L. L. SCOTT.

INTERNAL COMBUSTION ROCK DRILL.

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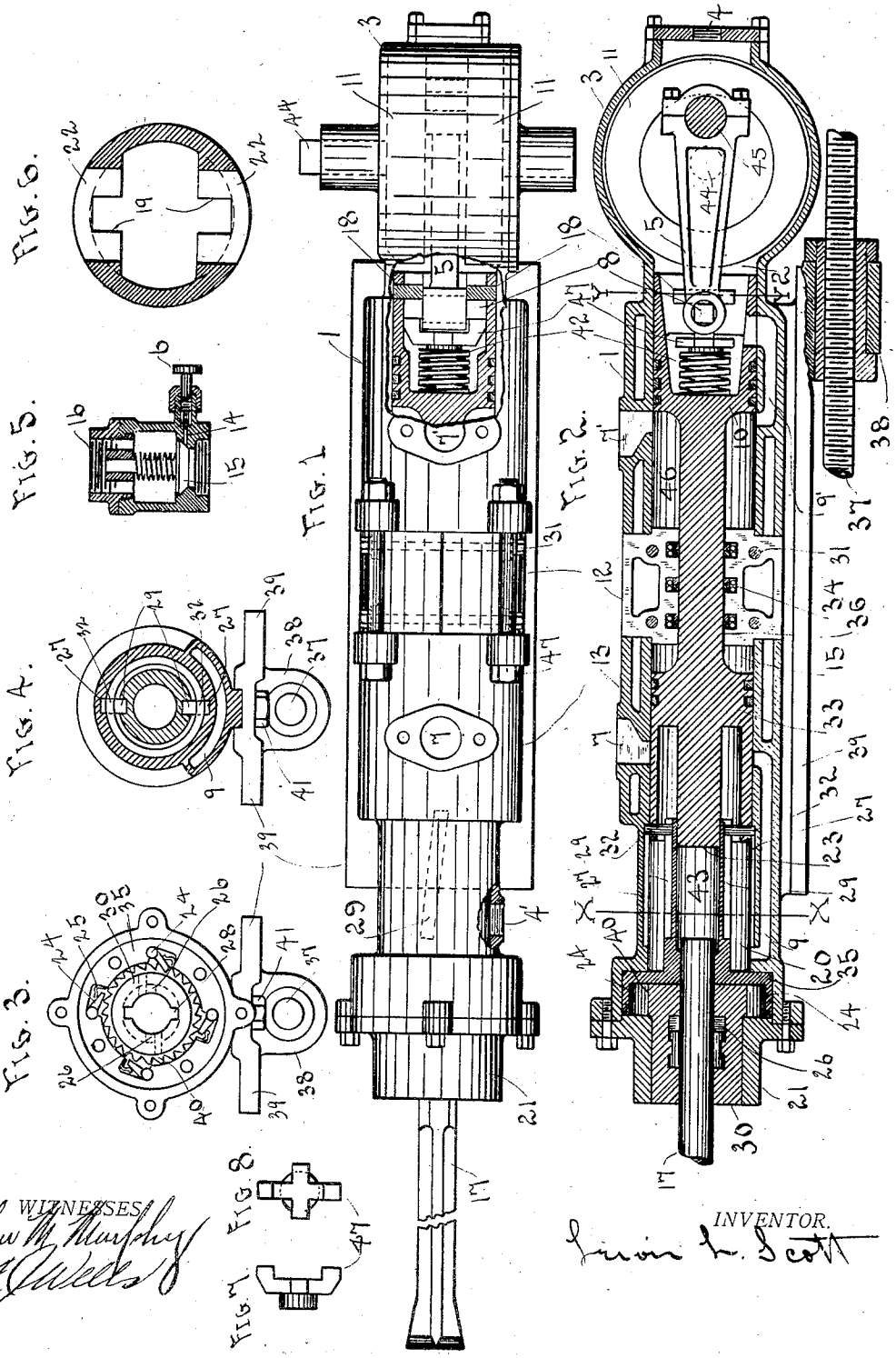
941,732.

Patented Nov. 30, 1909.



WITNESSES:

INVENTOR.

UNITED STATES PATENT OFFICE.

LEWIS L. SCOTT, OF JOPLIN, MISSOURI.

INTERNAL-COMBUSTION ROCK-DRILL.

941,732. Specification of Letters Patent. Patented Nov. 30, 1909.

Application filed November 2, 1908. Serial No. 460,732.

To all whom it may concern:

Be it known that I, LEWIS L. SCOTT, a citizen of the United States, residing at Joplin, in the county of Jasper and State of Missouri, have invented a new and Improved Internal-Combustion Rock-Drill, of which the following is a specification.

This invention relates to improvements in internal combustion rock drilling machines or engines, intended for use in mines and quarries for the drilling of holes to receive explosive charges for displacing or breaking away the rock or mineral.

The objects of this invention are: to produce a gas actuated rock drill which shall be of comparatively small dimensions, of compact, simple and inexpensive construction, having all moving parts entirely inclosed and thereby protected from damage consequent upon the rough handling such machines usually receive at the hands of their operators.

A further object is to provide an engine in which the piston is practically free (moved upward and downward entirely by the action of the internal fired gases upon it), yet connected to a crank shaft, (through a connecting rod which is slidingly and yieldingly connected to same,) said shaft being for the purpose of limiting the stroke of said piston, and being a means of manually starting said engine.

To these ends my invention consists in various features of construction and arrangement of parts, as hereinafter described, illustrated in the accompanying drawings and particularly pointed out in the appended claims.

Referring to the accompanying drawings which form a part of this specification, Figure 1. is a horizontal plan view, (shown partly in section), of my improved internal combustion rock drill. Fig. 2. is a vertical longitudinal section of same. Fig. 3 is a front end view of Fig. 2, with head 21 removed. Fig. 4 is a section on the line X. X. of Fig. 2. Fig. 5 is a sectional view of a generator valve, (commonly used on two cycle gasolene engines.) This valve forms no part of the invention, but is shown for a purpose that will be seen later. Fig. 6 is an enlarged sectional view of the piston 10, on the line Y. Y. of Fig. 2. Fig. 7 is a side view of the bumping piece 47. Fig. 8 is an end view of same.

Like parts are represented by similar numerals of reference in the several views.

The numeral 1 denotes, what I term as the first or upper cylinder. The explosive chamber 46 of the cylinder 1 is closed by the head 12; the chamber 2, (which receives the explosive mixture, drawn in at the connection 4, through a valve such as shown in Fig. 5), is closed by the crank case 3; the said crank case 3 carries the main journals 44 of the crank shaft; the balance wheels 11 join the main shafts 44 through the crank pin 45. The piston 10, (which is attached or connected to the piston 33 through the rod 36), is provided with the grooves 19; the piston pin 8, (which is connected to the crank pin 45 through the rod 5), has ends, (made in square section), that project beyond the bearing surface of said pin in the rod 5, these ends are adapted to work or slide in the grooves 19 of the piston 10; the sliding movement of the pin 8 is limited, and is stopped on one side by the piece 47, (which bears against the said projections of pin 8, said piece 47 carries the spring 42 which bears against the inner front wall of the piston 10), and on the other side by the tool steel pieces 18, which are placed in the slots 22 of the piston 10 (refer to Fig. 6). The long ways 39 form a part of the casting 1 and serve as slides, (which can be mounted on the shell and tripod commonly used on rock drills), and also forms a guide for the cylinder 13 which is secured to the ways 39 by the screws 41; the second or lower cylinder 13 is also secured to cylinder 1 by the bolts 48. The head 12 serves the purpose of closing the explosion chambers 15, and 46, and also forms a journal for the rod 36 and carries the packing rings 34, which fit around the rod 36, to prevent the escape or leakage of gas from one explosive chamber to the other; the head 12 is clamped and held firm between the cylinders 1 and 13, by the bolts 47 which are secured to the said cylinders. The cylinders 1 and 13, and connected parts, are adjustable by the screw 37, or by some other equivalent or convenient device, in connection with which the usual shell and tripod support may be utilized.

The explosive chamber 15 of the cylinder 13 is closed by the head 12; the chamber 20, (which receives the explosive charge, through a valve such as shown in Fig. 5, at the opening 4'), is closed by the head 21; the said

head 21 carries the chuck 30, which is adapted to rotate in the head 21. The cylinder 13 is enlarged at its outer end to make room for the enlarged portion of the rotating piece 35. The said rotating piece 35 is rotatively mounted in the enlarged portion of the cylinder 13, and has a small elongated projection, on the perimeter of which are cut the spiral grooves 29; the rotating piece 35 has a small central bore 43 through the elongated projection of the rotating piece 35; in this bore the shank of the drill steel 17 projects for a short distance; the hammer piece 23 of the piston 33 fits snugly in the said bore 43 and is adapted to reciprocate in the said bore and strike the shank of the drill steel 17 on each downward stroke of the pistons. The piston 33 carries the pins 32, (and is rigidly attached thereto), which are adapted to work in the spiral grooves 29, of the rotating piece 35, and in the straight grooves 27 of the cylinder 13. The rotating piece 35 carries the pawls 24. The chuck 30 has an enlarged diameter at its inner end, and on the circumference of this enlarged diameter are cut the common ratchet teeth 40. The pawls 24 are adapted to work in the said ratchet teeth, and are held in engagement with same by the springs 25. The drill steel 17 may be provided with the lugs 26, which fit in the grooves 28 of the chuck 30, so that if the chuck is rotated the drill steel will be compelled to rotate in unison with it. As the piston 33, (and all rigidly connected parts), moves upward the pins 32 (which travel in a straight line with the said piston and also work in the straight grooves 27 of the cylinder 13), working in the spiral grooves 29 of the rotating piece 35, will cause the latter to rotate a small amount; the rotation is transmitted from the rotating piece 35, to the drill steel 17, through the pawls 24, which engage the ratchet teeth 40 of the chuck 30; the said chuck 30 causing the drill steel to rotate with it as before described; on the down stroke of the piston 33, the pawls 24 run away from the ratchet teeth as will be fully understood.

Any suitable sparking mechanism, (commonly used on gasolene engines), may be utilized to explode the charges after they have been introduced into the explosive chambers. I do not wish to be restricted to any particular kind.

The operation of my improved internal combustion rock drill is as follows: Assuming that an explosive charge has been drawn into the chamber 2, (on the downward movement of the pistons, at opening 4 through a valve such as shown in Fig. 5), as the pistons move backward a similar charge will be drawn into chamber 20, (at 4′ through a valve such as shown in Fig. 5), while at the same time the charge in chamber 2 is being compressed; when the pistons approach the end of the backward stroke the charge in chamber 2 will rush through the passage 9′ into the explosive chamber 46 of the cylinder 1; as the pistons move forward the charges in chambers 46 and 20 will be compressed, while at the same time a new charge will be drawn into the chamber 2; as the pistons approach the end of the downward stroke the charge in chamber 20 rushes into the explosive chamber 15 of the cylinder 13, (through the passage 9), at this time the charge in chamber 46 is exploded, (by means of a spark commonly used on gasolene engines), and the pistons will be driven backward under the pressure of the explosion in chamber 46; as the pistons move backward a new charge is drawn into chamber 20 and the charges in chambers 2 and 15 are compressed; as the pistons reach the terminus of the upward stroke the burned gases are exhausted from chamber 46 through the port 7′, while at the same time the charge in chamber 2 rushes into chamber 46, and the charge in chamber 15 is exploded, (by a spark commonly used on gasolene engines), and drives the pistons downward. As these operations continue it will be plainly seen that an explosion will occur in chamber 46 on every up stroke, and a similar explosion will occur in chamber 15 on every down stroke; further, that as the pistons move downward, (by reason of the explosion in chamber 15), the piston pin 8, (which is connected to the crank pin 45 through the rod 5), will slide backward until it bears against the pieces 18, and will then be pulled forward with the piston. When the pistons approach the end of the downward stroke, the projection 23 of the piston 33 will strike the shank of the drill steel 17, and said drill steel being in contact with the rock face, will penetrate same. Should the projection 23 strike the said shank before the crank pin 45 reaches the dead center line, the pistons will come to a stop, but the crank will continue around moving the piston pin 8 forward in the slides 19 of the piston 10. When the crank pin 45 reaches the dead center line an explosion occurs in chamber 46 (as before described), and drives the pistons backward; on the backward stroke the pin 8 will slide forward and bump against the spring 42, through the piece 47. It will be plainly seen that the result of this action is that of a free piston; the pistons being moved entirely by the pressure of the exploded charges, and not by energy stored in fly wheels. The crank shaft serves the purpose of limiting the stroke of the pistons, (to insure the proper port opening, and to prevent an over stroke), without receiving any jar from the impacts of the pistons. Said crank is also a

means of manually imparting motion to the said pistons, for the purpose of starting the said engine.

The rotation of the drill steel occurs as before described,

Various changes in details of construction of component parts of the machine may be made without departing from the principle and intended scope of the invention.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an internal combustion rock drilling engine, a pair of spaced cylinders, a guide head connecting said cylinders, a piston slidable within the interior of each cylinder and dividing the same into mixing and explosion chambers; said explosion chambers being located proximal to said guide head; a piston rod slidable within said guide head and connected at opposite ends to said pistons; a crank shaft, a connecting rod connected to said crank shaft, and yieldingly connected to the adjacent piston, and a rock cutting drill bit arranged in striking relation to the other piston.

2. In an internal combustion rock drilling engine, a pair of spaced cylinders, a guide head connecting said cylinders, a piston slidable within the interior of each cylinder and dividing the same into mixing and explosion chambers, said explosion chambers being located proximal to said guide head; a piston rod slidable within said guide head and connected at opposite ends to said pistons; a crank shaft, a connecting rod connected to said crank shaft and yieldingly connected to the adjacent piston, for independent movement with respect thereto, and a rock cutting drill bit arranged in striking relation to the other piston.

3. In an internal combustion rock drilling engine, a pair of spaced cylinders, a guide head connecting said cylinders, a piston slidable within the interior of each cylinder and dividing the same into mixing and explosion chambers, the explosion chambers being located proximal to said guide head; a piston rod slidable within said guide head and connected at opposite ends to said pistons; a crank shaft, a connecting rod connecting said crank shaft and connected to said connecting rod, and upper piston; cushioning devices carried by the upper piston and a rock cutting drill bit arranged in striking relation to the other piston.

4. A motor drill comprising a pair of opposed explosive engines arranged in alinement with each other and having their pistons mutually connected, the upper piston being formed with a socket and with longitudinal slots communicating therewith; a crank shaft, a connecting rod, connected to said shaft, formed with an eye at its lower end, a transversely disposed pin carried in the eye of said rod having its ends arranged for sliding movement in said longitudinal slots, whereby an independent movement of said shaft is permitted; means for limiting such movement in both directions and a rock cutting drill bit arranged in striking relation to the lower piston.

5. A motor drill comprising a pair of opposed explosive engines arranged in alinement with each other and having their pistons mutually connected, the interior of the cylinder of each engine being divided into a mixing and an explosion chamber, the explosion chambers of the engines confronting each other; the upper piston being formed with a socket and with longitudinal slots communicating therewith; a crank shaft, a connecting rod connected to said shaft, formed with an eye at its lower end, a transversely disposed pin carried in the eye of said rod having its ends arranged for sliding movement in said longitudinal slots whereby an independent movement of said shaft is permitted; yielding means for limiting such movement in one direction, and means for limiting such movement in the opposite direction, and a rock cutting drill bit arranged in striking relation to the lower piston.

6. A motor drill comprising a pair of opposed explosive engines arranged in vertical alinement with each other and having their pistons mutually connected, the upper piston being formed with a socket and with longitudinal slots communicating therewith, a crank shaft, a connecting rod, connected to said shaft, and formed with an eye at its lower end, a transversely disposed pin carried in the eye of said rod having its ends arranged for sliding movement in said slots, whereby independent movement of said crank shaft with respect to said pistons is permitted; yielding means interposed between the inner wall of said socket and said pin for limiting the sliding movement of the latter in one direction and means located adjacent the outer end of said socket for limiting such movement in the opposite direction, and a rock cutting drill bit arranged in striking relation to the lower piston.

In testimony whereof I have hereunto set my hand this 29th day of October A. D. 1908.

LEWIS L. SCOTT.

Witnesses:
ELLEN M. MURPHY,
T. J. WELLS.