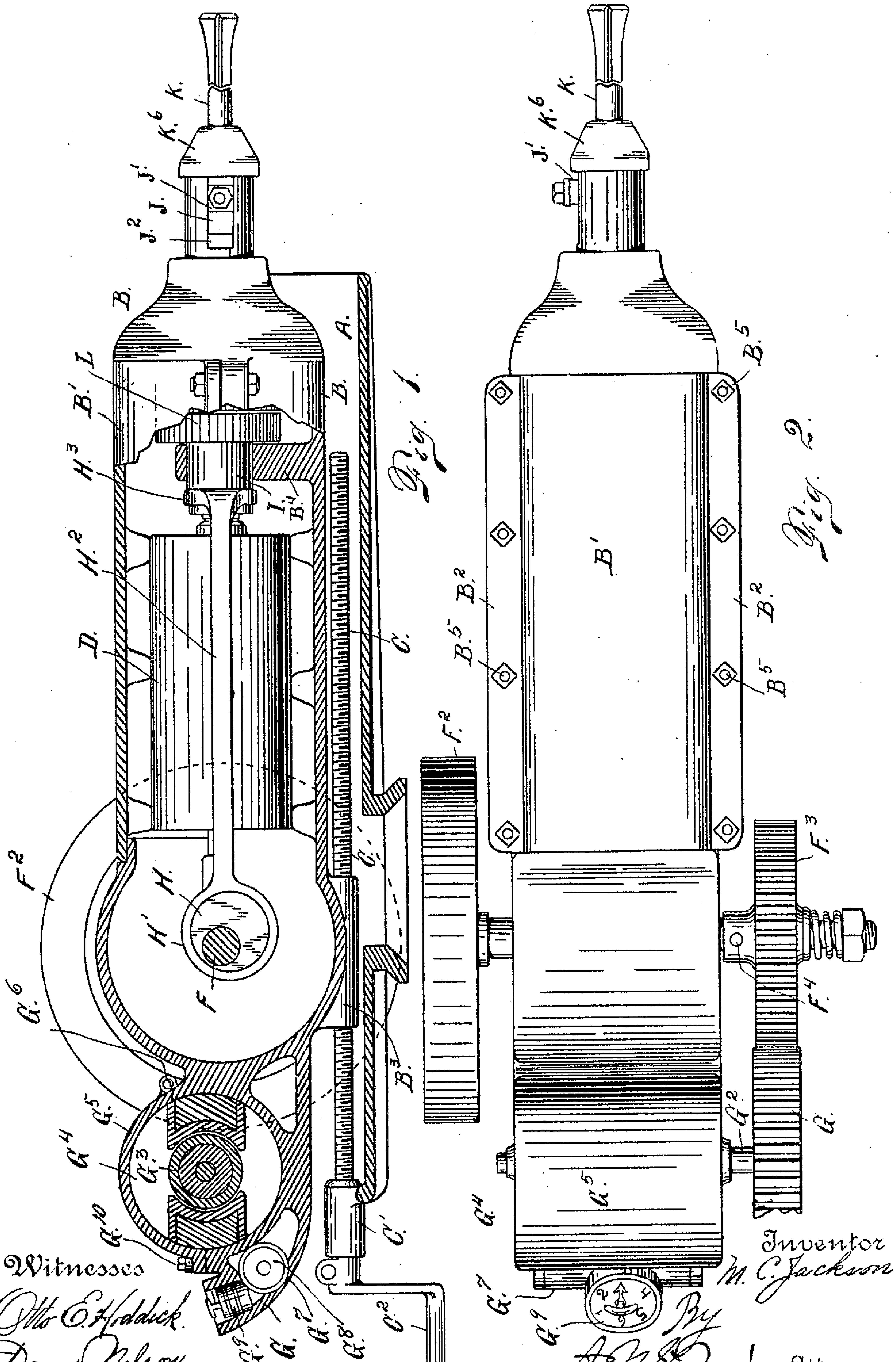
No. 798,416. PATENTED AUG. 29, 1905.

M. C. JACKSON.

ROCK DRILL.

APPLICATION FILED FEB. 15, 1904. RENEWED JAN. 30, 1905.

4 SHEETS—SHEET 1.



Witnesses

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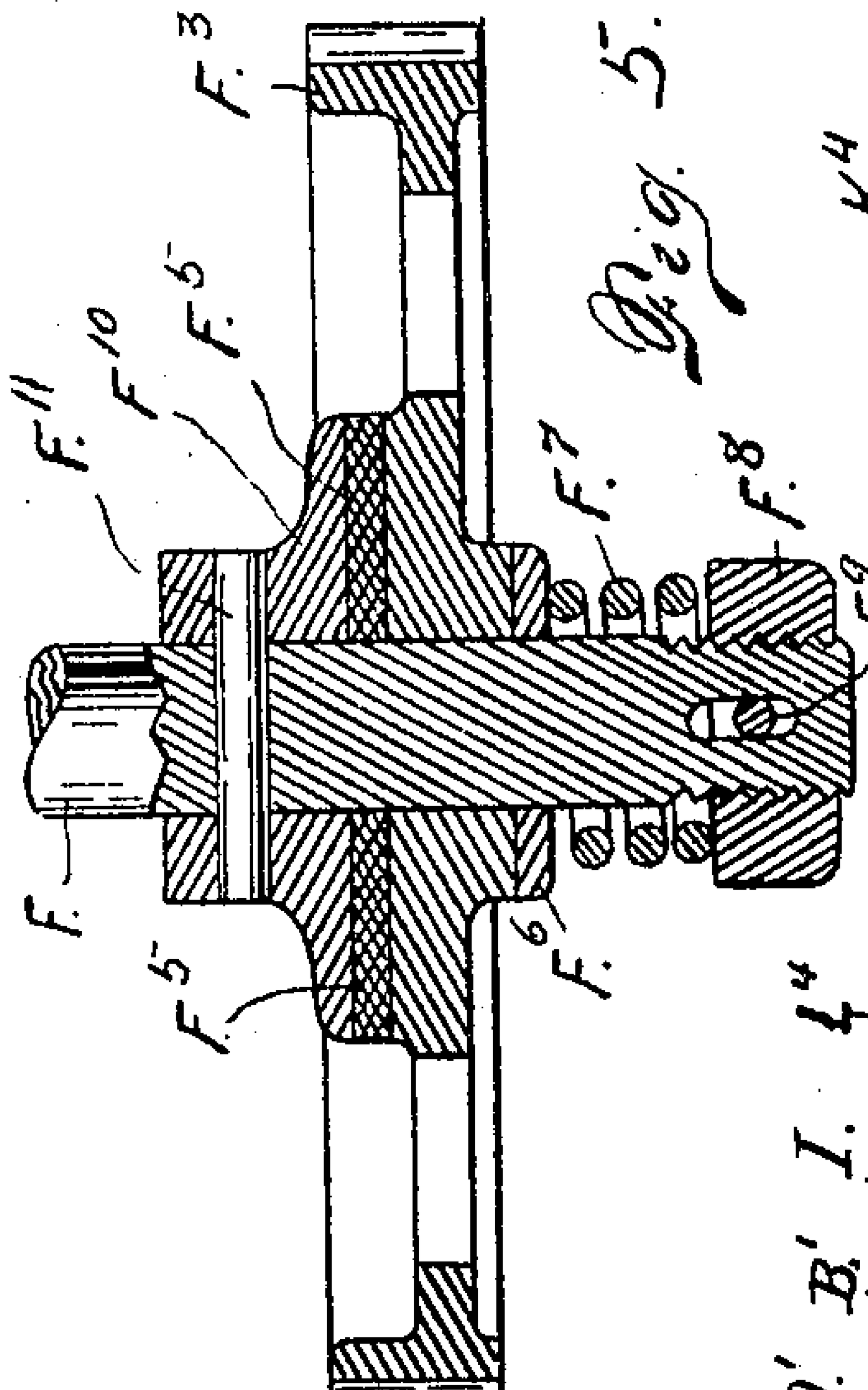

Fig. 5.

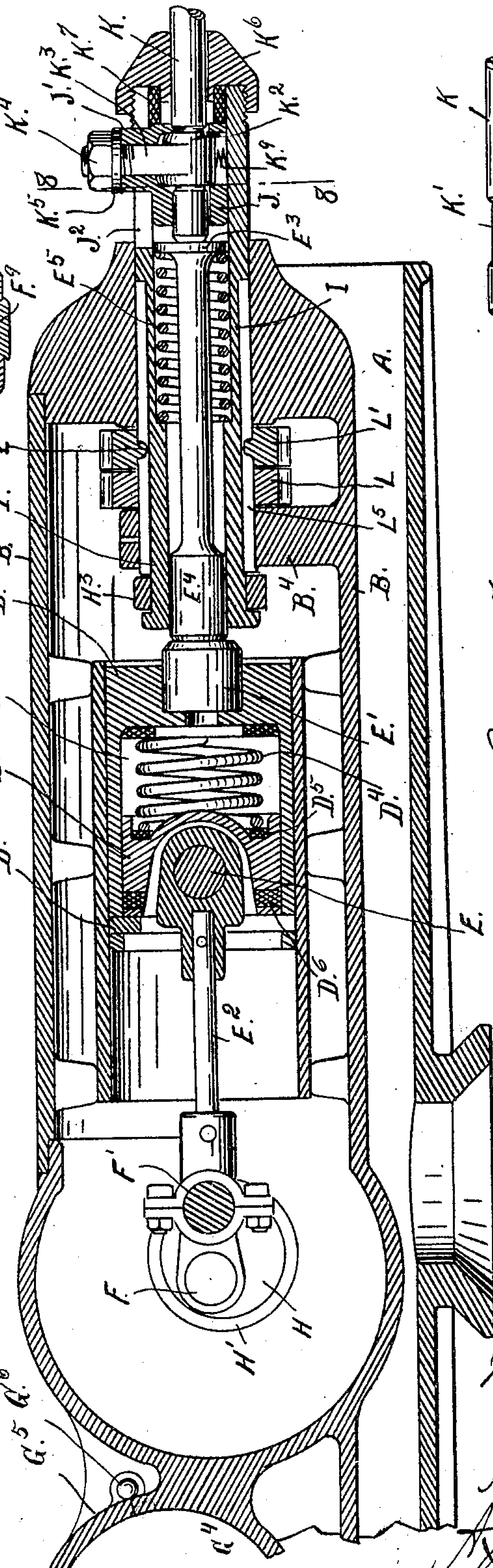

Fig. 3.

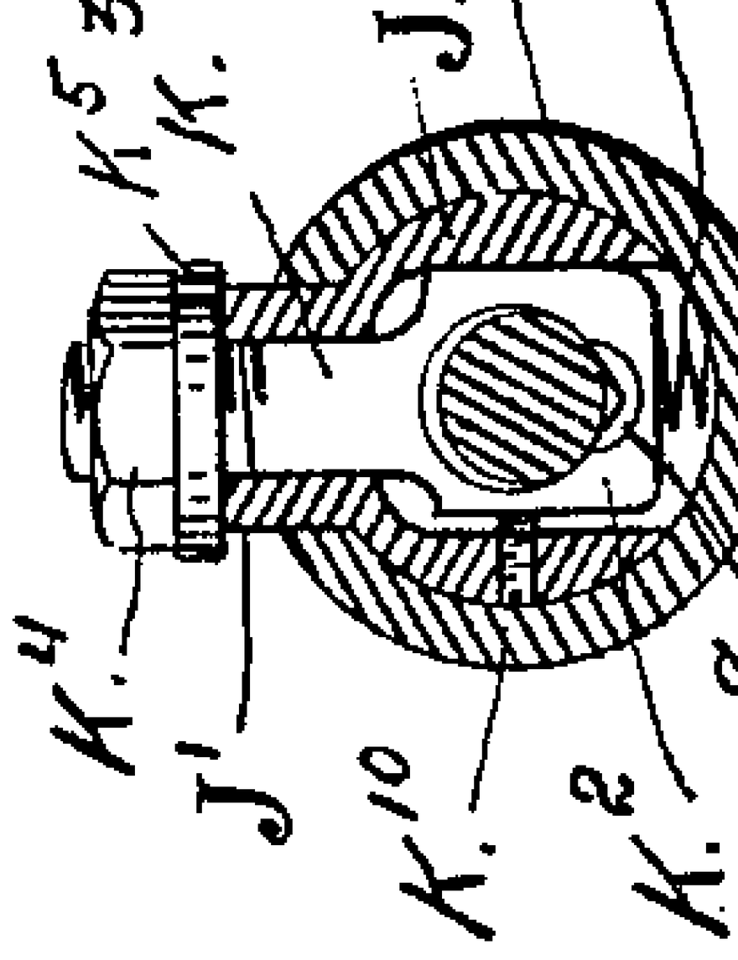

Fig. 8.

Fig. 9

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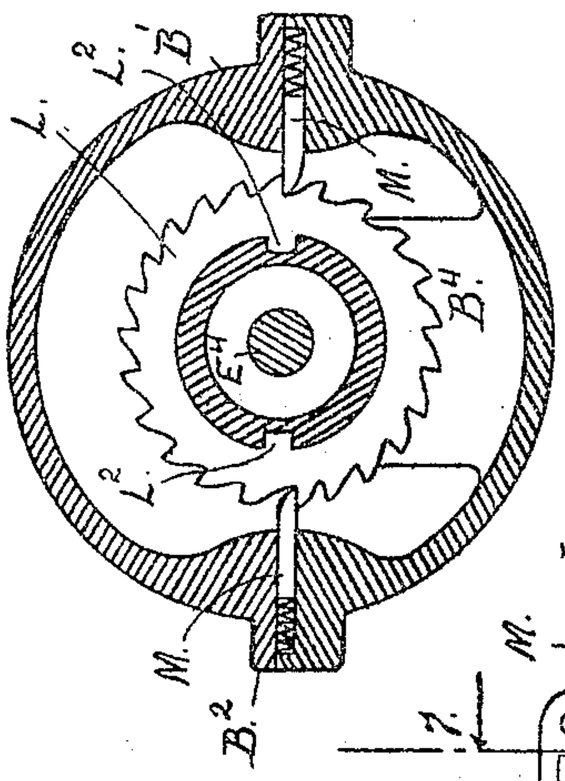
4 SHEETS—SHEET 3.

Fig. 6.



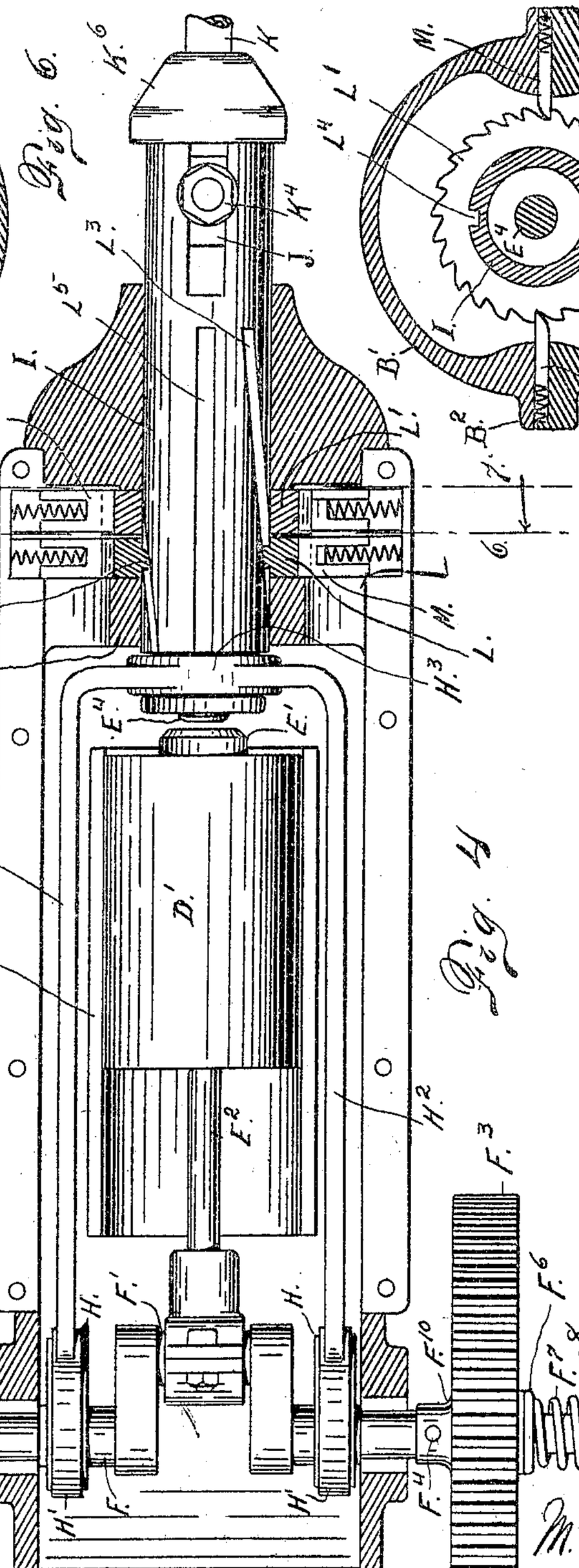


Fig. 7.

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4 SHEETS—SHEET 4.

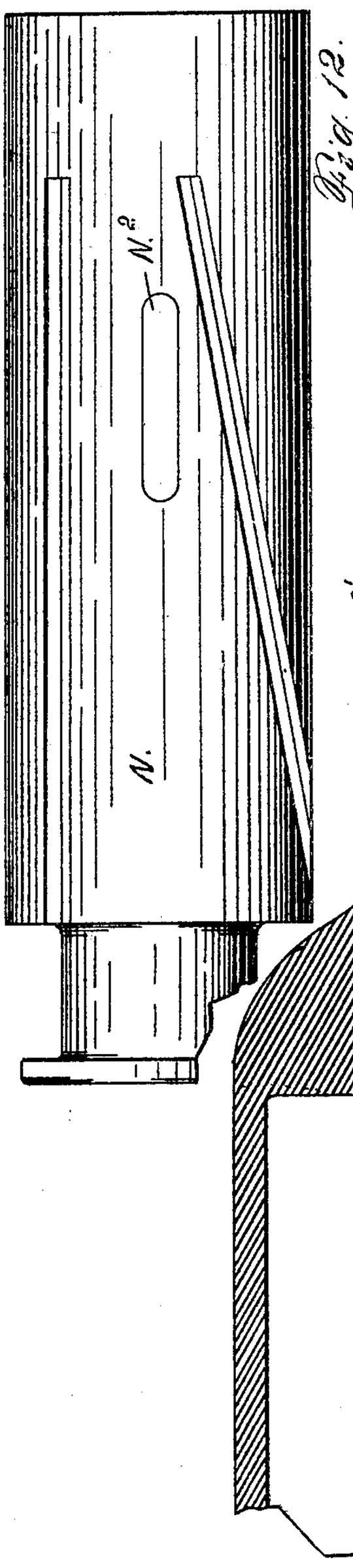

Fig. 12.

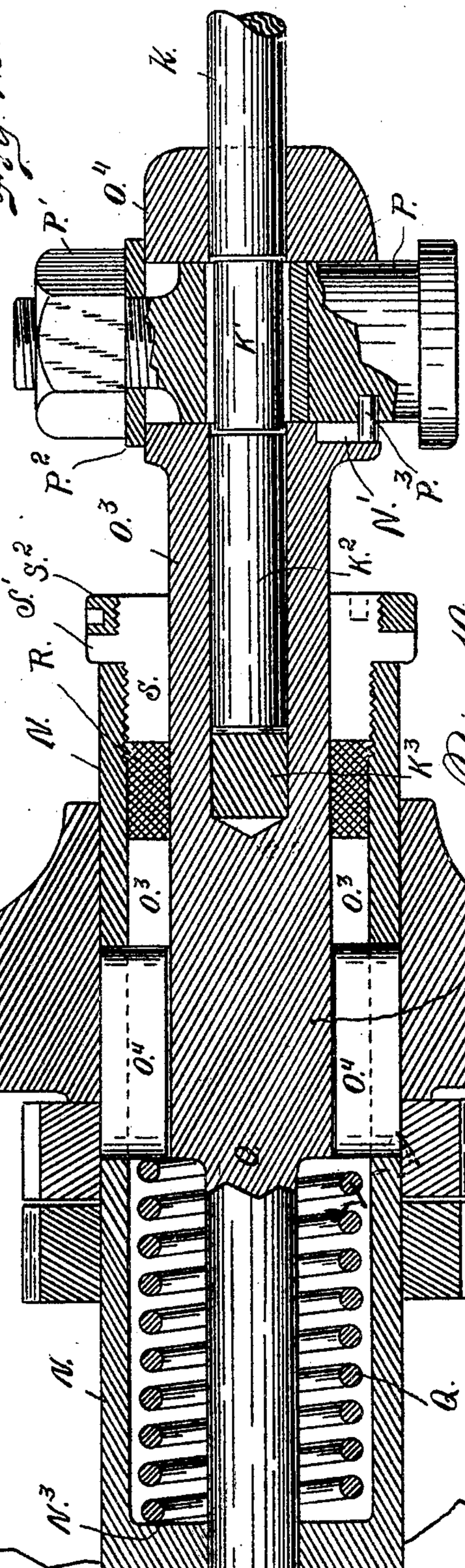

Fig. 10.

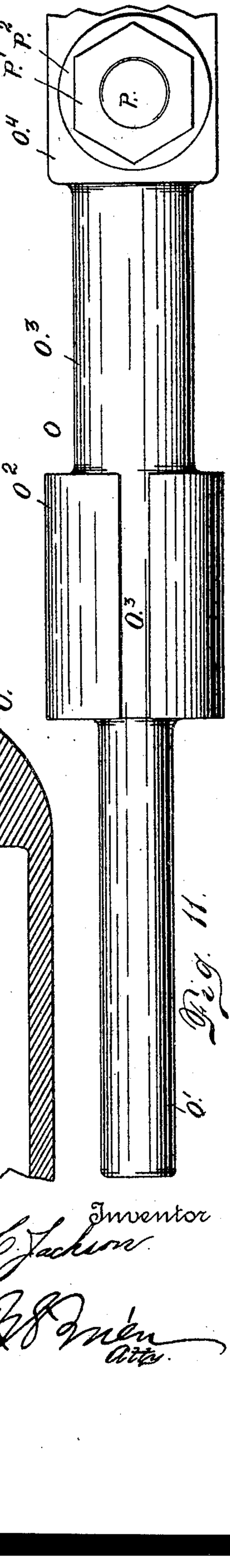

Fig. 11.

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UNITED STATES PATENT OFFICE.

MANETHO C. JACKSON, OF DENVER, COLORADO, ASSIGNOR TO THE JACKSON ELECTRIC DRILL AND SUPPLY COMPANY, OF DENVER, COLORADO.

ROCK-DRILL.

No. 798,416. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed February 15, 1904. Renewed January 30, 1905. Serial No. 243,349.

To all whom it may concern:

Be it known that I, MANETHO C. JACKSON, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Rock-Drills; and I 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 letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rock-drills.

Experience has proven that what is known as the "hammer-drill" is most effective in cutting rock were it not for the difficulty in keeping the hole clean of the rock-cuttings. Various devices have been resorted to to accomplish this purpose; but none of them have proven entirely satisfactory, being troublesome and complicated in operation and construction.

My object in producing my present construction is to combine in one mechanism the advantages of both the hammer and the piston drill construction, whereby all the advantages of the hammer-drill are obtained without experiencing any of the difficulties in keeping the hole clean. It will be understood that in what is known as a "hammer-drill" the driving reciprocating part is not directly connected with the drill proper or cutting-tool, while in what is known as the "piston-drill" the driving or reciprocating part is directly connected with the cutting-tool, which reciprocates therewith. In my approved construction the hammer is entirely distinct and separate from the drilling-tool or drill-bit proper, while at the same time provision is made for reciprocating the drilling-tool simultaneously with the operation of the reciprocating hammer. This is the broad distinguishing feature of my present construction, which 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 side elevation, partly in section, illustrating my improved drill. Fig. 2 is a top or plan view of the drill, the gear connection with the armature-shaft of the motor being partly broken away. Fig. 3 is a central vertical section taken through the drill mechanism. Fig. 4 is a top or plan view of the mechanism with the upper portion of the casing removed. Fig. 5 is an enlarged section taken through the gear on one extremity of the operating crank-shaft. Figs. 6 and 7 are sections taken on the lines 6 6 and 7 7, respectively, looking in the direction of the arrows. Fig. 8 is a section taken on the line 8 8, Fig. 3. Fig. 9 is a fragmentary view of the rear part of the drill bit or tool, showing the circumferentially-grooved portion which is engaged by the device for locking the drill-bit securely in the chuck. Fig. 10 is a section taken through the forward end of the mechanism, showing a modified form of construction. Fig. 11 is a detail view of the form of chuck shown in Fig. 10. Fig. 12 is an elevation of the outer chuck member through which the chuck proper or the device shown in Fig. 11 passes.

The same reference characters indicate the same parts in all the views.

Let A designate the guide-shell or relatively stationary support upon which the casing B is slidably mounted. This casing is provided with a top cover or housing B′, having horizontal flanges B^2, which engage corresponding flanges formed on the body of the casing. The flanges of the two casing parts are provided with registering apertures through which are passed fastening-bolts B^5. It will thus be seen that the housing part B′ is readily detachable whenever it is desired or necessary to gain access to the mechanism inclosed thereby. The casing B is provided on its lower rear portion with a nut B^3, in which is threaded the feed-screw C, journaled on the guide-shell, as shown at C′. This feed-screw is provided with the usual hand-crank C^2. Centrally secured within the casing B is an open-ended cylinder D, in which is located a reciprocating piston D′, in which is mounted the hammer E′. The piston D′ is hollow, and within it is mounted a block D^2, having a limited reciprocating movement within the hollow portion D^3 of the piston. Interposed between the forward extremity of the block D^2 and the forward portion of the piston D′ is a coil-spring D^4. The block D^2 is provided with yielding washers D^5 and D^6, engaging its opposite ends. The head D^2 is locked in operative relation with the piston from the rear by means of a key D^7.

Pivotally connected with the block D^2 by a pin E is the forward extremity of a pitman E^2, whose rear extremity engages the crank F′ of the crank-shaft F, the latter being journaled in the casing and provided with a fly-wheel F^2 at one extremity and a gear-wheel F^3 at the other extremity. This gear-wheel F^3 rotates with the crank-shaft F by virtue of frictional engagement with a fiber washer F^5, interposed between the hub of the gear-wheel and a hub F^{10}, secured to the shaft by a pin F^{11}. The exterior surface of the hub of the gear-wheel is engaged by a washer F^6. Between this washer F^6 and a nut F^8, threaded on the extremity of the crank-shaft, is located a coil-spring F^7. By screwing the nut F^8 tightly against the spring F^7 the gear F^3 will be clamped tightly against the fiber washer F^5, whereby the crank-shaft will be rotated by virtue of the meshing engagement of the gear F^3 and the gear G on the motor-shaft. If, however, for any reason the movement of the hammer is suddenly arrested or obstructed, the gear F^3 will rotate on the crank-shaft without moving the latter, thus preventing breakage of some of the parts of the mechanism. This will continue until the person in charge of the drill can turn off the current and stop the motor. It will be understood that this construction is for safety purposes. After the nut F^8 is screwed to position on the threaded end of the crank-shaft it may be locked against rotation by a pin F^9, passed through an opening in the nut and an elongated opening formed in the end of the crank-shaft. The gear F^3 meshes with the gear G, made fast to the armature-shaft G^2 of a motor G^3, inclosed within a housing G^4, formed integral with the rear extremity of the body of the casing B. The upper part G^5 of this housing is hinged to the casing, as shown at G^6, its opposite extremity being fastened to the body of the housing by a bolt G^{10}. It is evident that this cap or hinged housing part may be opened when for any reason it may be necessary to gain access to the motor mechanism. Also contained within a housing part G^7, formed integral with the casing, are located a rheostat G^8 and a controller G^9. It will thus be seen that the motor and its attachments are all mounted in the drill-casing or a housing formed integral with the body of the casing. On each side of the crank F′ of the crank-shaft F is formed an eccentric H, surrounded by a strap H′, formed integral with the yoke-arm H^2. The forward extremities of the two yoke-arms H^2 are connected by a ring H^3, which surrounds the rear extremity of the hollow chuck I, which is free to rotate in the yoke. In the forward extremity of this chuck is located a locking device J, open to receive the drill bit or tool K. This locking device is provided with a projection J′, which passes through a slot J^2, formed in the chuck, whereby the said device is permitted a limited movement in the chuck and independently of the latter. The portion of the drill-bit within the locking device is circumferentially recessed, as shown at K′, and is engaged by the hub K^2 of a fastening device, the latter being provided with an integral bolt K^3, which passes outwardly through an opening formed in the part J, its protruding portion being threaded and adapted to receive a nut K^4. Between the nut and the part J is located a washer K^5. The opening in the fastening device K^2 is large enough to receive the body part of the drill-bit K; but by adjusting the fastening-piece K^2 by means of the nut K^4 the drill-bit may be securely locked in the part J. The bottom of the fastening device K^2 where it engages the drill-bit is provided with a V-shaped recess K^8 to facilitate the fastening of the parts. Engaging the bottom of the fastening device K^2 is a coil-spring K^9, which has a tendency to normally support the fastening device K^2 in engagement with the drill-bit. When the fastening device is adjusted by means of the nut K^4, a screw K^{10} may be inserted in the device J for locking the device K^2 in the adjusted position. The part J is in turn securely retained in the forward end of the chuck, which is threaded to receive a nut K^6. Between this nut and the part J is located a packing ring or washer K^7. Located in and extending through the hollow chuck I and interposed between the rear extremity of the drill-bit K and the hammer E′ is an auxiliary hammer part E^4, having an enlarged forward extremity E^3. Between this forward extremity of the auxiliary hammer part and an interior shoulder formed on the hollow chuck is located a coil-spring E^5, which is normally under sufficient tension to hold the forward extremity of the auxiliary hammer part normally in engagement with the rear extremity of the drill-bit. This auxiliary hammer part is allowed to move freely in the hollow chuck, as will be readily understood.

The rotary movement is imparted to the drill-bit and chuck through the instrumentality of two ratchet-wheels L and L′, which are interposed between the forward extremity of the casing and a support B^4, formed integral with the casing and having an opening to receive the chuck. The teeth of these two ratchet-wheels are oppositely disposed and engaged by spring-actuated dogs M, located in recesses formed in the casing. The ratchet L is provided with lugs L^2, which engage spiral grooves L^3, formed in the chuck, while the ratchet-wheel L′ is provided with lugs L^4, which engage straight grooves L^5, formed in the chuck. During the forward movement of the chuck and drill-bit the latter moves in a direct line without any rotary motion, since the lugs of the ratchet-wheel L′, engaging the straight grooves in the chuck, prevent the chuck from turning in one direction, while the spiral grooves L^3 of the chuck, acting on the ratchet-wheel L, cause the same to turn

in the casing, while during the backward movement of the chuck the latter is given a partial rotation through the instrumentality of the spiral grooves acting on the ratchet-wheel L, and in this case the ratchet-wheel L′ turns with the chuck, as will be readily understood.

From the foregoing description the use and operation of my improved drill will be readily understood. As soon as the motor is started rotary movement is imparted to the crank-shaft F through the instrumentality of the meshing gears G and F^3. During the rotation of this crank-shaft it will be understood from the description heretofore given that the hammer will be reciprocated by the pitman E^2 and the chuck and drill-bit simultaneously actuated through the instrumentality of the yoke having the arms H^2. The crank and eccentrics are so arranged that the hammer and chuck simultaneously reach their forward limit of movement; but as the stroke of the hammer is considerably greater than the stroke of the chuck by reason of the difference in the throw of the crank and eccentrics when the hammer and chuck are at their rearward limit of movement there will be considerable space between the hammer and the rear extremity of the auxiliary hammer part, allowing the hammer when it acts on the auxiliary hammer part, and consequently upon the drill-bit, to gain momentum and act on the said parts by a sudden blow or impact, as is required or necessary, in order to get the best results in work of this character. By virtue of this operation the drill-bit is reciprocated simultaneously with the reciprocation of the hammer or driving-piston and the drill-hole kept clean or free from accumulated rock-cuttings in the same manner as in the use of a piston-drill.

Referring now to the construction shown in Figs. 10, 11, and 12, let N designate a hollow chuck member inserted in the forward end of the drill-casing and connected with the yoke-arms H^2 in the same manner as the chuck I shown in the other views of the drawings. Inserted in this chuck member N and passing therethrough is the chuck proper, O, whose rear extremity O′ is smallest in diameter, its central part being enlarged, as shown at O^2, the part immediately forward of the part O^2 being somewhat reduced in size, as shown at O^3, while the forward extremity O^4 is made larger than the part O^3. The forward part of the chuck O is centrally bored a suitable distance to receive the drill-bit K. The forward end O^4 of the chuck is also transversely bored to receive a locking device P, which is apertured to receive the drill-bit. The drill-bit is reduced in size, as shown at K′, where it is engaged by the locking device P, and when the nut P′ is screwed tightly against the washer P^2 the drill-bit is locked securely in the chuck. To prevent the locking device P from turning in the chuck, a locking-pin P^3 is inserted in the said device before the latter is introduced into the transverse opening of the chuck. This pin P^3 protrudes from the locking device into a slot N′, formed in the hollow chuck member, the said slot being of a size to fit the protruding portion of the pin P^3. The rear extremity K^2 of the drill-bit is composed of hardened tool-steel and engages a block or plug K^3 of the same material located in the rear extremity of the longitudinal chuck-opening. The two hardened parts being in engagement with each other prevent the upsetting of the rear extremity of the drill-bit during the operation of the drill. The enlarged part O^2 of the chuck is slotted, as shown at O^3, to receive keys O^4, dropped into openings N^2, formed in the hollow chuck member. These keys cause the chuck proper, O, to rotate with the hollow chuck member N. Surrounding the reduced part O′ of the chuck is a coil-spring Q, located within the hollow of the member N. The rear extremity of this spring bears against a shoulder N^3 on the part N, while its forward extremity engages the rear extremity of the enlarged part O^2 of the chuck. Forward of this part O^2 of the chuck is located a cushion ring or washer R. The chuck O is thus held within the hollow member N between the cushion R and the spring Q. The slots O^3 of the chuck are somewhat longer than the keys O^4, whereby the chuck is permitted a limited independent longitudinal movement in the hollow member N between the cushion R and the spring O. This provision will prevent breakage of any of the parts of the machine in case the drill-bit is forced too tightly against the rock or in case an unusually hard substance comes in contact with the cutting extremity of the drill-bit. In either case the chuck proper is allowed to yield by virtue of the construction heretofore explained. The cushion washer or ring R is held in place by means of a collar S, screwed into the forward extremity of the hollow member N and having a shoulder S′, which abuts against the forward end of the member N. The collar S is split or composed of two twin members. This is necessary in order to put the same in position. The two members of the part S are connected by an interiorly-threaded ring S^2, which is large enough to pass over the enlarged part O^4 of the chuck, and when screwed to position on the split collar S the latter is held together and performs the function of an integral collar.

Attention is called to the fact that the part D′, termed the "piston" and the hammer part E′ really together constitute a hammer. The part E′ is a hardened-steel part mounted in the part D′; but otherwise the two parts may be considered an integral device and in con-

struing the claims hereinafter presented this feature should be considered.

Having thus described my invention, what I claim is—

1. In a rock-drill or similar machine, the combination with a crank-shaft, of a hammer, a drill-bit arranged to be acted on by the hammer, and suitable connections between the crank-shaft and the hammer and between the crank-shaft and drill-bit for simultaneously imparting to the hammer and bit a reciprocating movement.

2. In a rock-drill or similar tool, the combination with an eccentric shaft, of a hammer, a drill-bit distinct from the hammer but arranged to be acted on thereby, and suitable connections between the eccentric shaft and the hammer, and between the eccentric shaft and drill-bit for simultaneously imparting to the hammer and bit a reciprocating movement.

3. In a rock-drill, the combination of a hammer, a crank-shaft, a pitman connecting the crank of the shaft with the hammer, a reciprocating chuck carrying the drill bit or tool, a yoke connected with eccentrics on the crank-shaft at one extremity and with the chuck at the opposite extremity, whereby as the crank-shaft is rotated, a reciprocating movement is simultaneously imparted to the hammer and chuck.

4. The combination with a suitable casing, of a hollow chuck mounted to reciprocate therein, a drill-bit connected with the forward extremity of the chuck, a hammer also mounted to reciprocate in the casing, an auxiliary-hammer part mounted in the chuck and interposed between the hammer proper and the drill-bit, a spring located in the chuck and acting on the auxiliary-hammer part to normally hold the forward extremity of the latter in contact with the rear extremity of the drill-bit, and suitable means for imparting to the hammer proper and the chuck and its connections a reciprocating movement, the strokes of the two instrumentalities being of different length.

5. The combination with a suitable casing, of a hollow chuck mounted to reciprocate and rotate therein, a drill-bit suitably connected with the forward extremity of the chuck, an auxiliary device located in the chuck, yielding means for holding the forward extremity of the auxiliary device in contact with the rear extremity of the drill-bit, a hammer mounted to reciprocate in the casing and arranged to act directly on the auxiliary device, and suitable means for simultaneously imparting to the hammer and the chuck and its connections a reciprocating movement.

6. In a drill, the combination with a suitable casing, of a chuck mounted to reciprocate and rotate therein, a drill-bit carried by the chuck, a hammer also mounted to reciprocate in the casing, an auxiliary device interposed between the hammer and drill-bit, means for simultaneously imparting to the hammer and the chuck and its connections a reciprocating movement by strokes of different length, and suitable means for automatically imparting to the chuck and drill-bit the required rotary action.

7. In a rock-drill or similar tool, the combination with a crank-shaft, of a hammer, a drill-bit distinct from the hammer but arranged to be acted on thereby, a connection between the crank-shaft and the hammer, and an independent connection between the crank-shaft and drill-bit, for simultaneously imparting to the hammer and bit a reciprocating movement.

8. In a rock-drill or similar tool, the combination with a crank-shaft, of a drill-bit, a hammer independent of the drill-bit, and suitable connections between the crank-shaft and the hammer and between the crank-shaft and the drill-bit for simultaneously imparting to the hammer and bit a reciprocating movement when the crank-shaft is rotated, the hammer and drill-bit moving in the same or parallel lines.

9. In a rock-drill or similar tool, the combination with a crank-shaft, of a bit or cutting-tool mounted to have a reciprocating movement, a hammer independent of the drill-bit and mounted to reciprocate and act on the drill-bit, and suitable connections between the crank-shaft and the hammer and between the crank-shaft and the drill-bit for simultaneously imparting to the hammer and bit a reciprocating movement by strokes of different length.

10. In a rock-drill, the combination with a crank-shaft, a drill-bit mounted to reciprocate, a hammer mounted to act on the drill-bit but distinct and separate therefrom, the hammer and bit being mounted to reciprocate in the same or parallel lines, and suitable connections between the hammer and crank-shaft and between the drill-bit and crank-shaft for simultaneously imparting to the hammer and bit a reciprocating movement by strokes of different length.

11. In a rock-drill or similar tool, the combination with a shaft having a crank and eccentrics, of a hammer, a drill-bit arranged to be acted on by the hammer, a connection between the crank of the shaft and the hammer and between the eccentrics of the shaft and the drill-bit, for simultaneously imparting to the hammer and drill-bit a reciprocating movement by the rotation of the shaft.

12. The combination with an operating crank-shaft, of a hammer mounted to reciprocate, a drill-bit mounted to reciprocate and disconnected from the hammer but arranged to be acted on thereby, and an operating connection between the crank-shaft and drill-bit and between the crank-shaft and hammer, substantially as described.

13. In a drill, the combination with a driving-shaft, of a collar fast thereon, a gear loose thereon, a friction-disk interposed between the gear and collar and of softer material than either, a spring surrounding the shaft and acting on the gear, and means for regulating the tension of the spring, whereby the pressure of the gear upon the friction-disk may be regulated at will.

14. In a drill, the combination with a driving-shaft, of a collar fast thereon, a gear loose on the shaft, a friction disk or washer interposed between the collar and the gear and of softer material than either, a washer engaging the outer face of the hub of the gear, a spring engaging the last-named washer, a nut screwed on the threaded extremity of the shaft to engagement with the spring whereby the latter may be given any desired tension, and means for locking the nut against rotation on the shaft.

15. In a motor-operated drill, the combination with the operating-shaft of the motor, a gear fast thereon, the driving-shaft of the drill, a gear mounted thereon and meshing with the motor-gear, the shaft being provided with a friction-face and the gear having a face engaging the friction-face of the shaft, the friction-face being of softer material than the parts engaged thereby and means applied to the shaft for forcing the gear against the friction-face of the shaft with any desired tension.

16. In a rock-drill or similar machine, the combination with a rotary shaft, of a hammer, a drill bit or tool independent of the hammer but arranged to be acted on thereby, and suitable connections between the hammer and shaft and between the tool and shaft whereby the rotation of the shaft imparts a reciprocating movement to the hammer and drill-bit.

17. In a rock-drill or similar machine, the combination with a rotary shaft, of a hammer, a drill bit or tool independent of the hammer but arranged to be acted on thereby, and connections between the hammer and shaft and between the tool and shaft whereby as the shaft is rotated a reciprocating movement is simultaneously imparted to the hammer and tool, both strokes of the reciprocation being imparted by the rotation of the shaft.

In testimony whereof I affix my signature in presence of two witnesses.

MANETHO C. JACKSON.

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A. J. O'BRIEN.