No. 886,407. PATENTED MAY 5, 1908.

J. V. RICE, Jr.

HYDROCARBON ROCK DRILL.

APPLICATION FILED MAR. 24, 1904. RENEWED JUNE 4, 1907.

3 SHEETS—SHEET 1.

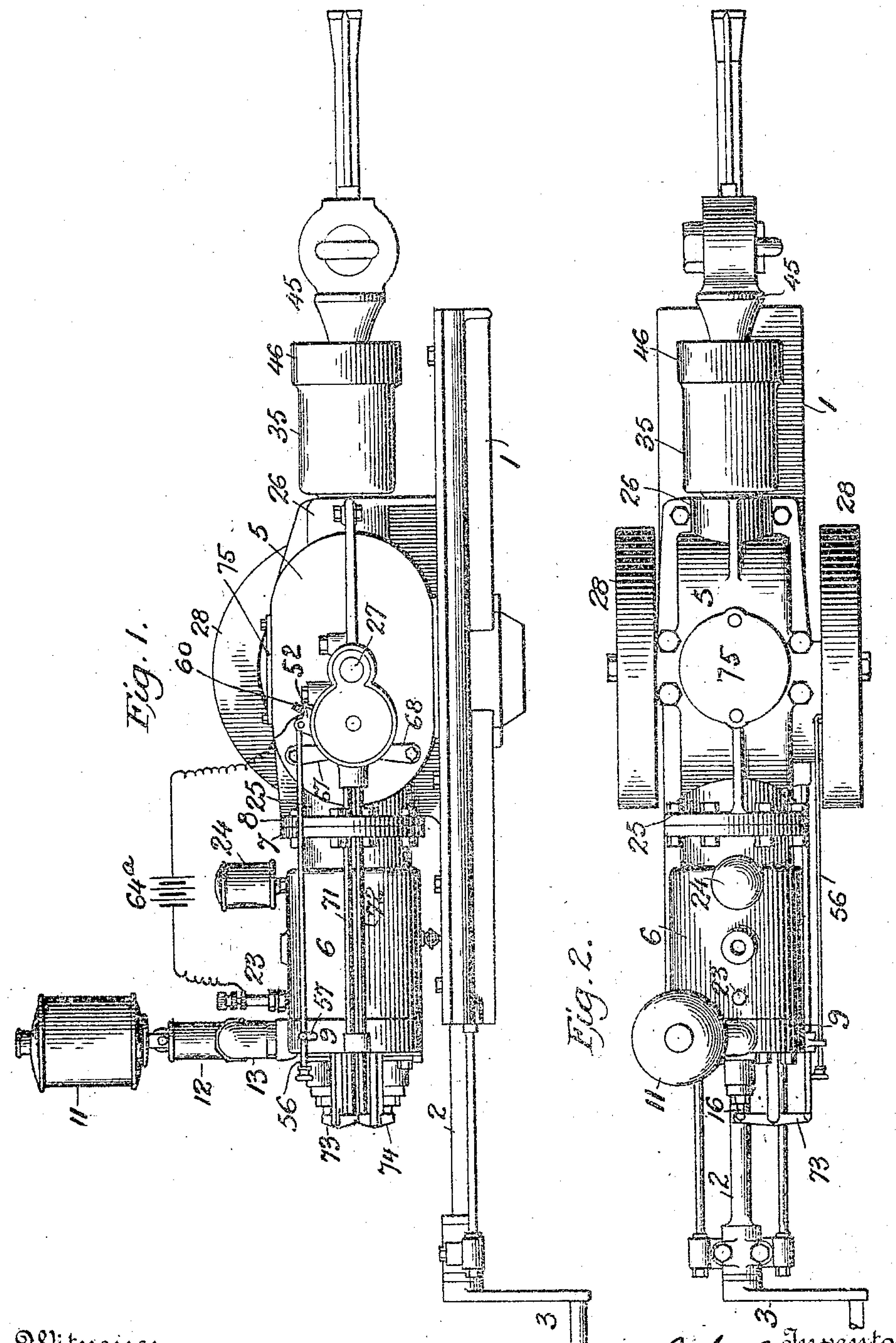

Fig. 1.

Fig. 2.

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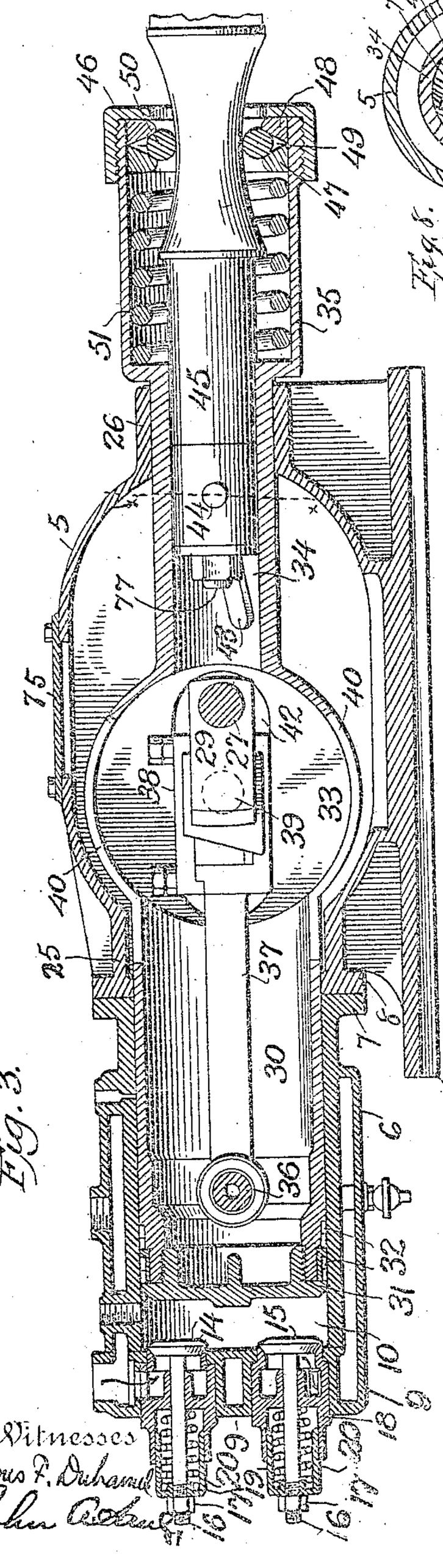

Fig. 3.

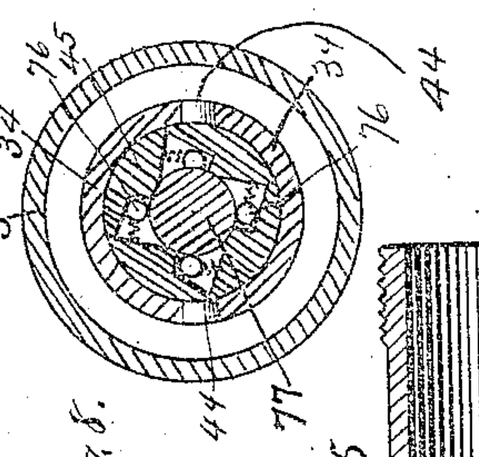

Fig. 5.

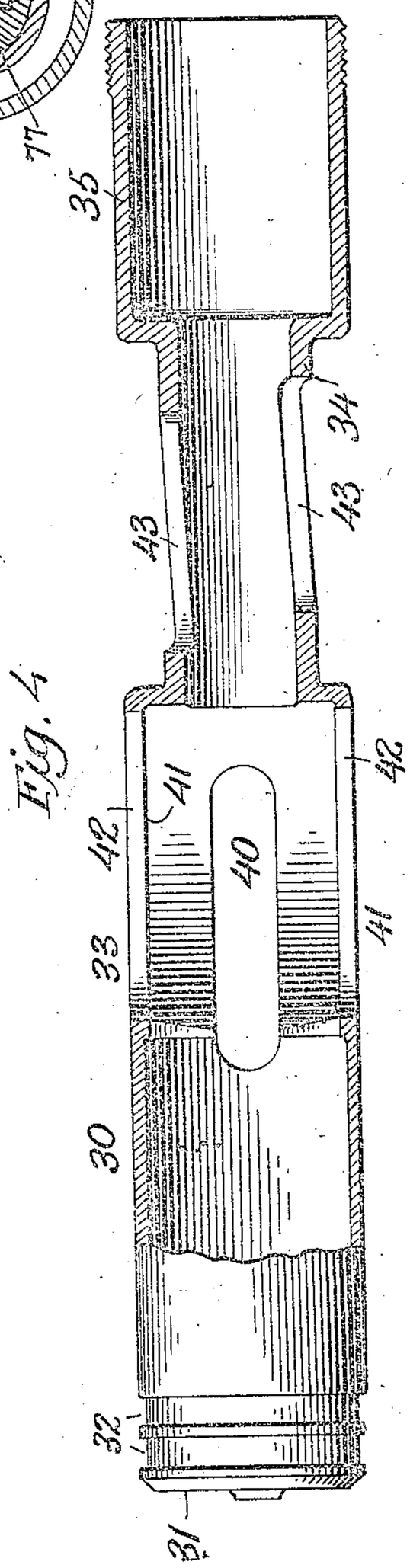

Fig. 4

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3 SHEETS—SHEET 3.

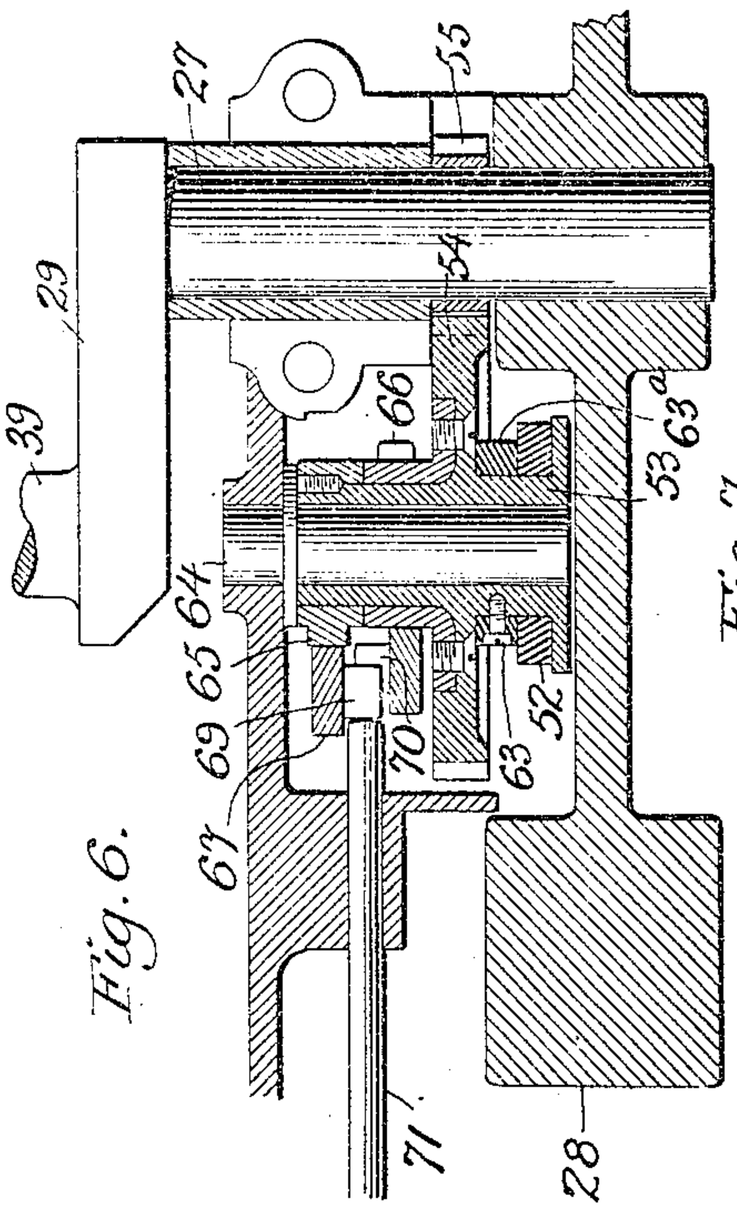

Fig. 6.

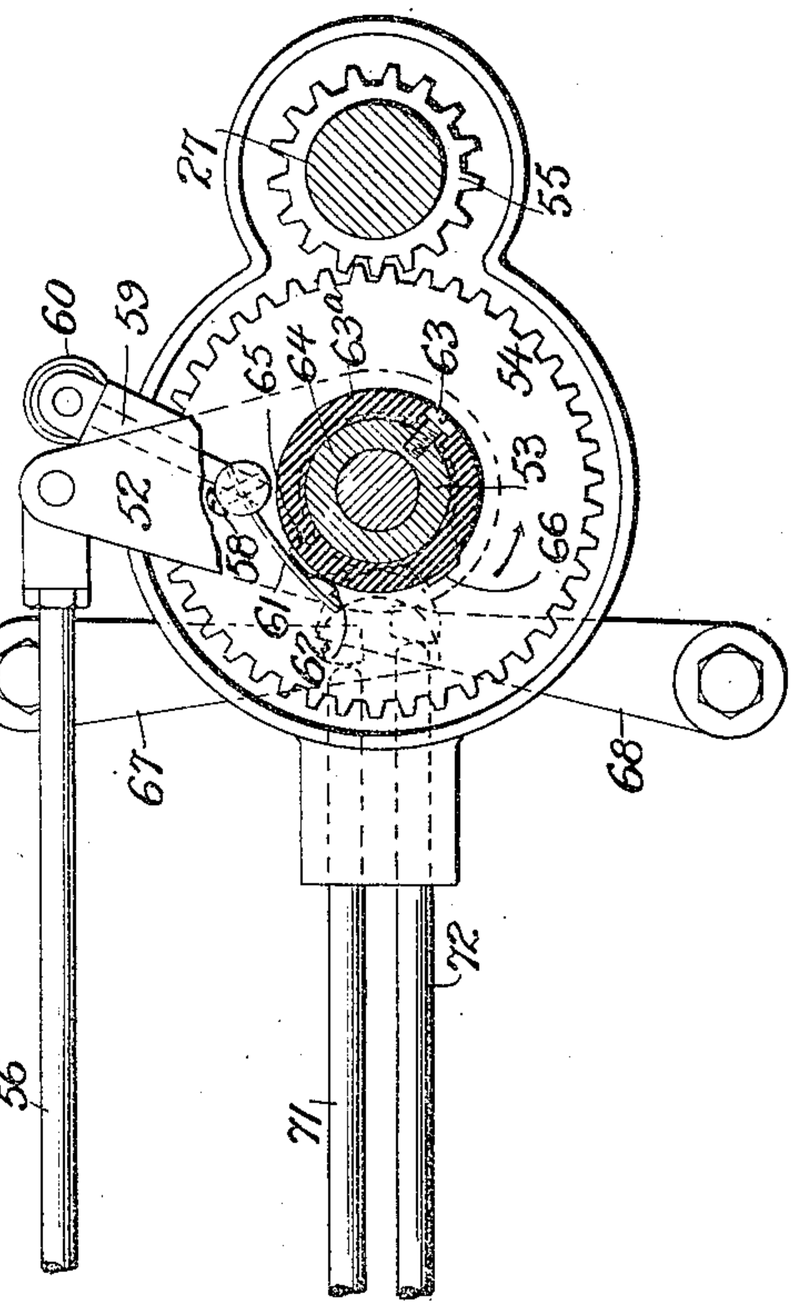

Fig. 7.

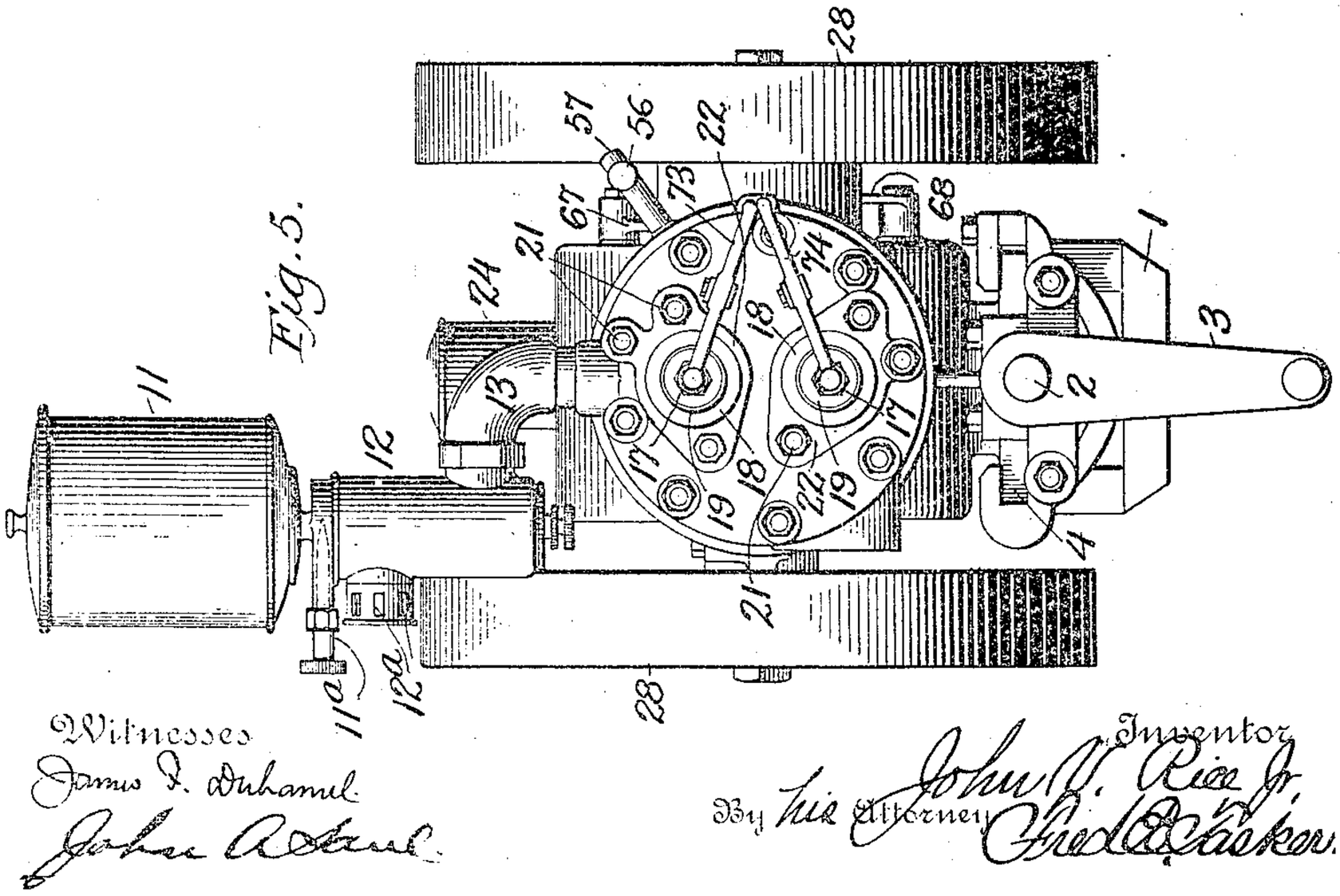

Fig. 5.

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UNITED STATES PATENT OFFICE.

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HYDROCARBON ROCK-DRILL.

No. 886,407. Specification of Letters Patent. Patented May 5, 1908.

Application filed March 24, 1904, Serial No. 199,699. Renewed June 4, 1907. Serial No. 377,264.

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 Bordentown, in the county of Burlington and State of New Jersey, have invented certain new and useful Improvements in Hydrocarbon Rock-Drills, of which the following is a specification.

My invention relates to an improvement in hydrocarbon or gas-actuated rock drills, and its object is to provide a compact and economical arrangement of parts whereby the operating parts are so disposed with relation to the piston of the engine proper that little or no additional space is needed for the former, while the operator is relieved of the danger which these parts entail when exposed.

The invention further consists in the novel construction, arrangement and combination of parts, substantially as will be hereinafter more fully described and claimed.

In the annexed drawings illustrating my invention and forming a part of this specification, like reference characters refer to like parts in the various figures and: Figure 1 represents a side elevation of my improved rock drill. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal vertical sectional view of the cylinder, piston and drill carrying rod. Fig. 4 is a plan view of the piston partly in section in a line at a right angle to the line on which the section of Fig. 3 is taken. Fig. 5 is an end view of the drill. Fig. 6 is a horizontal sectional view of the sparking device. Fig. 7 is a side elevation of the same. Fig. 8 is a cross-section of a suitable clutch mechanism on line X X of Fig. 3.

The drill and motor are carried by a saddle 1 which is adapted to be secured to a tripod or any desirable support and swiveled to operate in any direction. An adjusting screw 2 with a crank 3 serves to move the drill along the saddle and flanges 4 on the lower side of the casing 5 run in guide ways in the inner sides of the saddle as shown in Fig. 5.

The cylinder 6 has at its forward end a flange 7 which is bolted to a corresponding flange 8 on the casing 5 while at the other end or head 9 of the cylinder is the explosion chamber 10. The cylinder is shown provided with a water jacket and has the necessary openings to effect the circulation of the water, but it is obvious that any other means for cooling the cylinder may be used.

The cylinder head 9 carries the gasolene or oil tank 11 and the carbureter 12 and the explosive vapor enters the chamber 10 through the pipe 13 and valve 14 when the latter is actuated by the mechanism which will be described later. A valve 15 in the head 9 is opened by suitable mechanism, which I will hereinafter describe, to relieve the cylinder and explosive chamber of the spent products of the explosion. These valves 14 and 15 are identical in construction, each having a stem 16 threaded at its outer end to receive a nut 17 and the stem playing in a valve casing 18. The nut 17 secures upon the stem a cup 19 containing a spiral spring 20 which encircles the stem and is under compression between the nut and cup and the casing. When the valve casing 18 is seated in its opening in the head 9 it is secured thereto by means of the bolts 21 passing through flanges 22 on the valve casing and into the head. In Fig. 2 the valves are shown in their places in the head 9 and closed by the action of the springs 20 but it is evident that a pressure on the ends of the stems would open the valves. The cylinder is also provided with a sparker 23 and a lubricating oil cup 24.

The casing 5 which incloses the crank and crank shaft together with part of the piston is made in two sections which when bolted together is of a shape conforming with these parts and is suitably provided with cylindrical ends 25 and 26 having the necessary webs to strengthen the whole. Openings in the middle of each side form the bearings for the crank shaft 27 which carries at each end fly wheels 28 and has its crank arms 29 interposed between these wheels and within the casing and united by the pin 39.

The piston is more clearly shown in Figs. 3 and 4 where it will be seen to be composed of a cylindrical part 30 having a head 31 and provided with annular channels 32 for the packing, a transverse cylindrical portion 33 at about its center and a forward extending tube 34 and bell shape extension 35 for the drill carrying rod and its buffer. The part 30 near its rear end has a transverse pin 36 carrying one end of the connecting rod 37 whose other end carries in its box 38 the crank pin 39. The part 33 of the piston has slots 40 in its cylindrical walls for the play of the

end of the connecting rod and its vertical sides 41 have longitudinal slots 42 which allow the piston to play past the crank shaft 27. The part 34 has in opposite sides spirally inclined slots 43 in which play studs 44 projecting from the drill carrier 45 and operate a suitable ratchet or clutch mechanism shown in cross section in Fig. 8 and carried within the rear end of the carrier 45. Said carrier 45 is provided with recesses in its inner surface, which receive and contain small balls or rollers 76 that are normally pressed against a suitably-carried interior reciprocating rod 77 which is actuated by the piston and is connected at its outer end with the drill-chuck. When the carrier 45 revolves in one direction the rollers 76 play idly in the recesses without gripping the rod 77, but when the carrier 45 rotates in the other direction these rollers are drawn into the smaller ends of the recesses and are thus caused to bind between the carrier 45 and the piston-actuated rod 77, clutching the carrier to the rod 77 so that as the carrier revolves in consequence of the movement of the studs 44 in slots 43, both the piston actuated rod and the drill will be partially revolved and the angle of the cutting edge of the drill thus varied.

The extension 35 has a perforated cap 46 closing its outer end and retaining within this end two rings 47 and 48 with adjacent beveled faces which in cross section form a V-shaped raceway 49 for the reception of ball-bearings 50 and are held together by the pressure of the spiral spring 51 contained within the extension and bearing against one of the rings. The balls 50 play upon the reduced section of the drill carrier and ridé up and down the inclined faces forming same and when on the highest points of this section of the carrier the balls are forced down between the inclined faces of the rings spreading the same and causing the ring 47 to overcome the pressure of the spring 51. The pressure of the spring tends to force the movable ring 47 towards its companion, reducing the size of the raceway and forcing the balls from the bottom thereof and this pressure on the balls causes the carrier to move so that the balls will reach that part thereof having the least diameter where they will normally hold the carrier and drill.

The carbureter 12 may be of ordinary construction, receiving the fluid to be vaporized from the tank 11 through the valve 11^a and the air through the inlets 12^a.

In Figs. 6 and 7 is illustrated the sparking mechanism adapted for use in this form of rock drill and in which 52 represents an adjustable arm on the hub 53 of a gear wheel 54; the wheel 54 meshing with and being driven by a pinion 55 on the crank shaft 27. This adjustable arm 52 is of hard rubber, vulcanite or other electrically non-conductive material and has pivoted to its upper end a rod 56 which is adjustable in its bracket 57 projecting from the cylinder head 9 so that a longitudinal movement of the rod will throw the adjustable arm to one side or the other of the perpendicular. Carried in a perforation in the arm 52 and projecting laterally from the inner side of the arm is a stud 58 which is locked in its place by means of a pin 59 contained in a socket in one side of the adjustable arm which terminates at the opening for the stud and having at its outer end a binding screw 60 to attach one of the wires of an electric circuit. The stud 58 has secured to it a spring finger 61 having at its outer end a contact button 62 which bears upon the outer surface of a non-conductive collar 63^a secured to the hub 53 beside the adjustable arm 52 by means of a set screw 63 so that with each revolution of the hub on its stud 64 an electric circuit is completed through the pin 59, spring 61, screw 63, the frame of the apparatus to one of the points of the sparker 23 where the energy generated by the battery 64^a, connected with the cooperating point of the sparker and the binding screw 60, vents itself as a flash between the two points and explodes the compressed charge of vapor in the chamber 10. The hub 53 also carries two cams 65 and 66 which respectively actuate two arms 67 and 68 and rock the same on their pivot points as the gear wheel 54 and its hub rotate. The two arms have lateral projections 69 and 70 against which abut the front ends of two horizontal rods 71 and 72, the rear ends of these rods bear against ends of levers 73 and 74 which depress the stems 16 of the valves 14 and 15 and open the latter for entrance of the vapor or egress of the spent products.

In Fig. 7 it will be seen that the cams 65 and 66 are so secured to the hub 53 that the entrance valve is opened almost immediately after the egress valve closes or about the time the piston is about to begin its backward movement when it compresses the vapor about the time the screw 63 completes the electric circuit through the button 62 and explodes the charge. The object of the adjusting rod 56 is to so change the position of the arm 52 and the button 62 with relation to the cams as to cause the explosion of the vapor at a greater or less interval from the entrance of the same into the explosive chamber.

The casing 5 is provided with a lid 75 on its upper side which affords access to its interior and the parts therein.

It is obvious that many of the details of construction herein described may be varied without departing from the objects sought.

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

1. In a rock drill, the combination with an explosion chamber, of a piston, a drill-carry-

ing rod having a reduced portion, means for rotating said drill-carrying rod, and resilient means connecting the reduced portion of the drill-carrying rod and the piston, said means comprising rings, and balls held between said rings and said reduced portion of the drill rod.

2. In a rock drill, the combination with an explosion chamber, of a piston, a drill-carrying rod having a reduced portion, means for rotating said drill-carrying rod, and resilient means for connecting the drill-carrying rod and the piston, said means consisting of rings having adjacent beveled faces, a spring pressing against said rings, and balls held between the beveled faces of said rings and said reduced portion of the drill rod.

3. In a rock drill, the combination with an explosion chamber, of a piston, a drill-carrying rod having a reduced portion, means for rotating said drill-carrying rod, and resilient means connecting the drill-carrying rod and the piston, said means consisting of rings having adjacent beveled faces, a yielding device pressing against said rings, and rolling devices held between said rings and bearing upon said reduced portion of the drill-carrying rod.

4. In a rock drill the combination with an explosion cylinder, of a casing connected thereto, a hollow piston within the cylinder and casing, a drill carrier, resiliently connected with the piston, connecting rod and arms within the piston, a crank shaft and fly wheels.

5. In a rock drill, the combination with an explosion cylinder, of a casing connected thereto, a hollow piston within the cylinder and casing, a drill carrier resiliently and rotatingly connected with the forward end of the piston, connecting rod and arms within the piston, a crank shaft having bearings in the casing, fly wheels and means for affording the movement of the piston past the crank shaft.

6. In a rock drill, the combination with an explosion cylinder, of a casing connected thereto, a hollow piston operating in the cylinder and casing, a connecting rod secured within one end of the piston, a crank shaft rotated thereby, fly-wheels carried by said shaft, a drill carrier adapted to play in the other end of the piston, yielding means connecting the carrier with the piston and rotating means carried by the drill carrier and operated by the piston.

7. In a rock drill, the combination with an explosion cylinder having an extension, of a hollow piston operating within the cylinder and extension, a crank shaft, a rod within the piston, said rod connecting said piston and said crank shaft, a drill-carrier operating within one end of the piston and having a reduced portion, spring pressed means retaining the drill-carrier normally by means of the reduced portion at a certain point in its end of the piston, and rotating means connected with the drill-carrier and operated by the piston.

8. In a rock drill, the combination with an explosion cylinder having a forward extension, of a hollow piston adapted to operate within the cylinder and extension, an enlarged head on the forward end of the piston, a drill carrier secured within the forward end of the piston and having a reduced portion, rings with oppositely inclined sides within the enlarged head, a spring within the same head and bearing against one of the rings and ball bearings playing on the reduced portion of the drill-carrier and in the space between the inclined sides of the rings.

9. In a rock drill the combination with an explosion cylinder having a forward inclosed extension, of a hollow piston operating within the cylinder and extension a connecting rod, crank and arms and crank shaft within the piston, an enlarged portion in the piston to afford means for the operation of the connecting rod and arms, slots in the enlarged portion to enable the piston to clear the crank shaft, a drill carrier yieldingly connected with the piston, rotating means on the carrier operated by the piston, sparking means in the cylinder, an electric circuit, and contact means operated by the crank shaft for closing the circuit and effecting the sparking.

Signed at New York city this 5th day of March 1904.

JOHN V. RICE, Jr.

Witnesses:
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Charles F. O'Donnell.