C. JACKSON.

ROCK DRILL.

APPLICATION FILED MAR. 10, 1906.

917,074.

Patented Apr. 6, 1909

2 SHEETS—SHEET 1

Fig. 1.

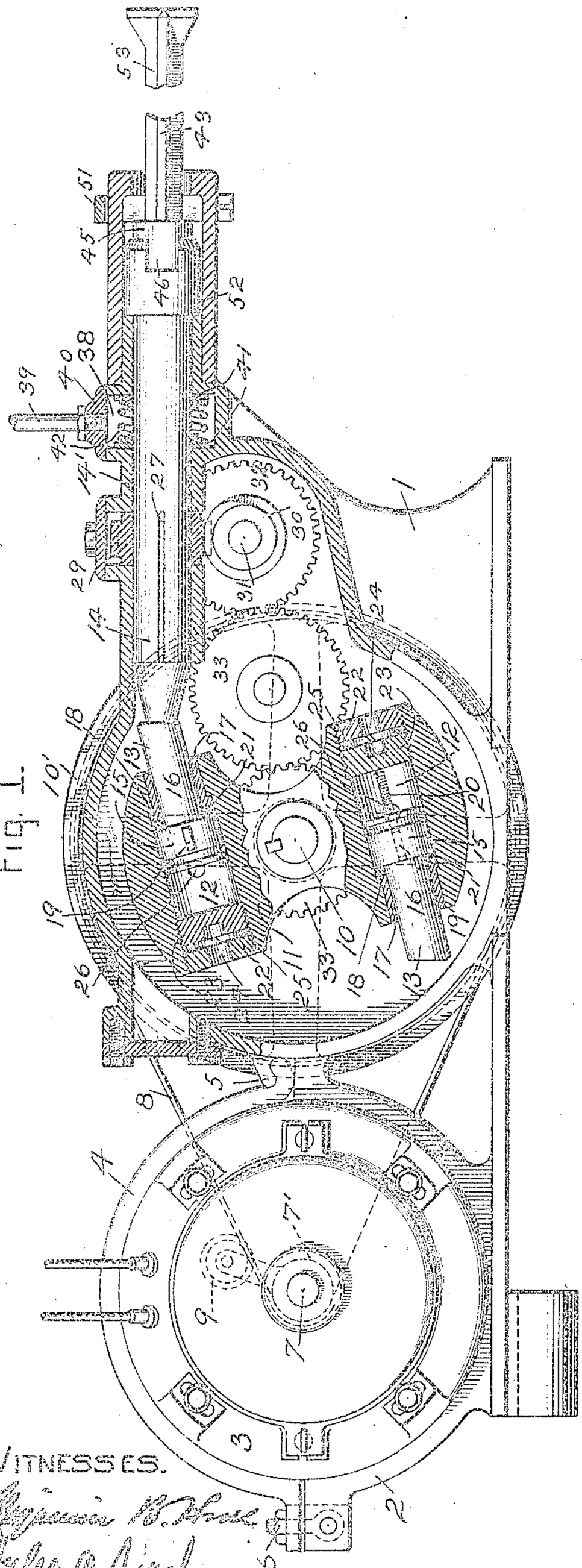
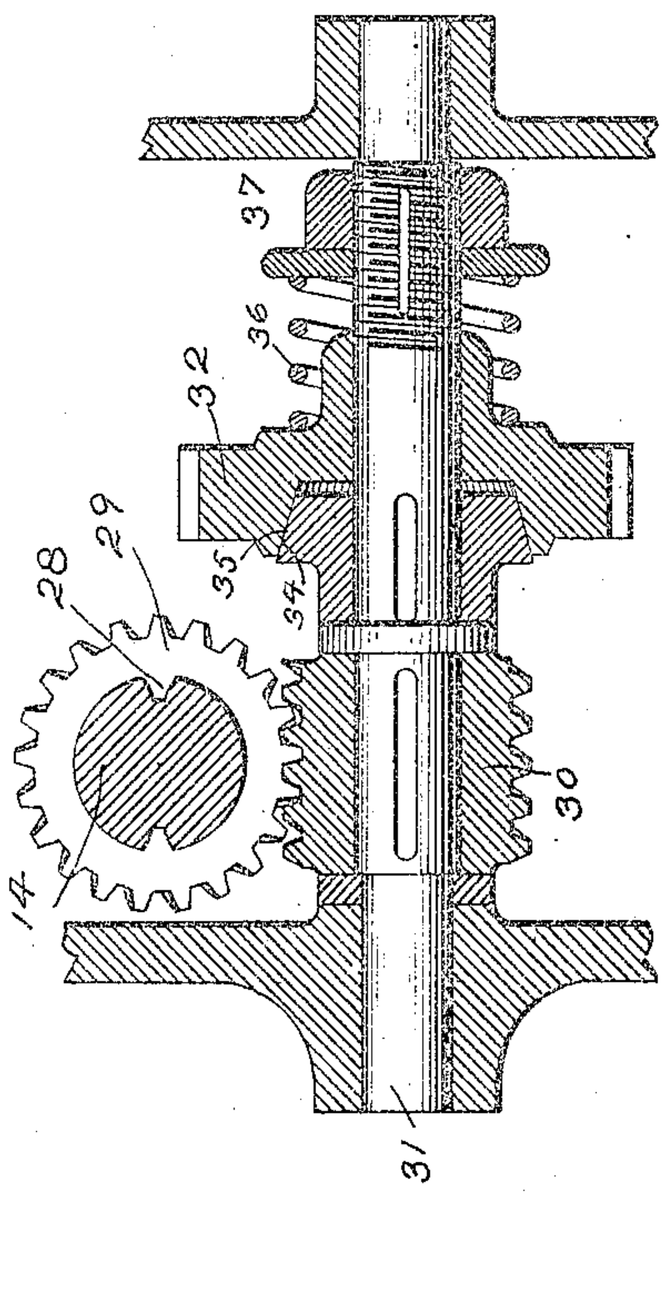


Fig. 2.



WITNESSES.

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2 SHEETS—SHEET 2.

Fig. 3.

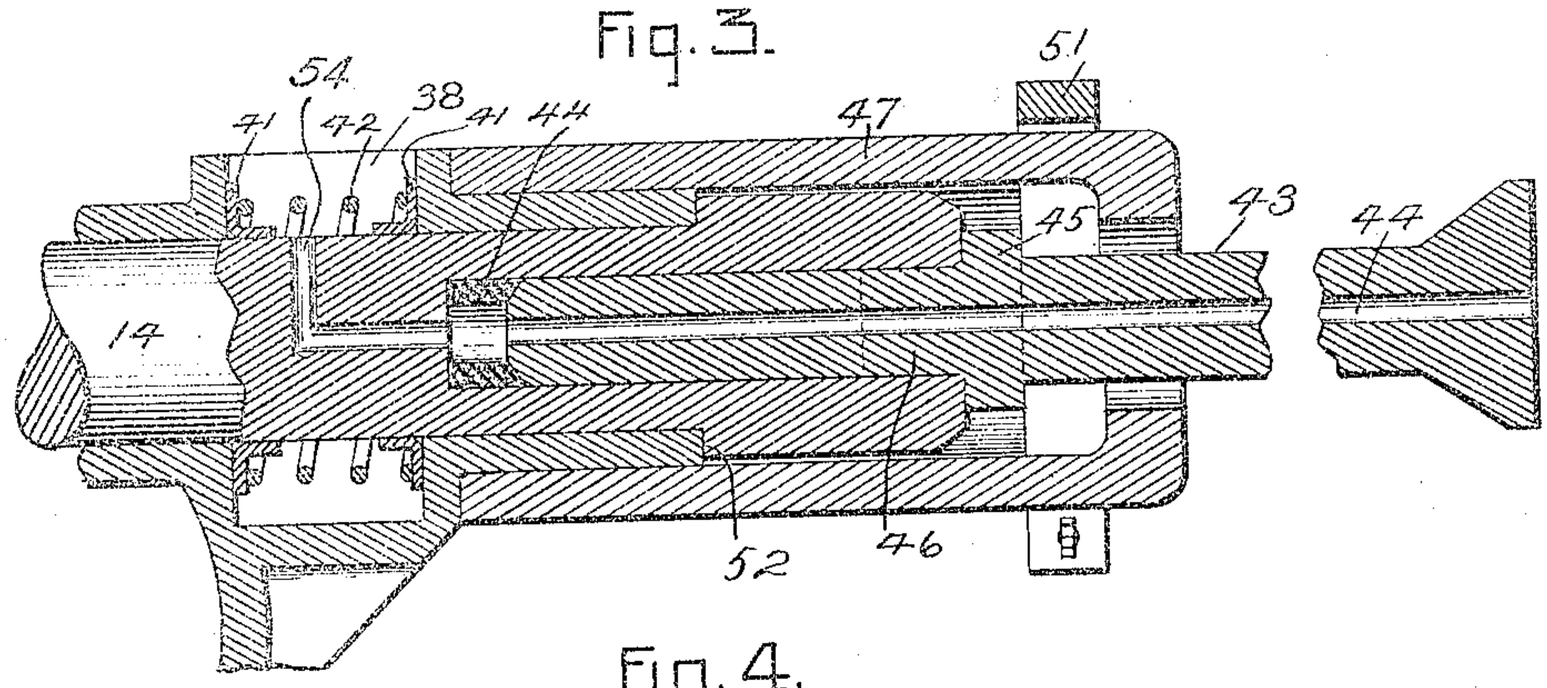


Fig. 4.

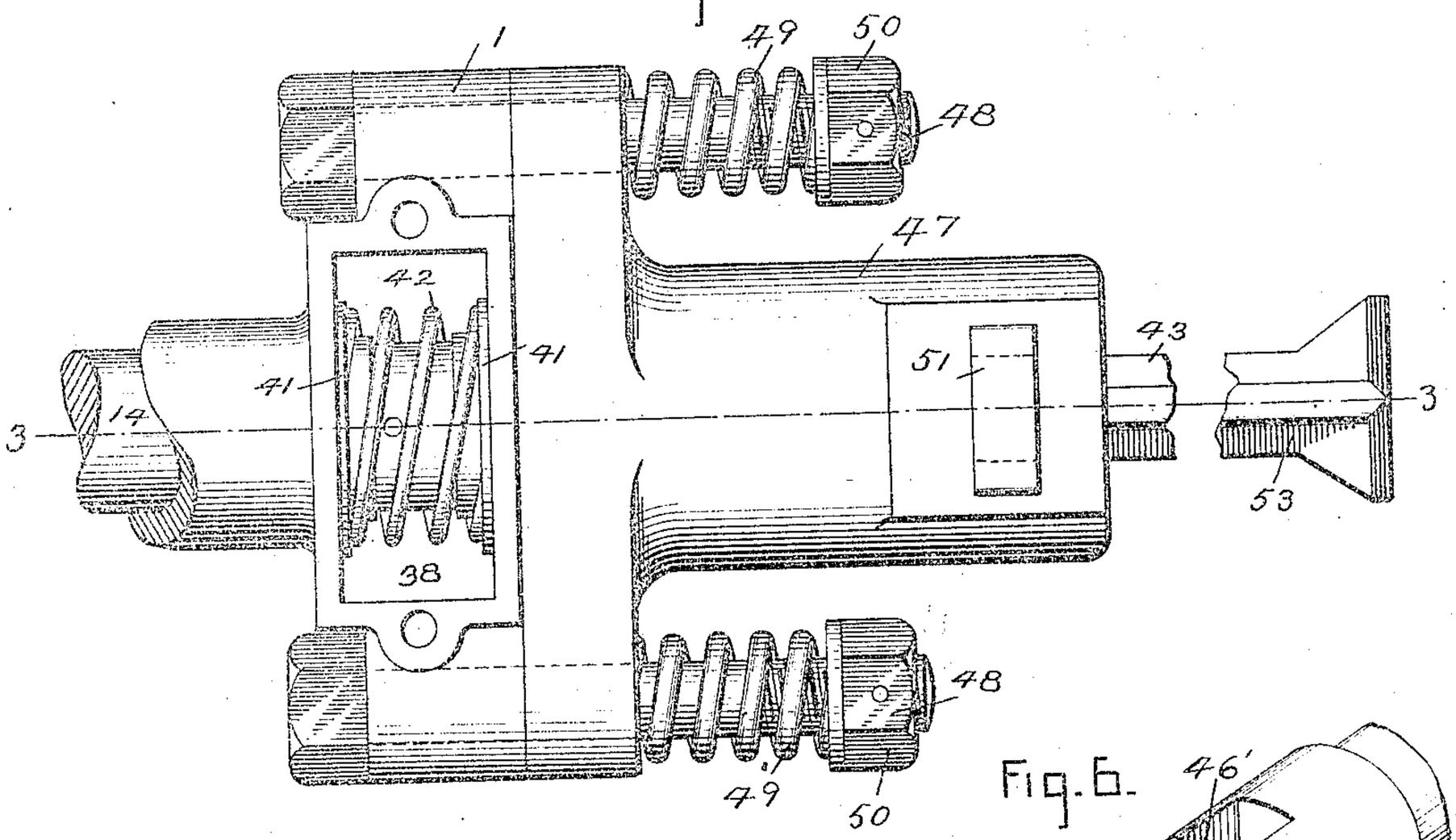


Fig. 5.

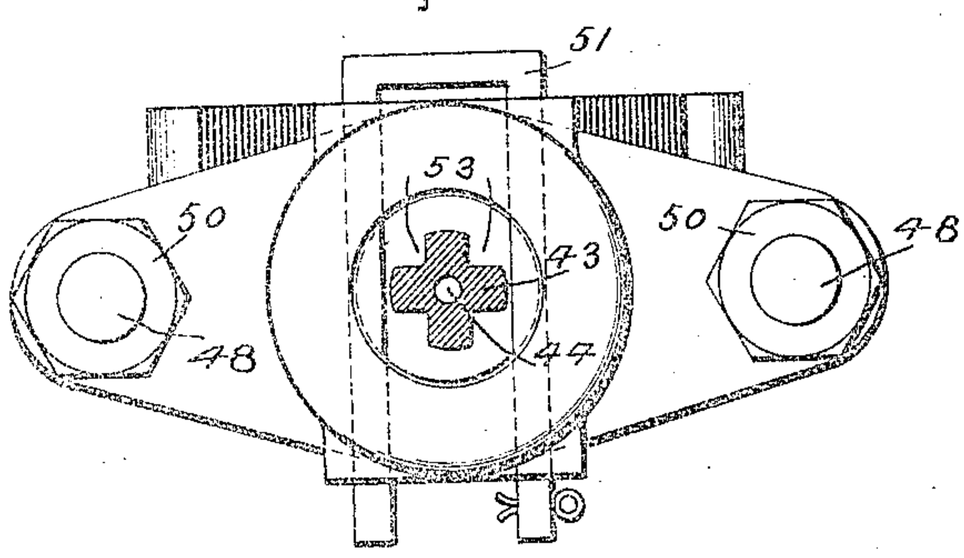
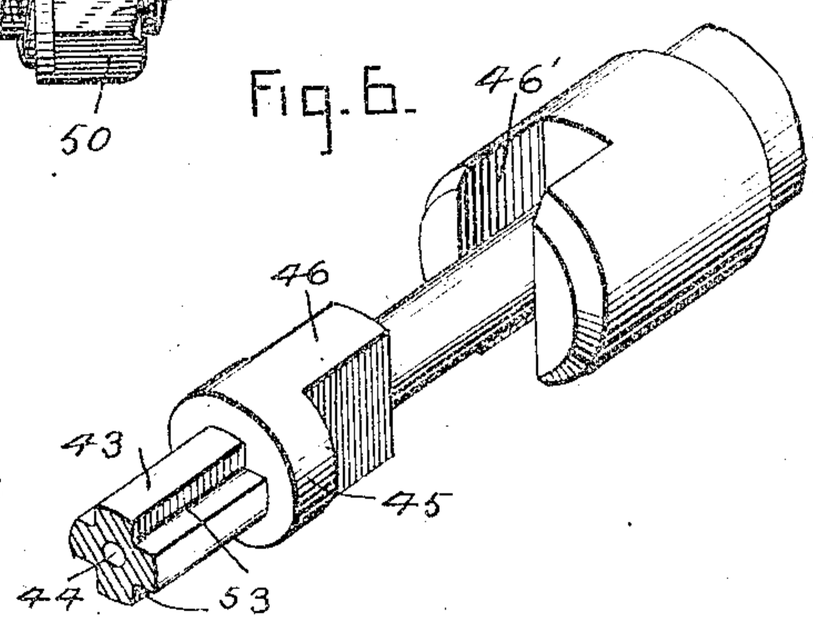


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ROCK-DRILL.

No. 917,074. Specification of Letters Patent. Patented April 6, 1909.

Application filed March 10, 1906. Serial No. 305,852.

To all whom it may concern:

Be it known that I, CORWILL JACKSON, a citizen of the United States, residing at Madison, county of Dane, State of Wisconsin, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

My present invention relates to mechanism such as rock drills, rock surfacers, riveting machines, and the like, in which a tool or device is actuated by hammer blows.

My invention comprises a novel construction of a rotating hammer and also certain features of construction and arrangement of a rock drill or similar device in which the hammer may be used.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, however, and of the advantages possessed by it, reference may be had to the accompanying drawings and descriptive matter in which I have illustrated and described one of the forms in which my invention may be embodied.

Of the drawings, Figure 1 is an elevation partly in section of a rock drill constructed in accordance with my invention; Fig. 2 is a sectional elevation of a portion of the mechanism employed for rotating the drill bit; Fig. 3 is a section on the lines 3—3 of Fig. 4; Fig. 4 is a plan view of the tool and tool-holding means; Fig. 5 is an end elevation showing the movable cross-head and tool with the latter in section; and Fig. 6 is a perspective view of a portion of the drill bit and the piston with which it is connected.

Referring to the drawings, 1 represents the frame of the rock drill proper which is adapted to be slidingly mounted upon any suitable support in the usual manner. The rear end of the frame 1 is provided with a curved seat 2 in which the field ring 3 of an electric motor is mounted. The field ring is clamped in place in the seat 2 by means of an arc-shaped piece 4 which engages with a hook or jaw 5 formed for the purpose on the frame 1 at one side of the motor and with a bolt and nut fastening device 6 secured to the seat 2 at the opposite side of the motor.

The armature shaft 7 of the motor drives in any suitable manner, as by means of a belt 8, a belt-tightener 9 and pulleys 7′ and 10′, a shaft 10 which extends parallel to the armature shaft 7 and is journaled in suitable bearings carried in integral or separable parts of the frame 1. On the shaft 10 is keyed a somewhat massive member 11 provided with two hammer barrels 12 which are parallel to each other and located at opposite sides of and equally distant from the shaft 10. The member 11′ is somewhat massive so that when in motion it has considerable momentum and its balance is not greatly affected by changes in position of the hammer members located in the barrels 12.

In each barrel 12 is located a floating hammer member 13 adapted to deliver a blow to the adjacent end of a piston member 14 slidingly mounted in a tubular portion 14′ of the casing 1. As shown, each member 13 is provided with a piston member 15 fitting the body portion of its barrel 12, and a reduced portion 16 which slides in a bearing sleeve 17 secured in a reduced portion of the hammer barrel. The inner end of each bearing sleeve 17 is provided with a shoulder 18 which abuts against a corresponding shoulder formed at the inner end of the reduced portion of the barrel. Each member 15 is provided with a key 19 which enters a slot 20 formed for the purpose in the member 11 at one side of each of the barrels 12. This prevents the hammer member from rotating on its own axis. A cushion 21 formed of suitable resilient material such as rubber is placed against the inner end of each sleeve 17 and surrounds the reduced portion of the hammer member. The rear end of each barrel is closed by a pair of lock nuts 22 and 23 which may be put in place by a suitable device such as a spanner entering openings 24 formed for the purpose in the nuts. A spring washer 25 is located between each pair of nuts 22 and 23. An air port 26 is formed in the side of each barrel 12 so as to be exposed when the corresponding hammer is in the forward position shown in Fig. 1 but closed after a slight initial backward movement of the hammers.

It will be observed that the center of gravity of each hammer member 13 is forward (having reference to the direction of rotation of the shaft 10) of a line radial to the axis of the shaft 10 and perpendicular to the line of movement of the hammer. As a result, when the shaft 10 is revolved by the motor in

the direction indicated by the arrow, each hammer 13 is moved by centrifugal force from whatever position it may be into the striking position occupied by it in Fig. 1. The outward movement of the members 13 are cushioned by the washers 21.

When each hammer member strikes the adjacent end of the piston 14 the hammer slides back in its barrel 12. The backward movement or rebound of each hammer at this time is cushioned by air in the portion of its barrel back of the port 26. As a result each blow is struck without greatly jarring the apparatus. The relative movement of separation after impact between the hammer member and piston is always sufficient to allow the hammer to clear the tool. If the tool sticks the hammer member flies back farther than it might otherwise do. I prefer to arrange the hammer and piston so that the hammer is not quite parallel to the tool at the instant of contact. For this reason the end of the hammer is beveled as shown.

The rotating member or body 11 is operatively connected to the piston 14 by means of a train of gears and a worm and worm wheel in order to rotate the piston as the member 11 rotates. In order to prevent injury to any part of the drill, in case it becomes fast in the rock which is being drilled, I have provided a friction clutch in the connections between the member 11 and the piston 14. In my preferred construction I have shown this clutch between the worm 30 and the last gear 32 of the train, but it is evident that this clutch may be placed between any two of the members which go to make up the connections between the member 11 and the piston.

The piston 14 is provided with diametrically opposed longitudinally extending slots 27 into which extend keys or ribs 28 of a worm wheel or gear 29 whereby the gear is slidably but non-rotatably mounted on the piston. The gear 29 meshes with a worm 30 keyed to a shaft 31 journaled in the frame and extending parallel to the shaft 10. The shaft 31 also has loosely mounted upon it a gear wheel 32 which is geared to the shaft 10 through gears 33. The gear wheel 32 drives the shaft 31 through a friction clutch comprising the friction surfaces 34 and 35, spring 36 and adjustable abutment 37.

A chamber 38 is formed in the barrel portion of the casing surrounding the body of the piston 14 through which a fluid is admitted from a suitable reservoir or pump through the pipe 39 connected to the cover member 40. Preferably the fluid employed is water, though air may be used under some circumstances. To prevent escape of the fluid entering the chamber 38 along the surface of the piston, packing members 41 are employed which are held in place by a helical spring 42.

As shown, in Fig. 3 the forward end of the piston member 14 is provided with a socket into which the hollow drill bit or other tool 43 is inserted. A passage 54 in the piston establishes communication between the chamber 38 and the bore 44 of the tool 43. A tubular packing 44′ is provided for preventing leakage of the fluid out of the tool-receiving socket.

The tool 43 is provided with a shoulder 45 which abuts against the end of the piston 14 and with an enlarged portion 46 substantially rectangular in cross-section which enters a corresponding recess 46′ in the end of the piston 14. The outer end of the piston 14 is located within a chambered cross-head member 47 which is connected to the casing 1 by bolts 48. As shown, helical springs 49 surround the bolts 48 and extend between the forward surface of the cross-head and nuts 50 carried at the forward ends of the bolts. To secure the drill bit in place a U-shaped device 51 is employed which passes through slots formed for the purpose in the forward end of the cross-head member and straddles the drill bit or tool in front of the shoulder 45. In the stationary position of the apparatus the springs 49 hold the cross-head in the position shown clearly in Figs. 1 and 4 at which time the piston 14 is at the backward limit of its movement with the shoulder 52 formed on it engaging the forward end of the barrel portion of the casing 1 surrounding the piston. The key or fastening member 51 is shaped and arranged to hold the drill bit firmly in the socket in the piston.

In the normal operation of the device the motor 7 rotates the shafts 10 and 31 and causes the hammer members to deliver rapid blows upon the inner end of the piston 14. The rotation of the shaft 10 causes the gear wheel 32 to be revolved and through the friction clutch a corresponding rotation of the worm-wheel 30 is obtained. This results in a slow rotation of the piston 14 and the tool 43. At each blow on the inner end of the piston 14 the piston and drill bit are advanced more or less depending on the nature of the material on which the tool is working. After each blow the piston is moved backward to the position shown in Fig. 1 by the springs 49. It will be understood that the frame 1 is advanced as the material upon which the tool is operating is worn away.

The fluid entering through the pipe 39 passes outward to the working edge of the tool and causes the chips formed by the tool to be forced away from its cutting edge. With the tool shown they may escape through the passages 53 formed in the tool. Should the tool stick the friction clutch connection between the gear 32 and the shaft 31 yields and prevents stripping of the gears or

other injury of the apparatus. Should the tool not be in contact with the work at the instant the piston is given a hammer blow the entire energy of the blow is taken up by the buffer springs 49.

The construction hereinbefore described and illustrated has been found in actual practice to give excellent results from the standpoints of durability and effectiveness. It will be obvious, however, to those skilled in the art that changes may be made in the form of my invention without departing from its spirit, and that certain features of my invention may be used without a corresponding use of other features, and I do not wish the claims hereinafter made to be limited to the particular embodiment of my invention shown and described, more than is made necessary by the state of the art.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In combination, a rotating body having a chamber formed in it extending tangentially to the axis of rotation of said body, a hammer member movable in said chamber and having its center of gravity at all times at one side of a line radial to the axis of rotation of the body and perpendicular to the line of movement of the hammer.

2. In combination, a rotating body having a cylinder formed in it, the axis of which is tangential to the axis of rotation, a hammer member located in said cylinder and free to move axially therein under the action of centrifugal force, the center of gravity of said hammer member being at one side of a line radial to the axis of rotation of said body and perpendicular to the line of movement of the hammer.

3. In combination, a rotating body having a chamber formed in it, a hammer member located in said chamber and free to move axially therein under the action of centrifugal force, the center of gravity of said hammer member being at one side of a line radial to the axis of rotation and perpendicular to the line of movement of the hammer, a device in a position to be struck by said hammer, and means for cushioning the hammer when it rebounds after each blow.

4. In combination, a rotating body having a pair of hammer receiving chambers formed in it, said chambers being located one at each side of and equidistant from the axis of rotation of said body, and two hammer members one located in each of said chambers and each free to have a limited movement in its chamber in a line tangential to a circle about said axis as a center.

5. In combination, a rotating body, and a hammer member slidably mounted in guideways permitting of a limited movement of said member with respect to said body in a direction tangential to a circle about the axis of rotation of said body as a center.

6. In combination, a rotating body having a chamber formed in it extending tangential to a circle about the axis of rotation of said body as a center, and a hammer member free to have a limited movement in said chamber, said hammer member having a center of gravity at all times at one side of a line radial to the axis of rotation of the body and perpendicular to the line of movement of the hammer.

7. In combination, a rotating body having a chamber formed in it extending tangentially to a circle about the axis of rotation of said body as a center, and a hammer member located in said chamber and free to have a limited movement therein in the direction of the length of the chamber, the center of gravity of said member being at all times at one side of a line radial to the axis of rotation of said body and perpendicular to the line of movement of the hammer.

8. In combination, a rotating body, a member slidingly connected thereto to have a limited movement with respect to said body in a direction tangential to a circle drawn about the axis of rotation of the body as a center, the member being held at the forward limit of its movement having reference to the direction of rotation of the body, and a device in a position to be struck by the said hammer once in each revolution of said body.

9. In a rock drill or the like, a tool, a rotating body the axis of which is at right angles to the line of movement of the tool, one or more chambers formed in said body, and a hammer member slidingly located in each chamber and adapted to be moved by centrifugal force when said body is rotated into the position in which it will strike said tool.

10. In combination, a rotating body having a chamber formed in it, a hammer member located in said chamber and free to move from one position therein to another position under the action of centrifugal force, a device in a position to be struck by said hammer, and means for cushioning the hammer when it rebounds at each blow.

11. In combination, a tool, a rotating body having a chamber formed in it, a hammer member comprising a piston located in said chamber and a portion projecting therefrom, said hammer being so arranged that centrifugal force normally tends to move the piston into a position in which said projecting portion is adapted to engage said tool, a port leading from said chamber, said port being exposed when the hammer is in the striking position but closed when the hammer is moved back from said position.

12. In combination, a rotating body having a chamber formed in it, and a hammer member reciprocating in a straight line and located in said chamber, said member being moved into a striking position by the action of centrifugal force and capable of yielding

out of the striking position at each blow struck by it.

13. In a combination, a rotating body, a hammer member secured thereto so that it is free to be moved bodily out of the striking position by the rebound at each hammer blow imparted and returned to the striking position by centrifugal force, and resilient means for limiting the movement out of the striking position.

14. In combination, a rotating body, and a hammer member slidably secured thereto so that it is free to be moved out of the striking position by the rebound at each hammer blow imparted and to be returned to the striking position by centrifugal force, said member having an air chamber at one side of said hammer for cushioning and limiting the movement thereof out of the striking position.

15. In combination, a rotating body, a hammer member secured thereto so that it is free to be moved out of the striking position by the rebound at each hammer blow imparted and to be returned to the striking position by centrifugal force, and resilient means for limiting the movement out of the striking position, said means comprising an air chamber, and a port therefor open when the hammer is in the striking position and closed by the movement of the hammer out of the striking position.

16. In combination, a rotating body, a hammer member slidably mounted on said body and capable of limited movement in a tangential direction, and means for cushioning the movements of said hammer.

17. In combination, a rotating body, a hammer member slidably secured thereto so that it is free to be moved out of the striking position by the rebound at each hammer blow and to be returned to the striking position by centrifugal force, said body having an air chamber for cushioning the movement of the hammer out of the striking position, and a port leading from said chamber, the port being so proportioned and arranged that it is open when the hammer is in the striking position and is closed by the movement of the hammer out of the striking position.

18. In combination, a rotating body having a chamber therein, and a hammer member loosely arranged in said chamber for limited bodily movements in a direction tangential to a circle about the axis of rotation of said body.

19. In combination, a rotating body having a chamber formed in it, a hammer member located in said chamber and free to move bodily from one position therein to another position under the action of centrifugal force, a device in a position to be struck by said hammer, and means for cushioning the hammer when it rebounds at each blow.

20. In combination, a rotating member, a centrifugally-actuated hammer device slidably mounted on the member and free to have a limited bodily movement with respect to the member in a tangential direction and means for cushioning the movements of said hammer device.

In witness whereof I have hereunto set my hand this 5th day of March, 1906.

CORWILL JACKSON.

Witnesses:
EMIL A. LAMBRECHT:
A. J. BUENZLI.