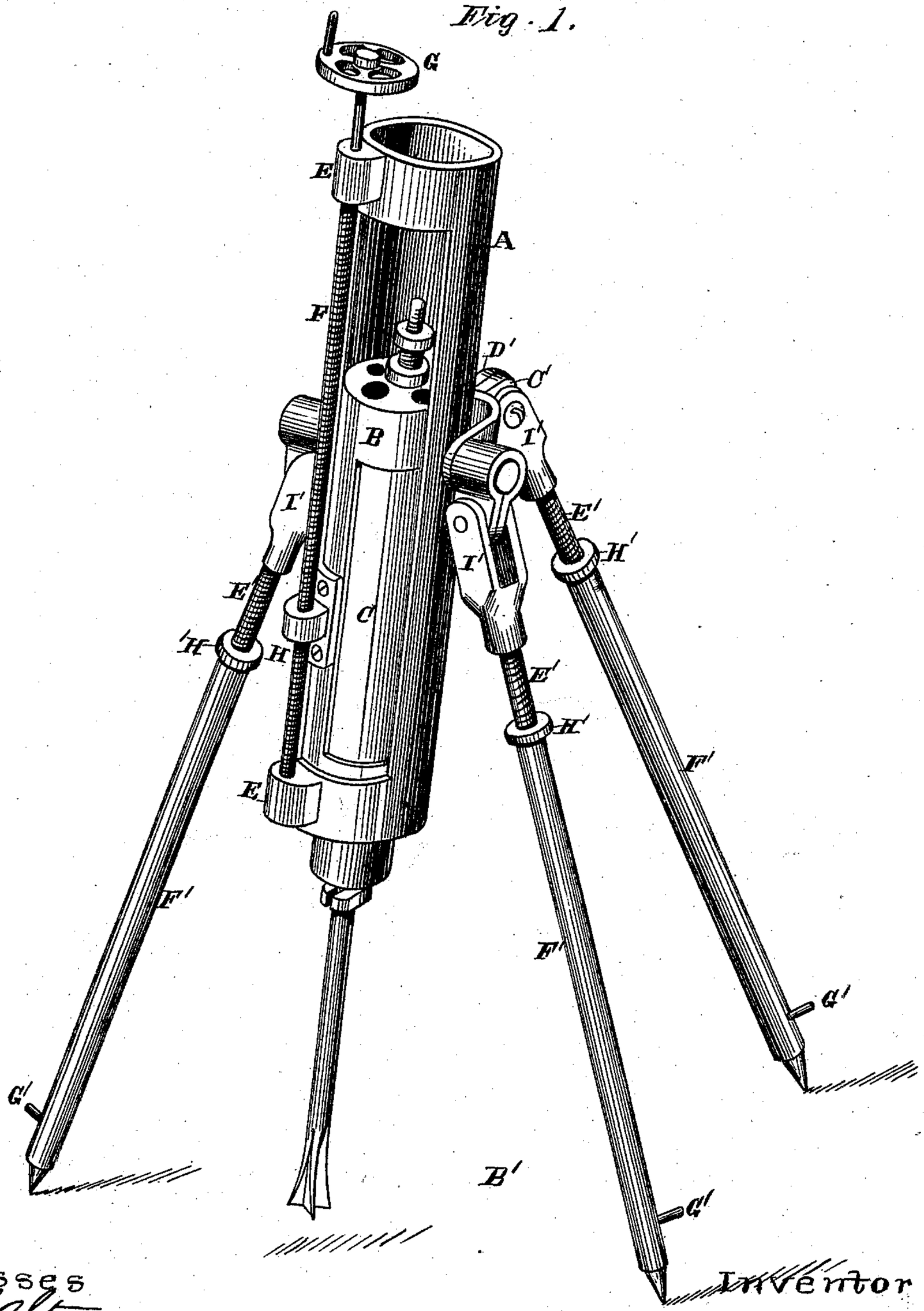
2 Sheets—Sheet 1.

H. RICHMANN.

Rock-Drilling Apparatus.

No. 214,704. Patented April 22, 1879.

Fig. 1.



Witnesses
Geo. H. Strong.
Frank A. Brooks

Inventor
Henry Richmann

2 Sheets—Sheet 2.

H. RICHMANN.

Rock-Drilling Apparatus.

No. 214,704. Patented April 22, 1879.

Fig. 2.

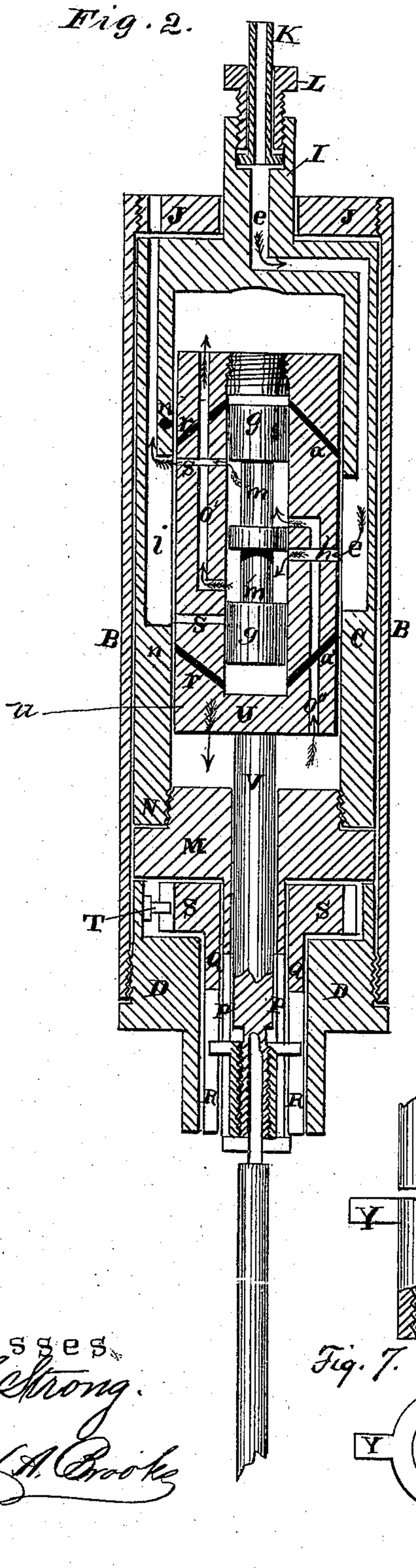


Fig. 3.

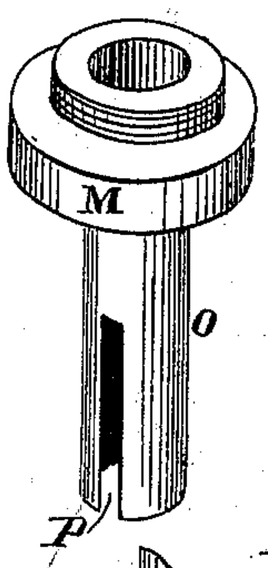


Fig. 4.

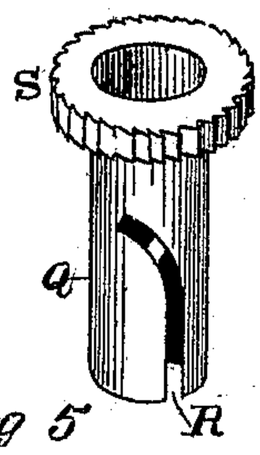


Fig 5

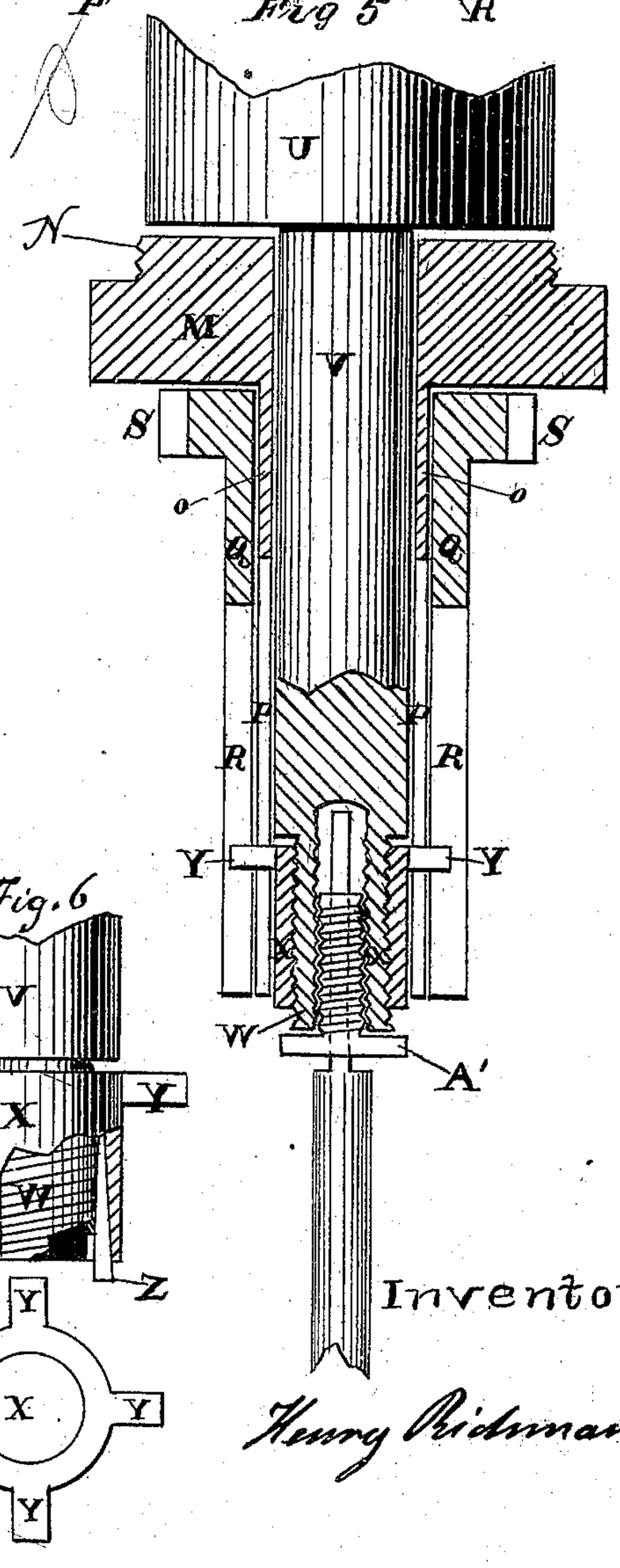


Fig. 6

Fig. 7.

Witnesses.
Geo. H. Strong.
Frank A. Brooke

Inventor
Henry Richmann

UNITED STATES PATENT OFFICE.

HENRY RICHMANN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF FIVE-EIGHTHS OF HIS RIGHT TO URIAH K. ARNOLD, OF SAME PLACE.

IMPROVEMENT IN ROCK-DRILLING APPARATUS.

Specification forming part of Letters Patent No. **214,704**, dated April 22, 1879; application filed November 6, 1878.

To all whom it may concern:

Be it known that I, HENRY RICHMANN, of the city and county of San Francisco, and State of California, have invented a Rock-Drilling Apparatus; and I hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings.

My invention relates to certain improvements in that class of machines known as "rock-drills," and in which the drill is actuated directly from a piston moving within a cylinder, which cylinder is in turn guided within a trough which is mounted upon a tripod.

My invention consists in a novel method of mounting and adjusting the parts upon the tripod, and also in an improved method of driving the piston which operates the drill and its actuating-valve, so that an extremely high rate of speed may be obtained.

My invention also consists in an improved means for regulating the rotation of the drill, and in certain details of construction, which will be more completely explained by reference to the accompanying drawings, in which—

Figure 1 is a view of my apparatus. Fig. 2 is a section through the axis of the cylinder. Figs. 3, 4, 5, 6, and 7 are detailed views of parts of the machine.

Let A represent the slotted cylindrical trough or carriage in which the cylinder and operating mechanism of the drill are supported, said carriage having trunnions, which are journaled in the tripod-stand, as shown. In the trough or carriage is fitted a slotted cylindrical case, B, which carries the cylinder C, said case having a removable head, D, arranged so that the head may be screwed on after the cylinder is in position.

At each end of the trough or carriage is a lug, E, in which rotates the feed-screw F, operated by the hand-wheel G, and said feed-screw passes through an internally-threaded lug or carrier, H, attached to the sliding case B, as shown. By rotating the hand-wheel the feed-screw slides the case B, carrying the cylinder and drill up and down in the carriage, thus giving any desired feed to the drill. By this construction the cylinder is free to revolve in the case, so as to give a proper rotation to the drill, as hereinafter described, while at the same time the drill may be fed forward or withdrawn from the hole.

The cylinder C has a neck or extension, I, which may project up through a central hole in the upper head, J, of the case B. At the upper end of this neck I is the coupling K for the hose, which furnishes compressed air or steam to the cylinder, and the stuffing-box L serves to keep a tight joint at this point. The hose-connection is made so as to remain stationary as the cylinder rotates.

A novel feature of my device is in the construction of the operating-piston having its controlling-valve situated within itself, and moving in the same direction with the piston, and this enables me to obtain a very high rate of speed.

The piston U moves in the cylinder C, and the stem or spindle V extends out through one end, and has the drill secured to it. The cylinder C has an extension or neck, I, through which an inlet-passage, *e*, is formed, this passage extending around to one side, as shown. Connection is made with this extension by means of a flexible pipe and a swiveling joint or coupling, K, which will allow the cylinder and drill to turn independently, as has been previously described.

Upon the side opposite to the inlet *e* are the outlet-passages *i n* for the cylinders and the valve-chamber, respectively. The piston is provided with inlet and discharge passages both for its own propulsion and for that of its contained valve. The valve *g* has two heads and a central projecting flange, which fit the chamber within which it moves, and between the central flange and the heads is a smaller connecting portion, *m m'*, on each side, as shown, which has a sufficient space around it to allow steam or air to pass from one port to another when exposed. The action will then be as follows: The piston being at one end of its cylinder and the valve being at the same end of its chamber, a passage, *h*, which extends from the exterior of the piston to the valve-chamber, will open into the inlet *e* and the space surrounding the port *m'*. A passage, *o'*, is made within the body of the pis-

ton, which extends from this space in the valve-chamber to one end of the piston, as shown. The air, gas, or vapor employed will then pass from the inlet *e* through the passage *h*, around the stem *m'*, and through the passage *o'* into the cylinder, where it acts to drive the piston forward to the opposite end of the cylinder. When the piston has started and moved a short distance it will expose a port, *a*, so that connection will be made between the inlet-passage *e* and the end of the valve-chamber. This allows the valve to be driven rapidly to the opposite end of the chamber, and the central flange of the valve will thus pass the passage *h*, so that communication will be opened into the space surrounding the port *m*, and thence through the passage *o''*, to return the piston. The passage *a'* will admit air in the manner before described to return the valve. The air is allowed to exhaust by means of passages *s*, which communicate with the spaces *m m'* around the valve, and when the piston moves toward either end of the cylinder the passage *o* or *o'* from that end will communicate through *s* with the exhaust-passage *i*. The valve is similarly relieved by ports *r*, which connect with small ports *n*, opening into the exhaust, when the valve is ready for its return stroke.

The lower cylinder-head, M, is made removable, and has a threaded offset, N, by means of which it is screwed in place, the lower internal portion of the cylinder-head being provided with threads for this purpose. On the lower or outer part of this cylinder-head M is formed a cylindrical projection or neck, O, having two or more straight slots, P, for part of its length, for the purpose hereinafter described.

Over the neck or projection O slips the cylinder-sleeve Q, having two or more curved slots, R, for the purpose hereinafter described. At the upper end of the sleeve Q, and encircling it, is the ratchet-wheel S, arranged so that when in place the pawl T on the inside of the lower head of the case B, in which the cylinder is placed, will engage with said ratchet-wheel, so as to revolve the drill, as is more fully described hereinafter.

The piston U and piston rod or stem V are all in one piece, and the lower end of the piston-rod is cut away somewhat smaller than the rest of the rod, and has screw-threads formed on it, as shown at W. It is also hollowed out at the lower end, and has screw-threads formed on its inner surface for the drill-clamp to screw into, as hereinafter described.

After the piston is in place in the cylinder, and the cylinder-head screwed on, the piston-rod projects down into and through the slotted neck or projection O. The cylindrical sleeve Q, having the curved slots in it, is slipped over the neck or projection O, so that the ratchet-wheel comes close up to the cylinder-head, as shown.

A small collar or sleeve, X, with screw-threads on its inner surface, and two or more lugs, Y, projecting from its sides, is screwed onto the threaded portion W of the piston-rod. It then remains between the outer part of the piston-rod and inner part of the projection or neck O, the lugs, however, projecting through the straight slots P in the neck O and through the curved slots R in the sleeve Q. A key, Z, is then placed in the key-seat cut in the inner side of the collar X and the outside of the lower end of the piston-rod, so that the collar X is keyed to the piston-rod, and thus kept from turning; or a screw may be employed.

The clamp A', by which the drill-rod is secured to the piston-rod, has screw-threads formed on its outer edge, and its lower end formed with a shoulder. This clamp is split lengthwise, and is made with slight taper, as shown, so that when screwed into the internally-threaded lower end of the piston-rod, hereinbefore described, the parts are sprung together, so as to gripe the drill-head closely. By unscrewing it the drill is quickly and easily released.

In working rock-drills it is necessary that the position of the cutting-edges of the tool shall be changed at each blow of the drill, and to accomplish this the drill must be more or less rotated, according to the nature of the rock, at each blow. In my improved drill this rotary motion is accomplished by means of the mechanism herein described, and the amount of rotation may be regulated at will.

When the cylinder C is in position in the casing B the lower head of the case B is screwed on, thus confining the cylinder in the case.

As before described, one or more spring-pawls, T, are secured to a flange on the inner part of the head D of the case B, and when this head is screwed in place the pawl or pawls are in position to engage with the ratchet-band S on the slotted sleeve Q. This sleeve Q has slots cut in it, which are made curved and with an increasing twist, while the slots P in the neck or projection O, over which the sleeve Q is slipped, are cut straight. The lugs Y on the collar X correspond in number to the slots in the neck O and sleeve Q, and project into said slots, the collar carrying the lugs being screwed onto the lower threaded end of the piston-rod and keyed to said rod, so as to be prevented from revolving except with said piston-rod. The piston-rod, however, cannot revolve independently, since the lugs on the collar X project into the straight slots in the neck O of the cylinder-head.

The cylinder itself, while confined in the case B, is free to revolve. The spring-pawls, which operate the ratchet S on the sleeve Q, are, as described, on the inner side of the head of the case B, and said case is kept from revolving by the feed-screw passing through the lug in its side. As the reciprocating motion is given to the piston and piston-rod by the valve motion herein described, when the piston-rod goes forward it carries with it the

collar X, the lugs on said collar being free to move forward and back in the straight slots in the neck of the cylinder. As the rod comes back, however, the lugs impinge on the sides of the curved slots R on the sleeve Q; and as this sleeve is held stationary by the pawl T in the head of the case B engaging with the ratchets on the upper end of the sleeve Q, the effect is to turn the cylinder slightly in the case, so that the cutting-edge of the tool clamped to the piston-rod is presented in a new position in the drill-hole; then as the piston is forced forward again the pawls allow the sleeve Q to revolve slightly, ready for a new hold.

The amount of rotation to the drill depends on the position of the lugs on the collar with relation to the curved slots in the sleeve Q. These slots have a gradually-increasing twist, as shown.

The collar may be screwed up or down on the lower end, W, of the piston-rod, so as to bring the lugs on said collar at any desired point in the slots. This is done by removing the key or screw holding the collar to the piston-rod. Then, by removing the case-head and cylinder-head and giving one or more turns to the piston and piston-rod, forward or back, the collar is screwed up or down the piston-rod until it reaches the desired point with relation to the curved slots in the sleeve; and as the lugs on the collar rotate the cylinder in proportion to the curve in the slots, as the lugs are brought up to a point of greater curve of the slots more rotation is given to the drill-point. The key or screw is then put in place and the collar secured to the piston-rod, as before. By thus varying the position of the collar and lugs in relation to the increasingly-curved slots on the sleeve more or less rotation is given to the drill, as desired.

The tripod-stand B′ is formed in two parts, the parts being joined together by screws passing through the flanges or clamps C′ and D′, the same screws or bolts joining the legs forming the tripod to the tripod-stand. The parts C′ and D′ have hollow bearings in them to form journals for the trunnions of the trough or carriage A and extensions or lugs to fit into the slotted heads of the legs.

The legs E′ have screw-threads formed on them, and internally-threaded sleeves F′ screw on the legs, so that the height and position of the drill may be regulated. These sleeves are pointed at their lower ends, to prevent slipping on the ground, and have lugs G′, on which weights may be hung, so as to steady the drill.

A lock-nut, H′, screws onto the legs above the sleeve, so that when the sleeve is turned to the proper position, by screwing this nut down against it, the sleeve is prevented from moving by the jar when the drill is running.

The upper end or head, I′, of each leg is enlarged and divided or slotted, as shown, to form a clamp, so that the two parts clasp the lugs on the tripod-stand. Then, by passing a screw or bolt transversely through both head of leg and lug, the legs are firmly clamped to the tripod-stand, the same bolt or screw serving to clamp the parts of the tripod-stand together.

By my method of construction I avoid all angular projections and exterior valve-chambers. All parts of my drill and valve are cylindrical and made from a common center, and this enables me to make the whole of steel and of the lightest and strongest construction. It is also easy to set up and take apart.

By my construction of the piston, containing its own operating-valve, moving in the same direction with itself, and a short stroke, I am enabled to attain a high rate of speed and strike a greater number of blows.

The adjustable rotary feed enables me to employ the drill to the best advantage in both hard and soft rock.

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

1. The parts C′ D′, fitted to receive the trunnion, and having an extension which fits into the head I′ of the legs of the tripod, said head being provided with a single screw, by which the clamps are secured to the legs and to the trunnions at one operation, substantially as herein described.

2. The case B, fitted to receive and support the independently-rotating driving-cylinder C′, said case having the threaded sleeve or nut H secured to one side to receive the screw F, which is journaled upon the trough or carriage A, so that the case and cylinder may be moved forward and back without reference to the action of the cylinder or piston, substantially as herein described.

3. The cylinder receiving and holding case B, with its removable head D, provided with the pawl T, together with the cylinder C, sleeve Q, having the curved slots R, as shown, collar X, provided with lugs Y Y, and the ratchet S, substantially as herein described.

4. The piston, with its extension W, fitted to receive the drill-clamp A′, and having screw-threads cut upon the outside, so that the collar X may be screwed up or down upon it, to adjust the position of the lugs upon said collar with reference to the curved slots in the sleeve Q, and the holding-key Z, substantially as herein described.

5. The extension O of the cylinder, with its straight slots P, together with the sleeve Q, with its curved slots R, and the collar X, with its lugs Y and pawl T, whereby the drill is rotated while being reciprocated, substantially as herein described.

6. The extension O, with its straight slot, and the sleeve Q, with its slots R, formed with an increasing curve, together with the adjusting-collar X, with its actuating lugs Y, whereby the amount of rotation may be regulated and adjusted, substantially as herein described.

7. The improvement in reciprocating drilling apparatus, consisting in forming the valve within the piston and concentrically with the

cylinder, inclosing-case, and guide or trough, whereby the drill, forming an extension of the piston-rod, is rotated with the cylinder within its case, substantially as herein described.

8. The improvement in direct-acting engines, consisting of the hollow piston U, moving axially within the cylinder C, and provided with the ingress-ports *h* and *o' o''* and the exhaust-ports *s*, in combination with the contained valve, consisting of the heads *g* and the central flange with the spaces *m m'*, the said valve arranged and operated as shown, whereby the piston is actuated in each direction, substantially as herein described.

9. The hollow piston U, moving axially within the cylinder C, and containing the controlling-valve with its heads *g* and surrounding spaces *m m'*, in combination with the ingress-ports *h a a' o' o''* and the exhaust-ports *s*, *n n*, and *r*, whereby the piston and valve are actuated in each direction simultaneously by direct air-pressure, substantially as herein described.

In witness whereof I have hereunto set my hand.

HENRY RICHMANN.

Witnesses:
GEO. H. STRONG,
FRANK A. BROOKS.