhaust ports hereinafter referred to communicate with the interior of the hollow flange 22 from which the exhaust issues by the aforementioned holes 23.

The drill holder comprises a hollow cylindrical member 24 which is constructed with a shank or rearward projection 25 which projects into the bushing 19. The shank 25 slightly exceeds the length of the bushing 19 so that it extends for a short distance into the bore of the cylinder 2 beyond said bushing. On its inner end the shank 25 receives the blows of the hammer piston and transmits the same directly to the drill holder 24 and drill 26. Around the rear end of the cylindrical member 24 and at the forward end of the shank 25 of the drill holder 24 is formed an annular projection 27. The bushing 19 is non-rotatably connected to the cylinder 2 and the drill holder 24 is non-rotatably connected to the bushing 19 by means of pins 28, see Figs. 1, 9, and 5, engaging recesses in the end of the cylinder 2 and flange 27 of the drill holder 24, which pins 28 pass through holes in the flange 27 of the bushing 19; other suitable means may be employed for non-rotatably connecting these parts.

In an annular space in the front head 21 forward of the flange 27 on the rear end of the drill holder 24 is located a metal washer 29 and a rubber, spring, or other resilient packing ring 30 for taking the blow of the piston hammer in case the drill is not in position to receive it.

At the bottom of the hole in the drill holder 24 is placed a cylindrical piece 31, of hardened steel or other suitable metal, against which the inner end of the drill 26 abuts when in position, as seen in Figs. 1 and 9. This piece 31 is retained in position in the holder 24 by means of a bushing 32 which is screwed into the drill holder 24. The hole in the bushing 32 is made of the same shape as the drill steel 26 or that portion thereof projected into the holder 24. The ordinary octagonal drill steel may be used or steel of any other suitable polygonal section, so that the drill 26 is rotated with the drill holder 24. A hole 33 is formed longitudinally of the drill steel 26 for permitting the passage through it of water to prevent the formation of dust and also to allow a quantity of the operating fluid to pass with and convey the water and remove the cuttings from the cutting end of the drill.

In the piece 31 are formed two oppositely coned communicating recesses 34, forming a restricted passage or ejector throat 35 through which the operating fluid and water pass to the drill steel. In the bottom of the drill holder 24 beyond the piece 31 is formed an annular recess 36 which communicates with the larger conical recess 34 in the rear end of the piece 31. From this annular recess 36 ports 37 communicate with an annular recess 38 formed between the flange 20 of the bushing 19 and the forward end of the shank or rearward projection 25 of the drill holder 24. This latter annular recess 38 is placed in communication through radial ports 39 in the flange 20 with another annular recess 40 between the front head 21 and the flange 20 on the bushing 19. The annular recess 40 communicates through holes 41—see Figs. 1, 9 and 5, formed in the front head 21 with an annular recess 42 in a water supply ring 43 arranged around the front head 21 and in which ring 43 the front head 21 may rotate. The water ring 43 is constructed as at 44, to make connection with a water supply pipe along which the water may be drawn from any suitable source of supply to the interior of the water ring 43 from which it passes by the passages 41, 40, 39, 38, 37, to the annular recess 36 in the holder 24, and from the latter through the ejector throat or restricted passage 35 in the piece 31 to the longitudinal hole 33 in the drill steel 26.

The water ring 43 is retained in position by means of a nut 45 screwed on the front end of the front head 21. In a recess formed between this nut 45 and the front head 21 and abutting the water supply ring 43 is a washer 46 and a helical or other suitable spring 47 to keep the water supply ring 43 in position on its seat around the front head 21 and to prevent the escape of water. The retaining nut 45 for the ring 43 is constructed with recesses 48 for the reception of a tool for screwing it on or off the front head 21.

Transversely of the shank or rearward projection 25 of the drill holder 24 is formed a hole 49 which communicates with another port 50 formed longitudinally of said shank 25 opening at its forward end into the larger coned recess 34 in the inner or rear end of the piece 31. The transverse hole 49 communicates with an annular recess 52 formed between the shank 25 of the drill holder 24 and the bushing 19 and through holes 53 in the bushing with an annular recess 54 between the bushing and cylinder, and through holes 55 in the cylinder with grooves 56 formed between the concentric cylinders 2, 3, which

grooves 56 form ports communicating with the main supply ports 61 for allowing a quantity of the operating fluid to pass through the shank 25 of the drill holder 24 to draw the water and convey it along the steel 26.

The hammer piston 58 consists of a cylindrical member adapted to be reciprocated in the bore of the cylinder. It is constructed at the forward end with a portion 59 of reduced diameter which strikes the inner end of the drill holder shank 25 when the machine is in operation. The piston hammer 58 is constructed at the center with an annular recess 60 which serves for controlling the distribution of the operating fluid. As previously explained said operating fluid passes into the receiver casing 1 through the rear guide 8. The feeding of the drill is effected through the medium of said operating fluid by the pressure thereof on the power cylinders 2, 3, in a forward direction exceeding the pressure in a rearward direction, owing to the diameter of the power cylinders 2, 3, exceeding the diameter of the back guide tube 6.

Two main inlet ports are provided shown consisting of grooves 61 formed between the concentric cylinders 2, 3, and placed in communication at the rear end of the cylinder with the interior of the receiver casing 1. In the inner of the two concentric cylinders 2, 3, are formed for each main inlet port 61, three holes 62 which place said main inlets in communication with the annular space 60 formed around the center of the piston hammer 58. In the normal running of the machine the live operating fluid is always present in the annular recess 60 in the piston hammer 58 through one or other of each of the three holes 62.

Longitudinally of the cylinder and extending for a suitable distance from the rear end in the direction of the center, as seen in Figs. 2 and 7, are formed two other ports 63 which lead from the annular space 60 in the piston hammer 58 to the back end of the cylinder, and longitudinally of the cylinder at the forward end and extending for a suitable distance toward the center, are two other ports 64 which lead from the annular space 60 in the piston hammer 58 to the forward end of the cylinder. These ports 64 are so positioned that the piston hammer 58 overruns the center before the air is permitted to pass to the front end of the cylinder, this to insure an unimpeded blow on the forward stroke of the piston hammer 58.

Two other ports 65, see Figs. 3, 6 and 7, are formed in the power cylinder which constitute the exhaust ports and are placed in communication with the power cylinder at 66 for the front end of the cylinder and at 67 for the rear end of the cylinder. These exhaust ports 65, as previously described, exhaust through the holes 23 in the hollow flange 22 of the front head 21, 68 being holes in the outer concentric cylinder 3 placing the forward end of said exhaust ports in communication with said hollow flange 22, see Figs. 3 and 6. The exhaust ports 65 communicate with the rear end of the cylinder in such a position that the full pressure is maintained at the back of the piston hammer 58 until just before the piston hammer 58 strikes the shank 25 of the drill holder 24.

In addition I provide two small auxiliary exhaust ports, one 69 for the back and the other 70 for the front end of the cylinder, slightly in advance of the exhaust ports 66, 67. In the cylinder I also provide auxiliary inlet ports 71, 72, leading to the front and back ends of the cylinder. These auxiliary ports 71, 72, are positioned slightly in advance of the inlet ports 63 and serve in conjunction with the auxiliary ports 69, 70 for starting the piston hammer 58 in case it comes to rest in such a position that the several inlet and exhaust ports are closed.

In the bore of the cylinder at the rear end, see Fig. 2, I provide grooves 73 which allow a quantity of the operating fluid to pass to the back end of the cylinder when the piston hammer 58 is at the extreme back end of the cylinder.

The operation of the machine is as follows:—In Fig. 2 the piston hammer 58 is shown traveling, as indicated by the arrow, on its forward and percussive stroke. The operating fluid is passing from the receiver casing 1, ports 61 and holes 62, to the annular space 60 around the piston hammer 58, and the ports 63 are open to the annular space 60, allowing the operating fluid to pass into the cylinder at the rear of the piston to impel it on its forward stroke. At the same time the forward ports 64 are closed to the recess 60 and the ports 66 are placing the cylinder in front of the piston hammer 58 in communication with the exhaust ports 65, and the exhaust from the front end of the cylinder is passing along ports 65 through holes 68 to the interior of the hollow flange 22 and out through the forwardly directed holes 23.

In Fig. 3 the piston hammer 58 is shown commencing, as indicated by the arrow, its rearward stroke after striking the shank 25 of the drill holder 24. In this position the ports 66 placing the interior of the cylinder in communication with the exhaust ports 65, are closed by the piston hammer 58 and the ports 64 are open to the annular recess 60 in the hammer 58 so that the operating fluid is passing to the front end of the cylinder and impelling the piston on its rearward stroke. At the same time the ports 67 are placing the rear end of the cylinder in communication with the exhaust ports 65. As the rearward stroke of the piston hammer 58 continues it closes the ports 67 to the rear

end of the cylinder, opens ports 66 to the forward end of the cylinder, closes ports 64 to the annular space 60 and opens ports 63 to said annular space 60 and permits the operating fluid to pass to the rear of the piston hammer 58 to again impel it on its forward and percussive stroke.

In the event of the piston hammer 58 traveling to the extreme back end of the cylinder a sufficient quantity of the operating fluid can pass along grooves 73 to the back of the piston hammer to start it on its outward stroke. Should the piston hammer 58 stop at or about the center of its stroke, sufficient of the operating fluid can pass through either of the small ports 71 or 72 to start the piston hammer, the small auxiliary ports 69 or 70 providing for the exhaust from the opposite end to that at which the operating fluid is admitted through ports 71 or 72.

When the cylinder reaches the limit of its forward movement in the receiver casing 1, the flanged ring 16 by closing the inlets to the main inlet ports 61, shuts off the operating fluid supply to said latter ports and so automatically puts the machine out of operation.

What I claim as my invention and desire to protect by Letters Patent is:—

1. In a rock-drilling machine, in combination, a power cylinder having exhaust ports communicating with the exterior thereof at the forward end, a cylindrical piece fixed to the front end of the cylinder, said cylindrical piece having a hollow flange which incloses the exhaust ports, and the hollow flange having holes in the front which form the exits for the exhaust, as set forth.

2. In a rock-drilling machine, in combination, a power cylinder comprising the two concentric tubular members 2, 3, providing between them the exhaust ports 65 for both ends of said cylinder, and a cylindrical member 21 having screw-threaded engagement with the front end of the power cylinder, said member 21 having at the rear end a hollow flange 22 through which are formed the forwardly directed ports 23, the outer cylinder 3 having the ports 68 placing ports 65 in communication with said hollow flange 22, as set forth.

3. In a rock-drilling machine, in combination, a receiver casing, a power cylinder slidably supported in said casing, a piston hammer controlling the distribution of the actuating fluid within the cylinder, a cylindrical piece fixed to the front end of the power cylinder for supporting the tool holder, a tool holder and tool arranged therein, said cylindrical piece having a hollow flange, the power cylinder having exhaust ports and also ports placing the exhaust ports in communication with said hollow flange and the hollow flange having holes through which the exhaust escapes in a forward direction to direct the exhaust away from the operator and to prevent the sludge issuing from the hole being thrown back on to the machine, as set forth.

4. In a rock-drilling machine, in combination, a power cylinder, a tool holder positioned at the front end thereof, the cylinder and holder having ports for permitting a quantity of the actuating fluid to pass therethrough to the tool, a tool having a longitudinal hole and a piece positioned between the tool and tool holder, said piece having an ejector throat, and means placing said ejector throat in communication with a source of water supply.

5. In a rock-drilling machine, in combination, a power cylinder, a tool holder carried at the forward end of said cylinder, said tool holder having a rearward projection to receive the blows of the hammer piston, a tool positioned in the tool holder, said tool having a longitudinal hole, a piece positioned in the bottom of the tool holder at the rear of the tool, said piece having an ejector throat or two oppositely coned communicating recesses, means for supplying water to said throat and means for permitting a quantity of the actuating fluid to pass to the throat to convey the water along the hole in the tool, as set forth.

6. In a rock-drilling machine, in combination, a power cylinder and a hammer piston therein, a tool holder having a rearward projection projecting into the forward end of the cylinder to receive the blows of the hammer piston, the said rearward projection having a transverse hole which is in communication with the main inlet ports in the cylinder, the projection also having a longitudinal hole communicating with the inner end of the tool holder, the tool holder having an annular recess in the bottom thereof around the aforesaid longitudinal hole, a water ring surrounding the tool holder said water ring communicating with said annular recess, a piece positioned in the bottom of the tool holder having an ejector throat or two oppositely coned communicating recesses, the one larger than the other, the larger communicating with the annular recess in the bottom of the tool holder, a bushing in the tool holder having a bore of polygonal cross section and a tool having a longitudinal hole and made of a cross section corresponding to the hole in the bushing to insure rotation of the tool with the tool holder, and means for non-rotatably connecting the tool holder with the cylinder, as set forth.

7. In a rock-drilling machine, in combination, a power cylinder, a piston hammer therein, a front head secured at the front end of the power cylinder, a tool holder supported by the front head, said tool holder

having a rearward projection to receive the blows of the hammer piston, a water supply ring encircling the front head, a nut screwed on the front head, a spring medium between said nut and water supply ring and serving as a retaining device for the latter, as set forth.

8. In a rock-drilling machine, in combination, a power cylinder, a piston hammer therein which controls the distribution of the actuating fluid, a front head screwed on the front end of the power cylinder, a bushing in the forward end of the power cylinder, said bushing having an external flange and forming an annular recess between said flange and the inside of the front head, a water supply ring mounted on the front head and in which the front head may rotate, said front head having ports placing the annular recess in communication with the water supply ring, a tool holder in the front head comprising a hollow cylindrical member constructed with an external flange and a rearward projection projecting into and beyond the bushing in the cylinder, said rearward projection having a transverse hole and a longitudinal hole communicating therewith and opening into the tool holder, the tool holder also having an annular recess in the bottom thereof, which recess is placed in communication with an annular recess formed between the flange of the bushing and said rearward projection, the bushing having holes placing the transverse hole in the rearward projection in communication with ports communicating with the main inlet ports in the power cylinder, packing between the flange around the holder and the front head and pins non-rotatably connecting the tool holder, bushing and power cylinder, a cap screwed on to the front end of the front head, a washer and spring medium between said cap and water ring for making a liquid tight joint between the water ring and front head, a bushing in the tool holder formed with a bore of transverse polygonal section, a piece positioned at the bottom of the holder beyond the bushing, said piece having an ejector throat or two oppositely coned communicating recesses, the rear one exceeding the diameter of the front one, said rear conical recess communicating with the annular recess in the bottom of the tool holder and with the longitudinal hole in the rearward projection, and a hollow tool positioned in and rotatable with the tool holder, as set forth.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES EDWARD HOSKINS GROSE.

Witnesses:
CHAS. OVENDALE,
R. OVENDALE.