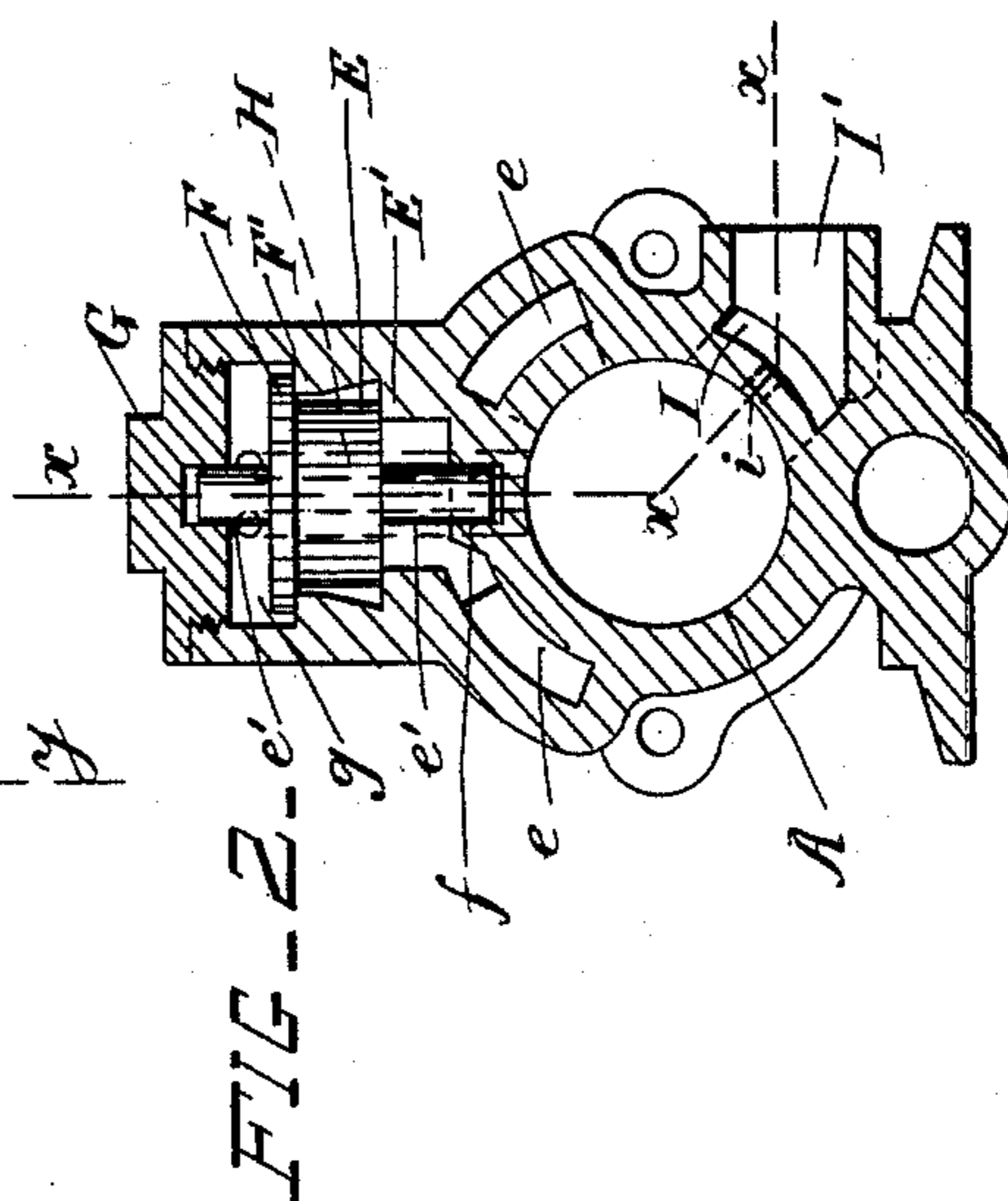
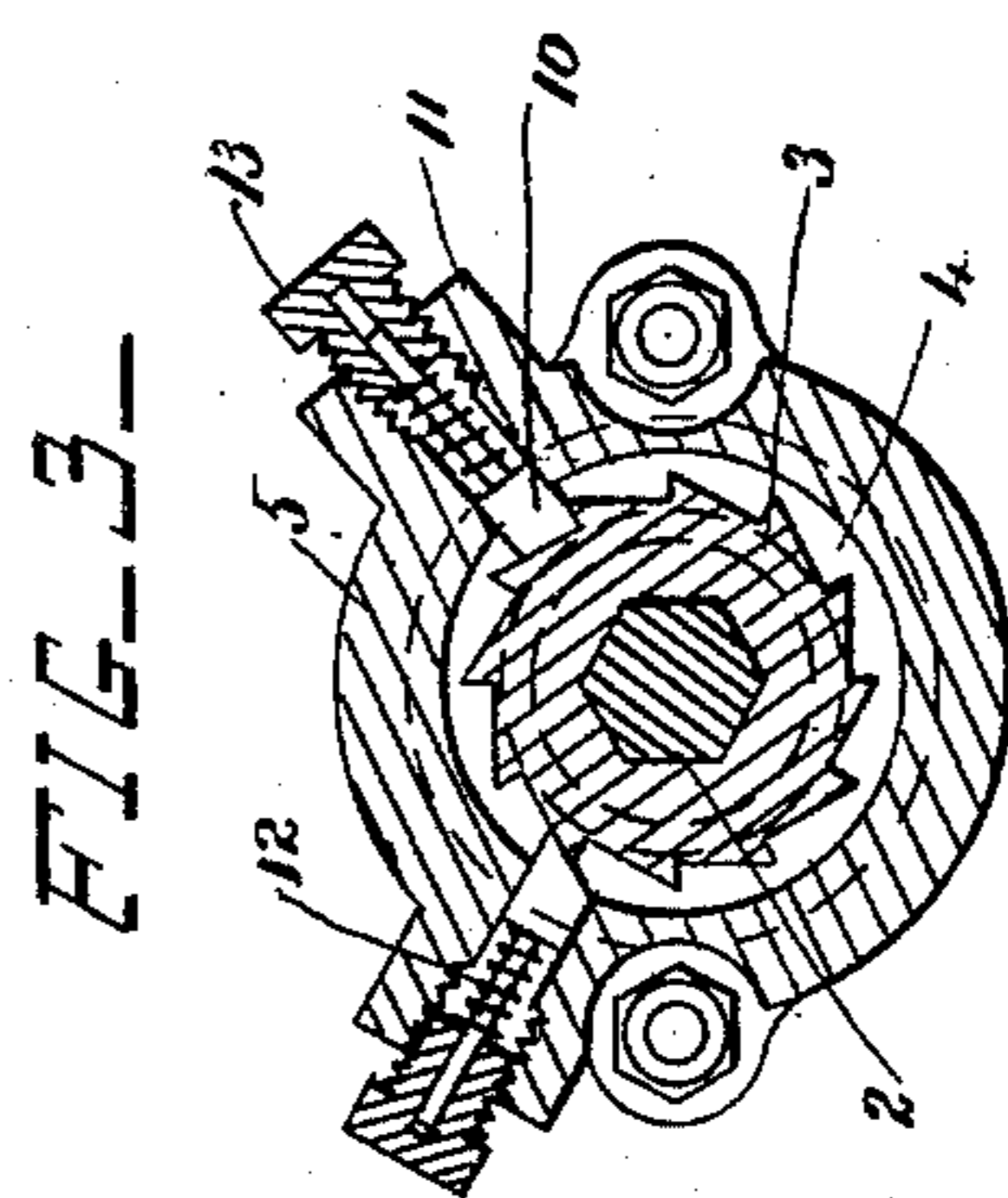
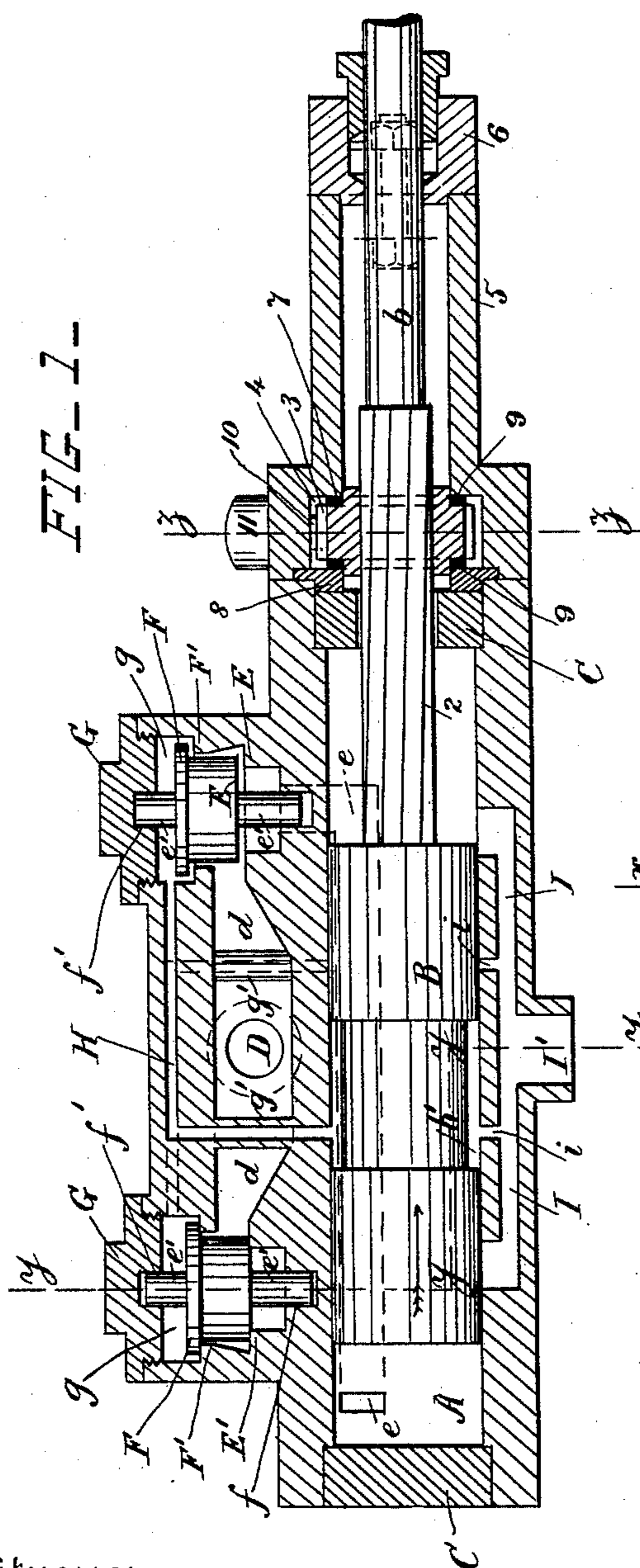


(No Model.)

H. G. WILLIAMS.  
ROCK DRILL.

No. 475,910.

Patented May 31, 1892.



## Witnesses

Walter Allen  
J. Winter

Inventor

Horace G. Williams

By *his* Attorney

Herbert W. Jenner.

# UNITED STATES PATENT OFFICE.

HORACE GUERNSEY WILLIAMS, OF LYKENS, PENNSYLVANIA.

## ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 475,910, dated May 31, 1892.

Application filed September 8, 1891. Serial No. 405,099. (No model.)

*To all whom it may concern:*

Be it known that I, HORACE GUERNSEY WILLIAMS, a citizen of the United States, residing at Lykens, in the county of Dauphin and State of Pennsylvania, have invented certain new and useful Improvements in Rock-Drills; and I do hereby 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.

This invention relates to rock-drills; and it consists in the novel construction and combination of the parts by which the drill is actuated, as hereinafter fully described and claimed.

In the drawings, Figure 1 is a longitudinal section through the cylinder of the rock-drill, taken on the line  $x x x$  in Fig. 2. Fig. 2 is a cross-section through the cylinder and one of the air-valves, taken on the line  $y y$  in Fig. 1. Fig. 3 is a cross-section through the piston-rod and distance-piece, taken on the line  $z z$  in Fig. 1.

A is the cylinder.

B is a long piston working in the cylinder and provided with a piston-rod  $b$  at one end for connecting it to the drill or other mechanical device to be worked by the piston. The piston-rod  $b$  is provided with spiral flat portions 2, which slide back and forth in a correspondingly-shaped hole in a ratchet-wheel 3. This ratchet-wheel 3 revolves in a chamber 4 in the distance-piece 5, which is bolted to the front end of the cylinder. A stuffing-box 6 is secured to the front end of the distance-piece, and that part of the piston-rod which passes through the stuffing-box is round. The ratchet-wheel is prevented from moving longitudinally by the shoulder 7 of the distance-piece and the collar 8, arranged between the distance-piece and the cylinder. Washers 9 are arranged on each side of the ratchet-wheel to reduce the friction. The ratchet-wheel 3 is provided with pawls 10, sliding in bosses 11 on the distance-piece. These pawls are adapted to permit the ratchet-wheel to revolve in one direction and to prevent its return movement. Springs 12 are provided for pressing the pawls into gear with the teeth of the ratchet-wheel, and 13 are caps

screwed into the bosses 11 and adapted to guide the stems of the pawls and to adjust the pressure of the springs. When the piston is pushed forward, the piston-rod turns the ratchet-wheel; but when the piston-rod is pushed backward the pawls prevent the ratchet-wheel from turning backward, and the flat spiral portions on the piston-rod cause it to be partially revolved, thereby giving the drill its necessary rotatory movement at each instroke.

C are india-rubber buffers at each end of the cylinder. The cylinder-back cover and the other parts of the rock-drill, which are not hereinafter described, and which are not shown in the drawings, are of ordinary approved construction.

D is the inlet for compressed air or steam, and  $d$  is a longitudinal passage communicating therewith and formed in the side of the cylinder-casting.

E are the inlet-valves to the cylinder, resting upon the seats  $E'$  at the ends of the passage  $d$ , and  $e$  are the inlet-ports, extending from the under side of the inlet-valves and entering the cylinder near its ends. The passage  $d$  is placed in the center and the ports  $e$  are arranged longitudinally upon each side of it in the cylinder-casting. Both the inlet-valves and their passages are exactly alike, and each inlet-valve is arranged at that end of the cylinder to which it does not pertain. Thus the valve E at the front end of the cylinder admits the compressed air to the rear end of the cylinder and the valve at the rear end admits the compressed air to the front end of the cylinder. The object of this arrangement is to obtain a large air-space between the under side of each inlet-valve and the cylinder. The air is compressed by the piston into these spaces, so that very great compression in the ends of the cylinder is avoided.

F are valves resting upon the seats  $F'$ , above the valves E, the holes through the seats  $F'$  being a little larger than the valves E, so that the valves E may project upward through the said holes and join onto the valves F.

G are removable caps for closing the valve-chambers  $g$ , and the said caps are secured to the valve-chambers in any approved manner. The valve-stems  $e'$  slide in the guides  $f$  in

the cylinder and  $f'$  in the caps G; but the valves may be guided in any other approved manner.

H are small ports which connect the valve-chambers  $g$ , above the valves F, with the middle portion of the cylinder, and  $g'$  are bosses or pipes in the passage  $d$  for the ports H to pass through. The ports H extend longitudinally past each other in the cylinder-casting. 5  
10 A circumferential groove  $b'$  is formed in the piston, and this groove has its length substantially equal to the distance between the ports H.

I are the exhaust-ports, formed through the side of the cylinder and provided with an outlet-opening I'. Small ports  $i$  are also formed through the side of the cylinder, substantially in line with the ends of the ports H, and open into the said exhaust-ports I. 15

20 The action of the engine is as follows: When the parts are in the positions shown in the drawings and compressed air is allowed to enter the inlet D, the compressed air raises the valves E and F at the front end of the cylinder, because the diameter of the hole through the valve-seat F' is greater than the diameter of the valve E and because the chamber  $g$  above the valve F is in communication with the atmosphere through the ports 25 H and  $i$ , the groove  $b'$ , and the exhaust-port I. The compressed air passes through the valve E, down the port  $e$ , into the rear end of the cylinder and propels the piston in the direction of the arrow in Fig. 1. The forward motion of the piston closes the exhaust-port I at 30 the front end of the cylinder and also closes the small port H at the rear part of the cylinder. The expansion of the compressed air in the cylinder, together with the momentum of the reciprocating parts, carries the piston on- 40 ward until the exhaust-port I at the rear end of the cylinder is uncovered, the air being compressed in the front end of the cylinder and in the port  $e$ , communicating with it during the latter part of the stroke of the piston. The forward motion of the piston also places the chamber  $g$  above the valve F at the rear end of the cylinder in communication with the exhaust-port I at the front end of the cylinder directly after it closes the small port H 50 at the rear end of the cylinder. The piston,

however, continues its forward stroke after uncovering the exhaust-port at the rear end of the cylinder, because it moves with a very high velocity and because it takes a certain 55 space of time for the compressed air to raise the valves E and F and to rush from the passage  $d$  through the valve E and down the port  $e$  into the front end of the cylinder. Directly the piston arrives at the end of its forward stroke it is propelled rearwardly by the 60 air compressed by it in the front end of the cylinder and in the port  $e$ , leading into that end, and by the compressed air which rushes in through the valve E. The piston returns 65 to the rear end of the cylinder and will continue to reciprocate in the cylinder as long as compressed air is supplied.

What I claim is—

1. The combination, with the cylinder and 70 the long-grooved piston sliding therein, of separate lift-valves resting upon seats at those ends of the cylinder to which they do not pertain, the said cylinder being provided with ports extending longitudinally past each other 75 and connecting the said valves with the ends of the cylinder to which they do pertain and having small ports also extending past each other and adapted to relieve the pressure behind the said valves and to permit them to 80 open automatically when the said small ports are uncovered by the piston in the cylinder, substantially as set forth.

2. The combination, with the piston-rod 85 provided with spiral portions, of a ratchet-wheel mounted on the said portions, the distance-piece inclosing the piston-rod and ratchet-wheel and provided with a stuffing-box at its front end, the collar between the ratchet-wheel and the cylinder, the washers 90 on each side of the ratchet-wheel, and the spring-actuated pawls adapted to engage with the ratchet-wheel, whereby the piston may be partially revolved at each alternate stroke, substantially as set forth. 95

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

HORACE GUERNSEY WILLIAMS.

Witnesses:

J. L. BRALLIER,  
M. DICKERSON.