(No Model.)

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## APPARATUS FOR OPERATING ROCK DRILLS.

No. 600,934. Patented Mar. 22, 1898.

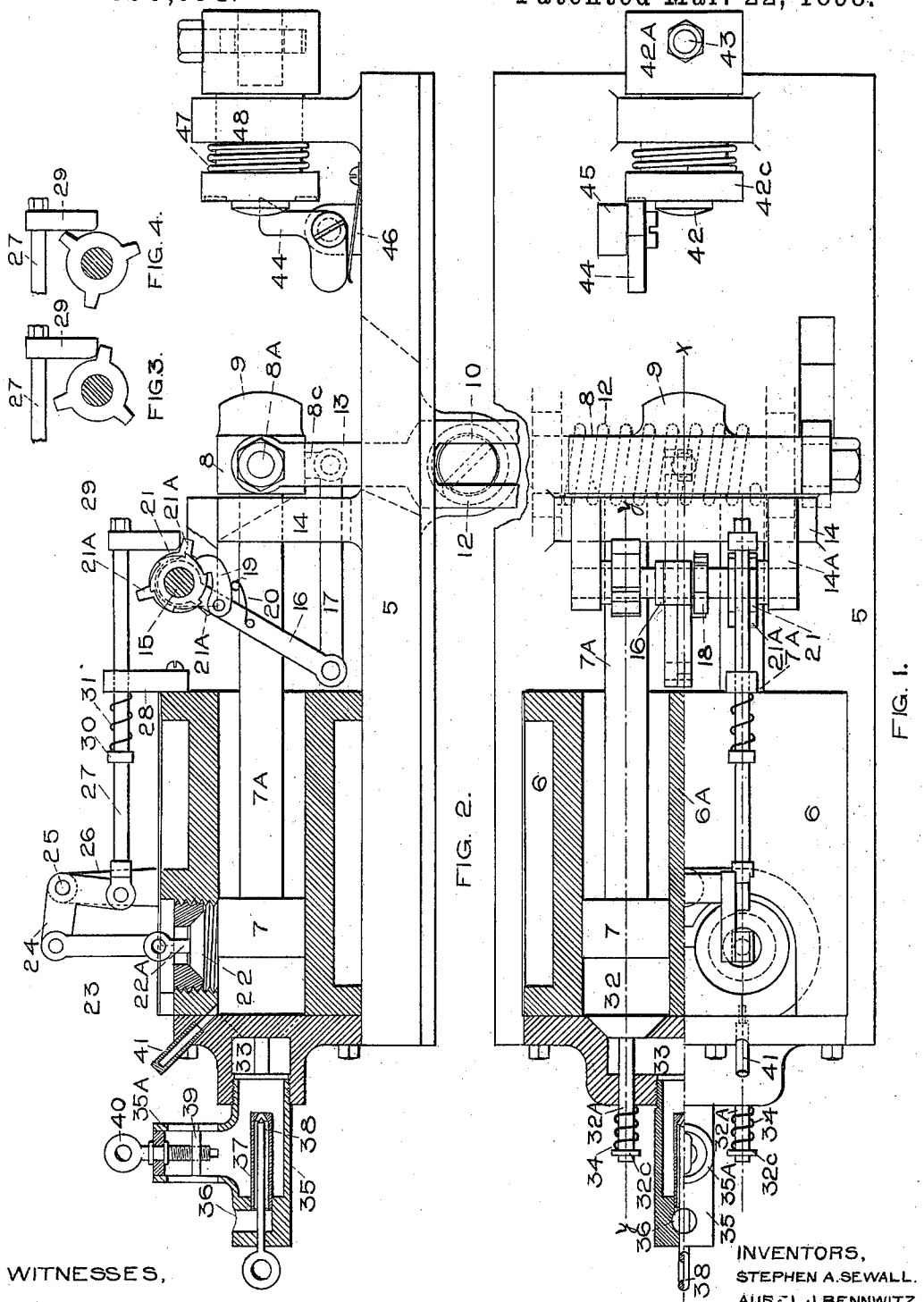

FIG. 4.

FIG. 3.

FIG. 2.

FIG. 1.

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## APPARATUS FOR OPERATING ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 600,934, dated March 22, 1898.

Application filed March 29, 1897. Serial No. 629,812. (No model.)

*To all whom it may concern:*

Be it known that we, STEPHEN A. SEWALL and AUREL J. BENNWITZ, citizens of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Methods of and Apparatus for Operating Rock-Drills; and we 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 figures of reference marked thereon, which form a part of this specification.

Our invention relates to an improved apparatus for operating rock-drills.

Our improved apparatus consists in the employment of the direct explosion in a cylinder of any hydrocarbon or other combustible gas mixed with atmospheric air or a proper proportion of oxygen. The apparatus will now be described in detail, reference being made to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a top or plan view of the apparatus, partly in horizontal section. Fig. 2 is a side view, partly in section and partly in elevation. The sectional portion is taken partly on the line $x\,x$ and partly on the line $y\,y$, Fig. 1. Figs. 3 and 4 show details of construction.

Similar reference characters indicating corresponding parts in the views, let the numeral 5 designate the drill base or carriage, which may be mounted on a suitable stationary support and controlled by any suitable feed mechanism. On this base is mounted a double cylinder 6, the two chambers being separated by a partition $6^A$ and provided with a water-jacket. In each cylinder is located a piston 7. The rods or stems $7^a$ of these pistons are connected with a common cross-head 8, carrying the drill-hammer 9, centrally located. Journaled in suitable bearings attached to the bottom or under surface of the base 5 is a shaft 10, surrounded by a coil-spring 12, one extremity of which is attached to the base, while the other extremity is secured to the shaft 10, which is flattened on two opposite sides to receive the forked lower extremity of an operating-arm 13, whose upper extremity is connected with the cross-head 8, which is provided with a journal or trunnion $8^A$, which enters an opening in the arm extremity. As the cross-head moves forward the spring is placed under tension. Its function is to impart the return or backward movement to the cross-head and pistons, which movement is accomplished by the recoil of the spring.

On the base 5 are mounted uprights 14, having rearward projections $14^A$, in which is journaled a shaft 15. To the central portion of this shaft is loosely connected the upper extremity of an arm 16, whose lower extremity is connected with one end of a link 17, whose opposite or forward extremity is connected with a depending projection $8^c$ of the cross-head 8.

Fast on the shaft 15 and located adjacent the upper extremity of the arm 16 is a ratchet-collar 18, which is engaged by a dog 19, mounted on the arm 16, and held in operative relation with the ratchet-collar by means of a spring 20, one extremity of which is attached to the arm, while the other extremity engages the dog. Fast on the shaft 15 and located, respectively, on opposite sides of the arm 16 are two collars 21, each having three projections $21^A$. These two collars 21 are relatively so arranged that their projections $21^A$ are staggered or located out of line with each other. Their function is to operate the mechanism connected with the valves 22, controlling the exhaust-ports of the respective cylinders. To the stem $22^A$ of each valve 22 is connected the lower extremity of a link 23, whose upper extremity is connected with one arm of a bell-crank lever 24, fulcrumed at 25 on a standard 26, mounted on the cylinder. To the other arm of the lever 24 is connected one extremity of a rod 27, which passes through an aperture in a guide-arm 28. The opposite extremity of the rod 27 carries a depending projection 29, which lies in the path of the projections $21^A$ of the collar 21. Each rod 27 is provided with a stop 30, which engages one extremity of a coil-spring 31, whose opposite extremity bears against the arm 28, which is secured to the cylinder-casing. Each cylinder is provided with a check-valve 32, controlling an inlet-port in one end thereof. The two cylinders communicate, by way

of these ports, with a common chamber 33, in which gas and air are mixed. The stems 32[A] of the valves 32 protrude through apertures in the chamber-casing. Each stem has a stop 32[c] at its outer extremity which engages one extremity of a coil-spring 34, whose opposite extremity bears against the chamber-casing.

Located between the two valve-stems 32[A] is a tube 35 for the admission of gas and air to the mixing-chamber. This tube is provided with a port 36, connected with a gasolene-reservoir or other suitable source of gas-supply. This port communicates with a small tube 37, projecting into the opening of the tube 35 and having a small outlet for the gas. This outlet is controlled by a valve 38, whose stems project beyond the tube to permit adjustment. The top of the tube 35 is provided with a neck 35[A] for the admission of air. In this neck is located a valve 39, controlled by a screw 40, engaging a threaded aperture in the valve. This screw is swiveled in the top of the neck, and by turning it the valve is vertically adjusted to control or regulate the admission of air.

The operation of the mechanism will now be described.

To start the machine, the cross-head and pistons must be moved forward, thus creating a partial vacuum in the piston-chambers. In response to this vacuum the check-valves 22 open and allow the explosive mixture in the chamber 33 to enter the cylinder-chambers. The forward movement of the cross-head gives the shaft 10 a partial turn by virtue of the arm 13, which connects the shaft and cross-head. As soon as the cross-head and piston have reached the forward limit of their stroke the recoil of the spring 12 imparts the return movement and one of the pistons compresses the explosive mixture in its cylinder extremity, while the charge escapes from the other cylinder by way of the exhaust-port, which is opened in time to produce this result, as hereinafter explained. As the cross-head moves forward the upper extremity of the arm 16 turns on the shaft 15 and moves the dog 19 forward one tooth on the ratchet-collar by virtue of the link 17, which connects the arm 16 with the cross-head. The collars 21 are so arranged on the shaft 15 that the exhaust-valves are alternately opened. Hence when the pistons make their return movement a projection 21[A] on one of the collars 21 engages a corresponding depending arm 29 and opens the valve 22, controlling the exhaust-port of one cylinder. This movement is effected through the instrumentality of the rod 27, the bell-crank lever 24, and the link 23. Hence when this exhaust-port is opened the explosive mixture in the corresponding cylinder is allowed to escape without an explosion. On the contrary, the other collar 21 does not engage its corresponding arm 29, and consequently the exhaust-valve of the other cylinder remains closed, and the explosive mixture is compressed sufficiently to cause an explosion through the agency of the ignition-tube 41, communicating with that cylinder. The respective ignition-tubes are heated in the ordinary or any suitable manner. This explosion, acting on one piston, drives the cross-head and both pistons forward again, actuating the arm 16 and the dog 19 as before, thus placing the spring 12 again under tension. As the recoil of the spring imparts the return movement to the cross-head and its connections the collars 21 are again actuated, but this time the exhaust-valve of the other cylinder, or that in which the explosion occurred, is opened to allow the products of combustion to escape, while the exhaust-valve of the other cylinder remains closed. Hence this time the explosion occurs in the last-named cylinder and the mechanism is actuated as before, the result being that the explosion occurs alternately in the two cylinders, every return of the two pistons being followed by an explosion in one chamber and accompanied by an exhaust from the other chamber. Hence the hammer 9 as it moves forward strikes a sudden and powerful blow on the chuck 42, which carries the drilling tool or bit. This tool is inserted in a suitable socket 42[A] and locked in place by a screw 43. The head 42[c] of the chuck has a ratchet-face, which is engaged by a spring-held dog 44, mounted on a suitable support 45. As the chuck is driven forward by the hammer blow the nose of the dog is lowered through the movement imparted by the spring 46, which causes the dog to turn on its pivot or fulcrum. This movement of the dog causes the latter to engage another tooth of the ratchet-head, and as the chuck is moved backward by the spring 47 the chuck and drill are given the necessary partial rotary movement between strokes. The spring 47 is located between the chuck-head and a block 48, mounted on the base 5.

While we have shown the mechanism in connection with a hammer-drill, it must be understood that the chuck carrying the drill-bit may be mounted directly on the cross-head. Hence the invention may be employed for operating any suitable drill mechanism.

Having thus described our invention, what we claim is—

1. In a drill the combination of a cylinder, a piston located therein, a suitable drilling-tool actuated by the piston, means for rotating the tool, means for admitting a suitable explosive to the cylinder, and suitable means for returning the piston after each forward stroke.

2. In a drill-operating apparatus, the combination of two cylinders, pistons located therein, a common cross-head with which the pistons are connected, a hammer carried by the cross-head, a drilling-tool actuated by the hammer, suitable means for the admission of the explosive to the cylinder, and suitable means for controlling the exhaust-ports of

the two cylinders whereby the explosions occur alternately in the cylinders, one piston being acted on by an explosion after each return or backward movement of the cross-head.

3. In a drill-operating apparatus, the combination of two cylinders, pistons located therein, a common cross-head with which the pistons are connected, a hammer carried by the cross-head, a drilling-tool actuated by the hammer, means for the admission of the explosive mixture to the cylinders, an exhaust-valve for each cylinder, means for controlling the exhaust-valves to cause the explosions to occur alternately in the two cylinders, and suitable means for returning the cross-head and pistons after each forward stroke.

4. A drill comprising two cylinders, pistons located therein, a common cross-head with which the pistons are connected, a hammer carried by the cross-head, a drilling-tool actuated by the hammer, means for the admission of an explosive mixture to the cylinders, means connected with each cylinder for igniting the explosive mixture, means for alternately exhausting the cylinders, and suitable spring mechanism for returning the cross-head and pistons after each forward stroke.

5. A drill comprising two cylinders, pistons located therein, a common cross-head with which the pistons are connected, said cross-head carrying a hammer adapted to act on the drill-chuck, means for the admission of an explosive mixture to the cylinders, means attached to each cylinder for igniting the explosive mixture, means for alternately exhausting the cylinders, a suitable mechanism for returning the cross-head and pistons after each forward stroke, comprising a shaft, a coil-spring surrounding the same, and a suitable connection between the cross-head and shaft whereby the spring is placed under tension by each forward movement of the cross-head.

6. A drill comprising two cylinders, pistons located therein, a common cross-head with which the pistons are connected, a hammer carried by the cross-head, means for the admission of an explosive mixture to the cylinders, means connected with each cylinder for igniting the explosive mixture, valves for controlling the exhaust-ports of the two cylinders, two collars suitably mounted and having projections relatively staggered, suitable means connected with the cross-head for turning the collars as the cross-head moves backward, and suitable means actuated by the collars for alternately operating the exhaust-valves of the two cylinders.

7. A drill comprising two cylinders, pistons located therein, a common cross-head with which the pistons are connected, a hammer or chuck carried by the cross-head, means for the admission of an explosive mixture to the cylinders, valves for controlling the exhaust-ports of the cylinders, a shaft suitably journaled, two collars 21 fast thereon and having relatively staggered projections, a ratchet-collar also fast on the shaft, an arm loosely connected with the shaft, a dog mounted thereon and engaging the ratchet-collar, a link connecting said arm with the cross-head, and suitable means operated by the collars 21 for alternately operating the exhaust-valves of the two cylinders.

8. A drill comprising two cylinders, pistons located therein, a common cross-head with which the pistons are connected, means connected with the cross-head for operating the drill bit or tool, means for the admission of an explosive mixture to the cylinders, valves for controlling the exhaust-ports of the two cylinders, a shaft suitably mounted in proximity to the cylinders, two collars 21 fast thereon and having projections relatively staggered, a ratchet-collar also fast on the shaft, an arm loosely connected with the shaft, a dog mounted thereon and engaging the ratchet-collar, a link connecting said arm with the cross-head, and suitable means for operating the exhaust-valve of each cylinder, comprising a bell-crank lever, a link connecting one arm of the lever with the exhaust-valve, and a spring-held rod connected with the other arm of the lever and having projections lying in the path of the projections on the corresponding collar 21.

9. The combination with a suitable base or frame, and suitable drill-operating mechanism mounted thereon, of the chuck movably mounted on the base or frame and adapted to carry the drilling tool or bit and suitable means for rotating the said chuck.

10. The combination with a suitable base, and suitable drill-operating mechanism, of a chuck mounted on a suitable support attached to the base, and a suitable spring connected with the chuck for imparting a limited return movement after each blow delivered by the operating mechanism and suitable means for rotating the chuck.

11. The combination with a suitable base and drill-operating mechanism mounted thereon and carrying a hammer, of a chuck mounted on the base and carrying the drill-bit, a spring for imparting a limited return movement after each blow of the hammer, and a spring-actuated dog engaging a ratchet-face formed on the chuck and adapted to impart the rotary movement to the drill-bit.

12. In a drill-operating mechanism, the combination of a cylinder, a piston located therein, a cross-head with which the piston is connected, a hammer carried by the cross-head, means for admitting the explosive mixture to the cylinder, and suitable means for returning the cross-head and piston after each forward stroke.

In testimony whereof we affix our signatures in presence of two witnesses.

STEPHEN A. SEWALL.
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Witnesses:
ALFRED J. O'BRIEN,
EDITH HIMSWORTH.