No. 840,867. PATENTED JAN. 8, 1907.

J. V. RICE, JR.

HYDROCARBON ROCK-DRILL.

APPLICATION FILED MAY 9, 1903.

2 SHEETS—SHEET 1.

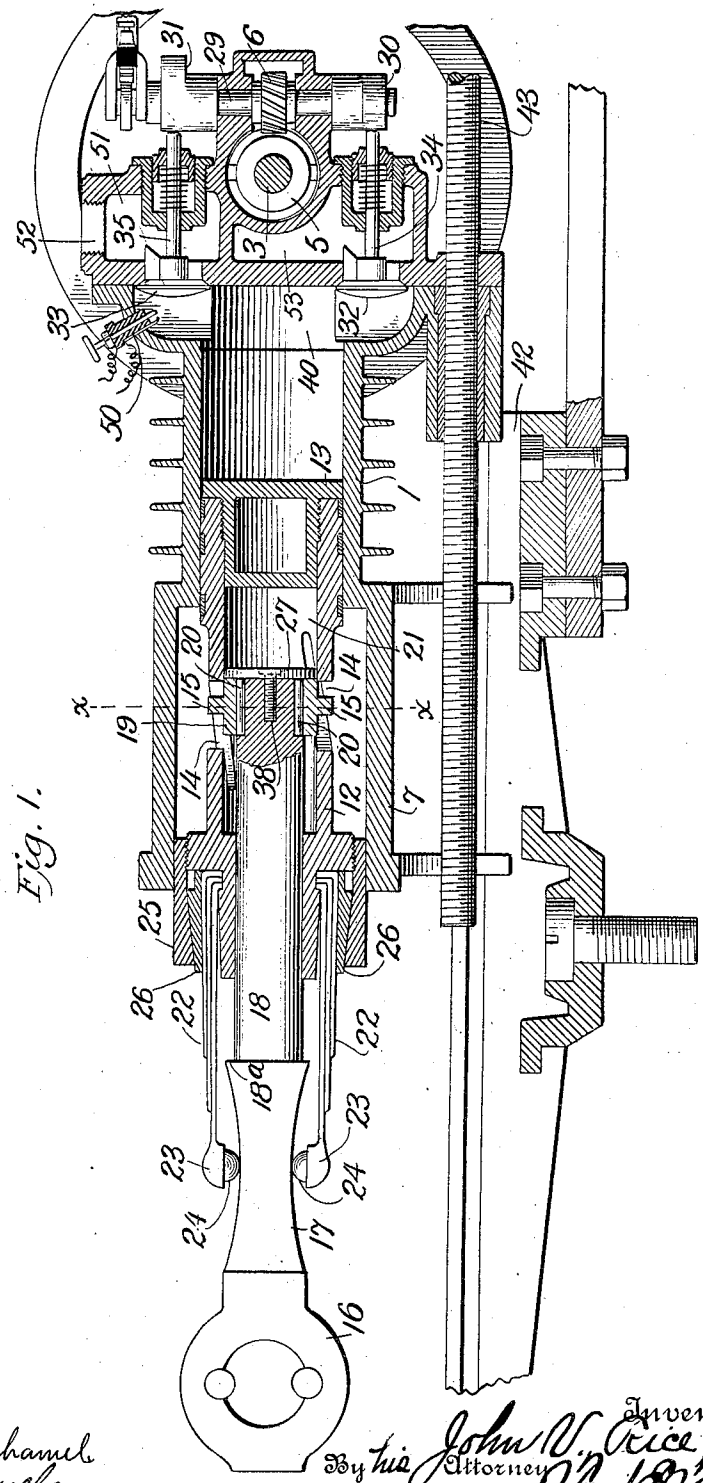

Fig. 1.

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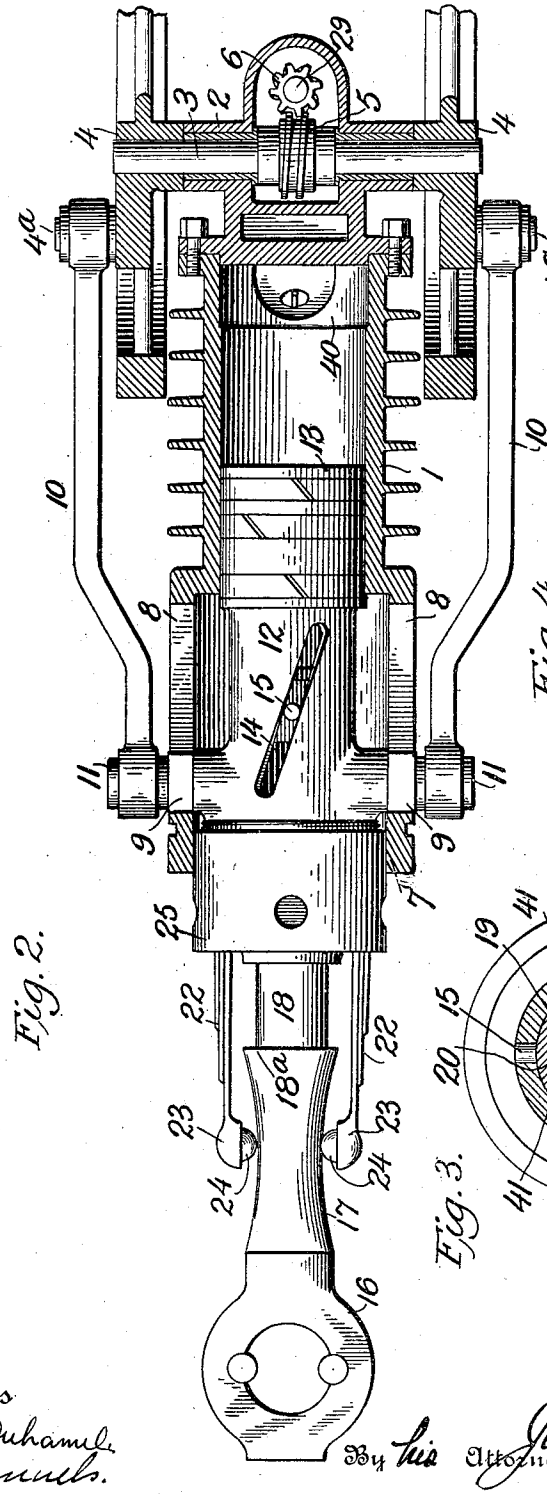

Fig. 2.

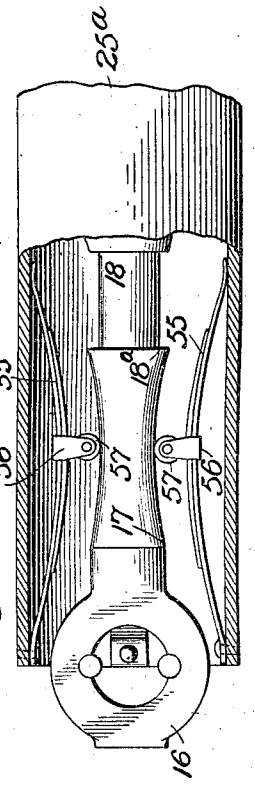

Fig. 4.

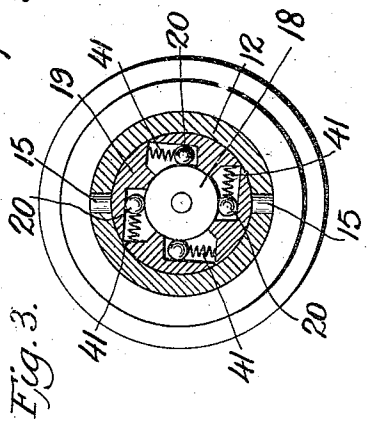

Fig. 3.

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HYDROCARBON ROCK-DRILL.

No. 840,867. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed May 9, 1903. Serial No. 156,480.

To all whom it may concern:

Be it known that I, JOHN V. RICE, Jr., a citizen of the United States of America, and a resident of Edgewater Park, in the county of Burlington, State of New Jersey, have invented certain new and useful Improvements in Hydrocarbon Rock-Drills, of which the following is a specification.

My present invention relates to an improvement in hydrocarbon or gas-actuated rock-drills, and more particularly to the means for rotating the drill.

The object is to simplify the construction and provide a more efficient rotating device, as well as to improve the drill in many other respects; and the invention consists, essentially, in the construction, arrangement, and combination of parts, substantially as will be hereinafter more fully described and claimed.

In the annexed drawings, illustrating my invention, Figure 1 is a vertical longitudinal section of my improved hydrocarbon rock-drill. Fig. 2 is a horizontal sectional plan of the same. Fig. 3 is a cross-section on the line *x x* of Fig. 1. Fig. 4 is a sectional view of a modification of the invention.

Similar numerals of reference designate like parts throughout all the figures of the drawings.

1 denotes the main cylinder, which may be of any suitable or preferred design and form, being generally open at one end and closed at the other and made either with or without a water-jacket. At the closed end is the explosion-chamber 40, while the other or open end is formed with an integral barrel-like extension 7, which serves as a guide and support for the outer end of the elongated piston 12. Said cylinder extension 7 is provided with longitudinal slots 8 8, formed opposite to each other and receiving the sliding blocks 9 9, which are designed to reciprocate in said slots as guides. The blocks 9 are engaged by pins or studs 11, that pass through round orifices in the blocks and that project laterally from the piston 12, being screwed into the latter or otherwise rigidly attached thereto or made a part thereof. Piston 12 is of a hollow elongated pattern or type, one end entering and working within the cylinder 1, where it receives against itself the impact due to the successive explosions of the mixture of air and gas ignited in the combustion-chamber 40, while the other end of this long piston plays back and forth inside of the hollow extension 7 and carries the piston-rod or drill-supporting rod 18, the means for imparting rotation to said rod, and the means for cushioning the blow of the tool. This rod 18 has on its outer end the drill-chuck 16, adapted to hold any suitable drill or other tool. Also it has a shoulder 18^a, which is adapted to abut against the outer end of piston 12 at certain times. The exterior surface of the drill-supporting rod 18, which rod may also be termed the "piston-rod," is, between the chuck 16 and the shoulder 18^a, slightly rounded, dished, or concaved at 17, making it, as it were, in the shape of a spool, for a purpose to be presently explained.

Piston-rod 18 moves obviously with the piston 12; but it also has a secondary movement within the piston, and its inner end is movably connected to the piston in such a manner that intermittent partial rotations may be imparted to the piston-rod on each return stroke, the means for thus accomplishing the rotation of the drill being as follows: 19 denotes a sleeve or ring that encircles the inner end of piston-rod 18 and is held thereon by an end plate 27, secured to rod 18 by a center screw 38 or by some other equivalent device. This sleeve has a couple of oppositely-located integral lugs or projections 15, that engage the diagonal slots 14 in the piston 12, so that as the ring 19 reciprocates it will be caused to rotate. The inside surface of ring 19 is recessed to receive and contain small balls or rollers 20, that are normally pressed against the rod 18. Hence the ring 19 and inner rollers 20 constitute a friction-clutch. When the ring 19 revolves in one direction, the rollers 20 play idly in the recesses without gripping the rod 18; but when ring 19 rotates in the other direction these rollers are drawn into the smaller ends of the recesses and are thus caused to bind between the ring 19 and rod 18, clutching the ring to the rod, so that as the ring revolves in consequence of the movement of lugs 15 in slots 14 the piston-rod and the drill carried thereby will likewise be revolved, a movement which preferably occurs on the return stroke of the drill, and it will thus be seen that the means for rotating the drill are not brought into action directly by the reciprocation of the piston, but by the rod's return movement after the yielding movement of the piston-rod which produces the cushion effect.

The cylinder 1 and connected parts are carried by some suitable supporting-frame, as 42, on which they are adjustable by a

screw 43 or by some other equivalent and convenient device in connection with which the usual tripod-support may be utilized.

I have shown in the drawings one form of means for yieldingly connecting the piston-rod and piston. This means consists of a series of springs 22, arranged around the drill-carrying rod 18 and pressing upon and against the side of the latter for the purpose of making the movement thereof yielding and easy. These springs 22 may consist of a single leaf or a plurality of leaves. Their free ends have cup-bearings 23, carrying antifriction-balls 24, that travel on the concave line 17 of the spool portion of rod 18, thus preventing friction and giving a strong and even pressure. The inner ends of springs 22 are preferably bent to take into notches on the outside of piston 12 and are held in this position by the sleeve 25, which screws over the end of piston 12 and is interiorly beveled, there being a sectional beveled ring 26 between sleeve 25 and springs 22, which is tightened more or less against the springs by the screwing up of the sleeve 25 upon and against the sectional ring 26, whereby the springs 22 are caused to bear with greater or less tension against the side of rod 18.

In Fig. 4 I have shown a modification of the springs for connecting the piston and the piston-rod. The sleeve 25 is extended to form a long barrel 25^a, and secured on the inside thereof, by riveting or otherwise, are springs 55—a series of four of them, for example—one end being fast and the other free, said springs carrying centrally the clips 56, in which the rollers 57 are journaled that bear against the concave spool 17 of piston-rod 18.

Bolted to the cylinder 1 in any suitable manner is a frame or casting 2, which provides the head of the cylinder, if desired, as shown, and also which affords a substantial bearing across the end of the machine for a main transverse shaft 3, a bushing being preferably placed in the bearing for the easy running of the shaft. This shaft has on each end a fly-wheel 4, provided with a crank-pin 4^a. Two fly-wheels are preferred; but one may be used, if desired. Connecting-rods 10 extend from the pins 4^a to the piston-carried pins or journals 11. On the shaft 3 is a worm 5, that meshes with and drives a small worm-pinion 6 on a shaft 29, supported at right angles to shaft 3 in suitable bearings in frame 2.

The frame of casting 2 contains an inlet-chamber 51, having an induction-opening 52, entered by a pipe or passage leading from the vaporizer and the gasolene or hydrocarbon tank to supply the requisite explosive mixture of air and gas to the cylinder.

33 denotes the inlet-valve for the air and gas, opening from the chamber 51 to the explosion-chamber 40, said valve being carried by a stem 35, having a closing-spring, while the end of the stem projects into a position to be struck by the cam 31 on the shaft 29, and 32 denotes the exhaust or outlet valve for the spent products of the explosions, leading from the explosion-chamber 40 into the exhaust-chamber 53 and thence to atmosphere through some suitable vent or eduction-port, said valve 32 having a stem 34, provided with a closing-spring, while the end of the stem 34 projects into a position to be struck by another cam 30, which is fast on the shaft 29, the said two cam devices 30 and 31 being so arranged relatively to each other, projecting as they do in different directions, that when one is acting on the end of one valve-stem for the purpose of opening its valve the other will be inactive and exert no pressure against the stem of the other valve—that is to say, when the inlet-valve is open the exhaust-valve will be closed and when the exhaust-valve is open the inlet-valve will be closed.

Any suitable sparking mechanism may be utilized to explode the charge of air or gas after it has been introduced into the cylinder. I do not wish to be restricted to any particular kind. Ordinarily I have employed a common spark-plug, as 50.

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

1. In a rock-drill or similar machine, the combination with a cylinder and a piston, of a piston-rod, slidable within the piston and means for rotating said rod, said means being carried in part by the piston and in part on the rod, and consisting of a rolling-device clutch.

2. In a rock-drill or similar machine, the combination with a cylinder and a piston, of a piston-rod carrying a drill or other tool and slidable within the piston, means on the piston and coöperating means on the piston-rod for rotating the drill, the same operating automatically, and consisting of a rolling-device clutch.

3. In a rock-drill or similar machine, the combination with a cylinder and a piston, of a piston-rod carrying the drilling-tool, said rod being slidable within the piston and means for automatically rotating the drill consisting essentially of a rolling-device clutch carried by the piston-rod and operated by connection with the piston.

4. In a rock-drill or similar machine, the combination with a cylinder, a piston therein, and a piston-rod carrying a drill and slidable within said piston, of means for rotating the drill consisting essentially of rolling devices carried by the rod and acting as an automatic clutch together with a ring surrounding said rolling devices and engaging the wall of the piston.

5. In a rock-drill, the combination with a cylinder and a piston, of a piston-rod carry-

ing the drilling or other tool, and means for rotating the drill consisting essentially of rolling devices and a ring surrounding said rolling devices and having pins that engage slots in the piston.

6. In a hydrocarbon rock-drill, the combination of a cylinder, a piston therein having oblique slots, a piston-rod slidable within the piston and carrying a drill or other tool, means for moving said piston-rod with the piston and also permitting said piston to have an additional movement relatively to the piston, and means for automatically imparting a rotation to the drill consisting essentially of a clutch on the end of the piston-rod having rolling devices and a ring provided with pins engaging the slots in the piston.

7. In a hydrocarbon rock-drill, the combination of a cylinder having an extension forming a guide, a slotted piston in said cylinder and guide, a piston-rod for carrying the tool, means on the piston exerting a pressure against the side of the piston-rod to cushion the blow, and means for rotating the drill consisting essentially in clutching-rollers carried at the end of the rod and a ring surrounding them having pins engaging the slots in the piston.

8. In a hydrocarbon rock-drill, the combination of a cylinder having a guide, a slotted piston in said cylinder and guide, a piston-rod slidable within the piston and carrying the tool, means on the piston exerting pressure against the side of the rod to cushion the blow, and a clutch device, consisting of rollers or balls and a ring surrounding said balls or rollers and having projecting pins that engage the slots in the piston.

9. In a hydrocarbon rock-drill, the combination of an explosion-cylinder and a piston, of a piston-rod carrying the drilling-tool and slidable within the piston, means on the piston exerting a pressure against the piston-rod to cushion the blow and means for automatically rotating the drill, said means being in part in the piston and in part on the piston-rod, substantially as described.

10. In a hydrocarbon rock-drill, the combination with an explosion-cylinder and a piston, of a piston-rod carrying the drill and slidable within the piston, and means for automatically rotating the drill, said means being in part in the piston and in part on the piston-rod, substantially as described.

11. In a hydrocarbon rock-drill, the combination of an explosion-cylinder and a piston, of a piston-rod carrying the drilling-tool and slidable within the piston, means on the piston exerting a pressure against the piston-rod to cushion the blow, and means for automatically rotating the drill, said means consisting of a rolling-device clutch.

12. In a hydrocarbon rock-drill, the combination with an explosion-cylinder and a piston, of a piston-rod carrying a drill and slidable within the piston, means on the piston exerting a pressure against the piston-rod to cushion the blow, and means for automatically rotating the drill, said means consisting of rolling devices and a ring surrounding said rolling devices and having pins that engage slots in the piston.

Signed at New York city this 9th day of April, 1903.

JOHN V. RICE, JR.

Witnesses:
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