2 Sheets—Sheet 1.

A. HERRING

ROCK-DRILL.

No. 181,576. Patented Aug. 29, 1876.

Fig. 2.

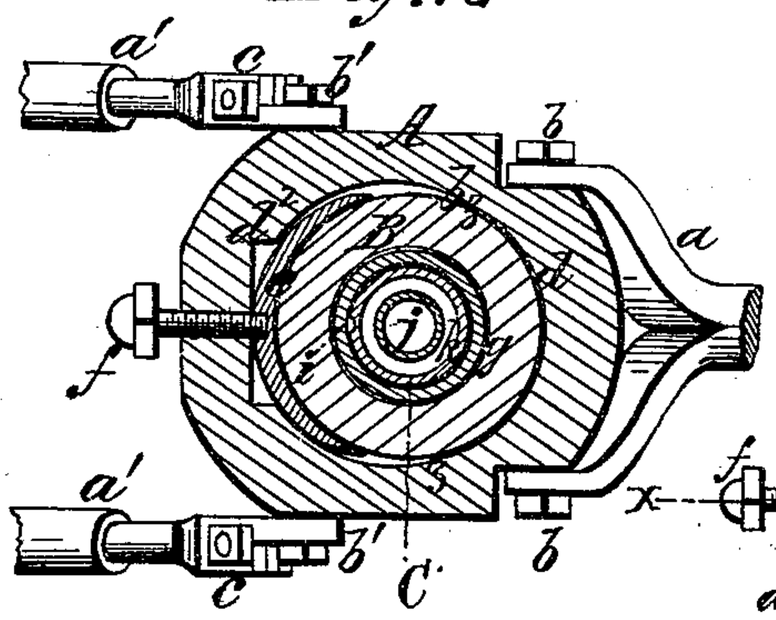


Fig. 1

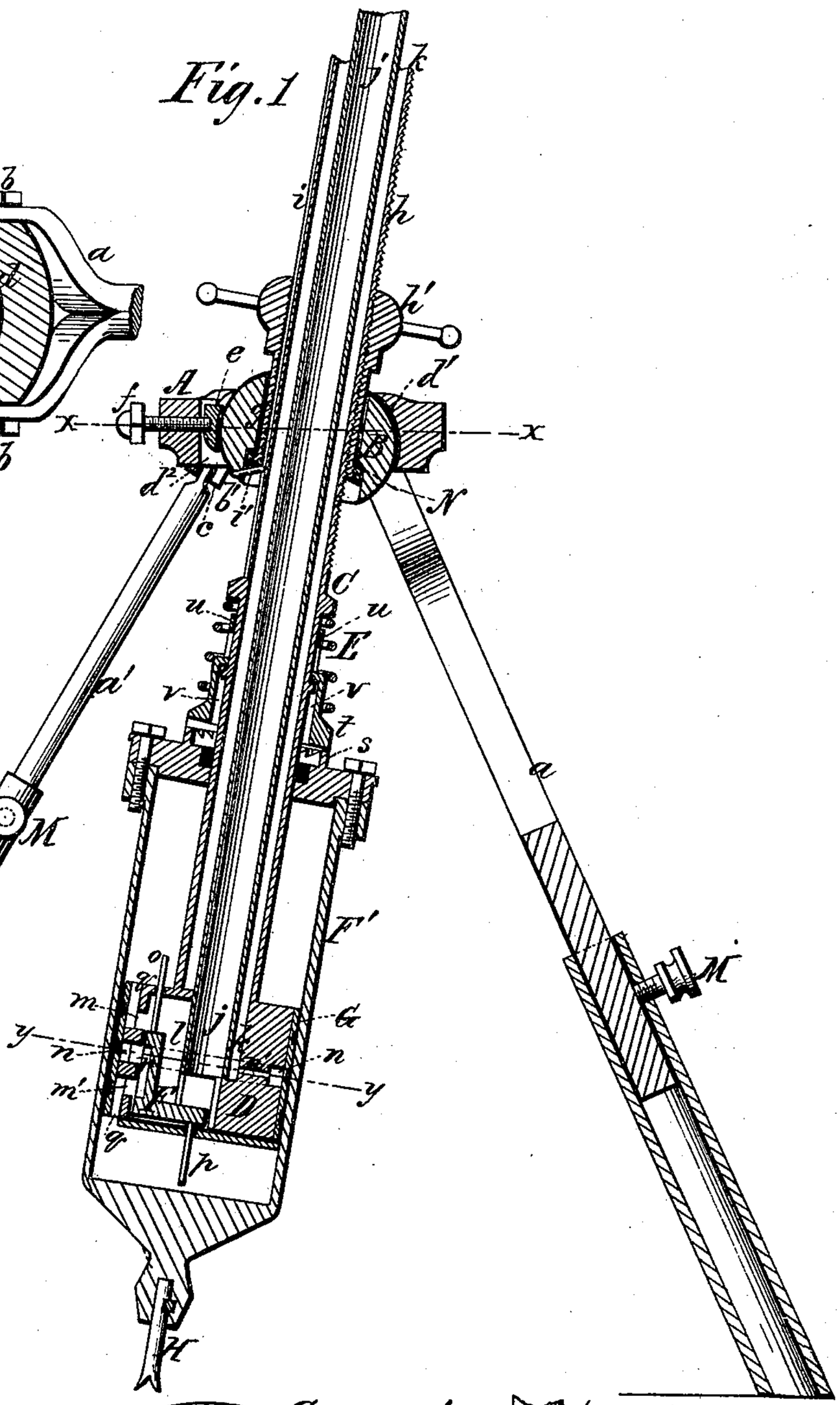


Fig. 3

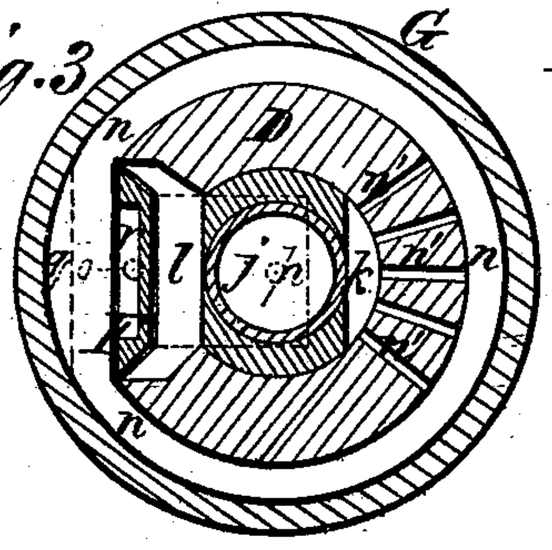


Fig. 4

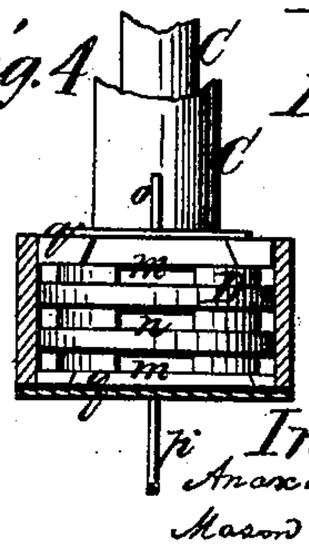
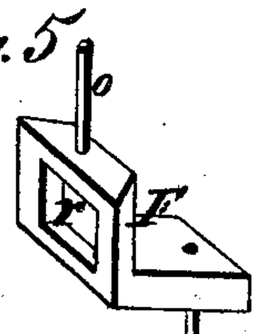


Fig. 5



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2 Sheets—Sheet 2.

A. HERRING.

ROCK-DRILL.

No. 181,576. Patented Aug. 29, 1876.

Fig. 6

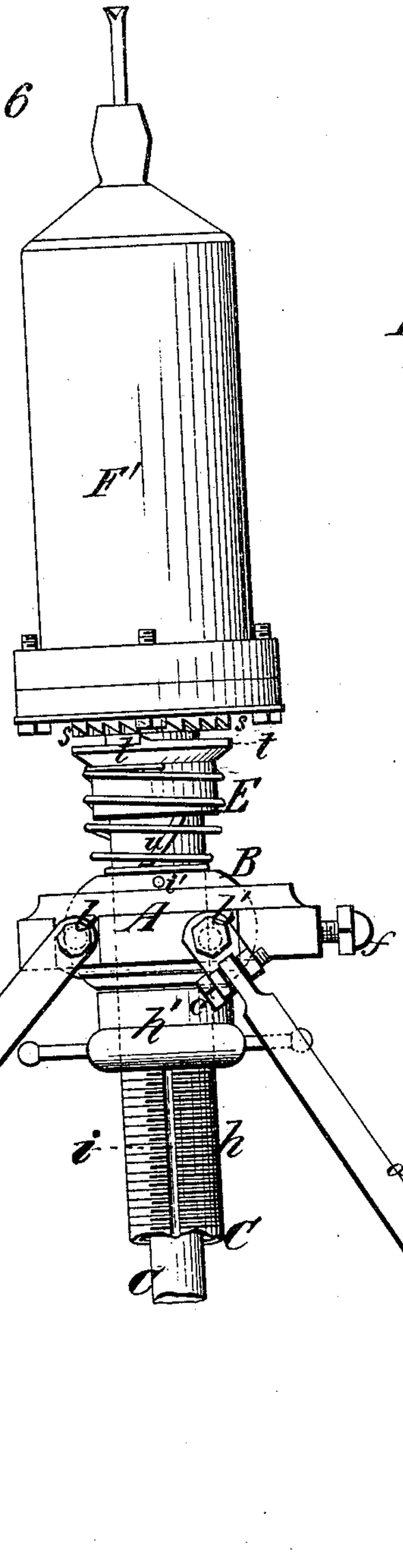


Fig. 8

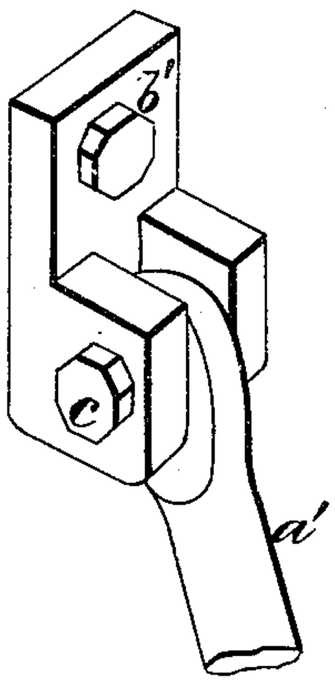
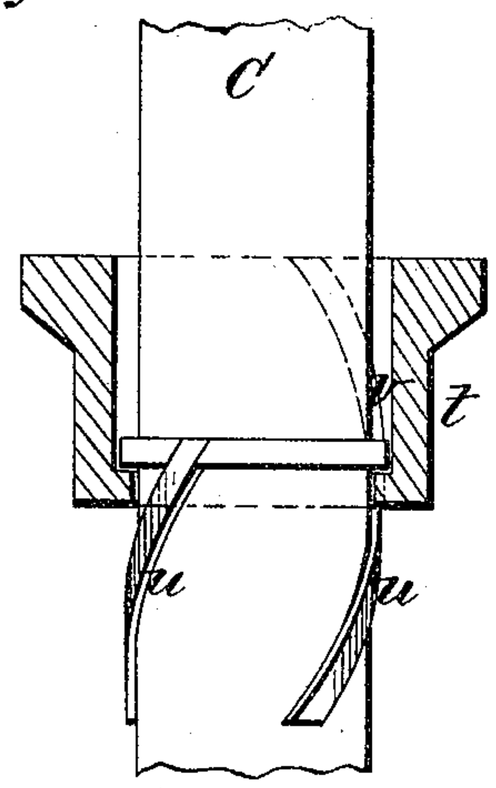


Fig. 7



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UNITED STATES PATENT OFFICE.

ANAXAMANDER HERRING, OF CROWN POINT, NEW YORK.

IMPROVEMENT IN ROCK-DRILLS.

Specification forming part of Letters Patent No. **181,576,** dated August 29, 1876; application filed March 31, 1876.

To all whom it may concern:

Be it known that I, ANAXAMANDER HERRING, of Crown Point, in the county of Essex and State of New York, have invented new and useful Improvements in Rock-Drilling Machines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical central section of my improved rock-drilling machine. Fig. 2 is a horizontal section of the same in the line *x x* of Fig. 1. Fig. 3 is a horizontal section, on a larger scale, in the line *y y* of Fig. 1. Fig. 4 is a partial section and elevation of the piston. Fig. 5 is a perspective view of the valve of the piston. Fig. 6 is a side elevation of the drilling-machine as adjusted for drilling upward. Figs. 7 and 8 are detail views of the operating mechanism.

Similar letters of reference indicate corresponding parts in the several figures.

The object of my invention is, first, to make a drill-support, upon which the drilling mechanism can be adjusted for drilling in either a downward or upward direction, and at intermediate angles with a vertical or horizontal plane; second, to make a drilling-machine which is operated by either steam, air, or gas admitted through the piston, and brought in contact alternately with the upper and lower ends of a cylinder, which moves back and forth over the piston, and carries the drilling-tool proper, whereby a greater superficial area in a power drilling-machine having a given-sized piston is exposed, for the steam, air, or gas to act against, than is practicable with a power drilling-machine wherein the piston carries the drilling-tool proper; third, to simplify the mechanisms which produce the vertical feeding and horizontal turning of the drilling-tool.

The nature of my invention consists in certain constructions, arrangements, and combinations of parts, whereby the objects above mentioned are secured in a more perfect manner and by simpler means than heretofore, and the steam or air chests, ports, and the valve are applied within the piston and cylinder of the drilling-machine; and at the same time the piston is stationary, the cylinder movable with the drilling-tool attached to it; and the adjustment of the cylinder and piston together, for the purpose of lowering the drill as occasion requires, can be effected by a hand-nut working directly upon a screw formed on the piston-rod, without subjecting the feed-screw to the recoil action of the cylinder.

To enable others skilled in the art to make and use my invention, I will describe one mode of carrying the same into operation, without intending to limit myself to the precise construction and arrangement of the devices shown in the drawings.

A represents a head-plate, to which supporting-legs *a a'* are hinged, as at *b b'*, the hinges being screw-pins, which serve as means for clamping the legs fast to the plate after they have been adjusted as desired. The leg *a* is forked at its top, so as to clasp two sides of a narrowed portion of the plate, and be adjustable on the joints *b b* to the extent of a semicircle, and the legs *a'* are jointed between their upper and lower ends, as at *c*, so that they may be moved outward on the joints *c*, and upward on the joints *b'*.

The outward adjustment of all the legs is to spread them apart and lower the plate, or bring them together and raise the plate, and the upward adjustment is to turn the plate upside down. The plate has a nearly circular passage, *d*, through it, and nearly the whole inner surface d^1 of this passage is in form of a sphere cut off horizontally at its top and bottom. Beyond certain points, say *z z*, this spherical socket is elongated and enlarged, and at the terminus of this elongated portion a straight-sided vertical slot, d^2, is formed, and in this enlarged portion and slot a movable stop, *e*, having a concave face, which is in form of a part of a hollow sphere, is fitted and attached to the end of an adjusting-clamp-screw, *f*, which is tapped in, and passed horizontally through, the plate A into the said slot. B is a hollow bearing, of spherical form, except at its top and bottom, where it is cut off horizontally, as shown. Through the center of this bearing a cylindrical passage, *g*, is cut, and this passage, near its lower end, is enlarged

by counterboring, so as to form a shoulder, N. This bearing B is introduced into the spherical cavity d^1 by being first passed through the elongated and enlarged portion of the passage *d*, and forced laterally to its position by the movable stop *e*, acted upon by the clamp-screw *f*. C is a piston-rod passed through the passage *g*. This rod is of smaller diameter than the passage *g*, and on its periphery a feeding screw-thread, *h*, of considerable length is cut or provided, and over this screw-thread a tubular hand-feed nut, *h'*, is screwed, and on the end of the nut a screw collar or stops are applied just below the shoulder N of the bearing, for the purpose of preventing the nut rising when being turned around on the piston-rod. The piston-rod is grooved at *i*, and in this groove a key-pin, *i'*, works, it being attached to the bearing, and thereby prevents the rod turning with the nut. By means of the spherical bearing the piston-rod can be swung laterally, so as to stand at any desired angle with respect to the horizon, and by means of the hand-nut and screw it can be fed downward, as occasion requires. The same results are attained from these parts when the piston-rod is inverted, as in Fig. 6; but, of course, the feeding will be upward instead of downward.

For the purpose of working the drill by steam, compressed air, or gas, the piston-rod is made with a receiving-passage, *j*, and an exhausting-passage, *k*, and the piston D is constructed with an internal steam-chamber, *l*, and receiving steam-ports *m m'*, and exhaust-ports *n n'*, and over the ports *m m'* and *n* a slide-valve, F, of angular or other suitable form is arranged to work, as shown in the drawing.

The slide-valve has an upper stem, *o*, and lower stem *p*, by which it is moved during the reciprocations of the steam or air cylinder F'.

In order to have the steam discharge into the respective ends of the said cylinder F', and exhaust through the piston, one side of the piston is cut down, as at *q*, and a cylindrical band, G, is fitted around the whole surface of the piston, and an exhaust-cavity, *r*, is formed in the upper or outer side of the valve, as shown in the drawings. The operation of receiving and exhausting the steam might be reversed—that is, the exhaust might take place at the center of the piston-rod, and the steam supplied at the periphery—in which case the valve would have its exhaust-cavity on its under or inner side.

The drilling-tools H are to be keyed firmly in the lower thickened head of the cylinder, as shown, or in any proper manner, and as fast as the drills of greater length are required the shorter ones are removed, and the longer ones are keyed in their places.

For turning the cylinder gradually, as it reciprocates, an annular ratchet-plate, *s*, is fastened firmly upon the upper end of the cylinder, and above this ratchet an annular pawl, *t*, is fitted loosely upon the piston-rod, and keyed to the same by spiral feathers *u* of the rod, which take into spiral grooves *v* of the tubular portion of the annular ratchet, as shown. E is a spiral spring fastened by one end to the piston-rod, and by the other to the annular pawl. This spring forces the pawl back to its normal position, after it has turned the cylinder and drill the distance of one ratchet-tooth, at the moment the cylinder has begun its downward stroke.

In the manufacture of the cylinder and piston it is contemplated to use the well-known self-adjusting packing, which is expanded by air, steam, or gas, and with such packing the friction between the piston and the cylinder will become greatly lessened at the moment the cylinder has finished its stroke, and hence the operation of turning the cylinder and drill can be readily effected by the ratchet and pawl.

By having this piston stationary and the cylinder move, the whole area of the heads of the cylinder is acted upon by the steam, as no room is lost (as in cases where the piston moves the drill) from the surface being occupied by the piston-rod, and at the same time the recoil of the cylinder cannot come upon the feed-screw to break it, although placed upon the piston-rod, for the steam in the cylinder acts as a relief-cushion, and is aided to the same end by the spiral spring interposed between the ratchet and pawl used for turning the drill.

By the facility afforded for adjusting the drill to bore up or down, and also oblique or horizontal, a very great objection to the most improved drill is overcome, and by having the feed-screw on the stationary piston-rod, the mechanism for feeding the drill is greatly simplified.

The invention of making the piston a steam-chest is a very important one in this special application, as it permits the ports and valve to be arranged within the piston and cylinder of the drilling-machine, and thus greatly compacts the machine; and the operation is as follows: The cylinder of the drill, as shown in Fig. 1, is supposed to have made a downward movement, and is nearly at the completion of its return stroke. In this position the steam is entering through the passages *j* and *m* and pressing against the upper end of the cylinder, and the exhaust steam in the lower end of the cylinder is passing through the passages *m'*, *n*, *n'*, and *k*. At the completion of the upstroke the drill will have been turned the distance of one ratchet-tooth, and the valve F will have been moved for admitting steam for the downstroke, by the stem *p* being struck by the lower head of the cylinder. At this moment the piston-cylinder reverses its motion and makes a downstroke, and the exhaust steam in the upper end of the cylinder passes through the passage *m*, at the upper end of the piston, into the cavity *r* of the

valve and the exhaust-passages *n*, *n'*, and *k*. As the downstroke is being completed the upper head of the cylinder strikes the stem *o* and moves the valve for an upstroke, and thus the operation continues.

Whenever the drill is to be fed down, the hand-screw *h'* is turned, and whenever it is desired to change the angle of drilling, the clamp-screw is loosened, and the spherical bearing turned as desired, and again made fast by the said clamp-screw; and if it is desired to invert the drill, as in Fig. 6, the legs are loosened at their hinges and turned upward, and the drill set upward upon the same, and all again made rigid; or the drill may be turned upward and the legs allowed to gravitate, and, after all is in position, the clamp-screws of the legs fastened.

For bodily adjusting the drilling-machine to different attitudes, the legs may be made extensible, as shown at M.

It may be desirable to make the piston-rod solid instead of tubular; and, if so, this can be done by drilling the inlet and exhaust passages in the rod in any proper manner for admitting and exhausting steam through the piston; and in some cases the universal support will be used for suspending rods of drilling-tools operated by levers, or other agents than steam, air, or gas.

I do not claim a piston-rod made hollow, and having its two ends passed through the heads of a moving steam-engine cylinder, as shown in Fairclough's patent dated June 22, 1867; nor do I claim a piston having inlet and outlet passages, in combination with a movable cylinder, having the drilling-tool or a crushing-hammer attached to it, and with a valve and valve-chest outside of the cylinder, as shown in Robinson & Wood's patent dated November 26, 1867, and in the English Patent No. 1,693 for 1873; neither do I claim anything shown in the patents of Brookes, Gates, and Burleigh, dated March 6, 1866; D. Kennedy, September 30, 1873; C. Burleigh, April 27, 1875, and L. W. Coe, March 7, 1876, and the English Patent No. 2,477 for 1858; but

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

1. The piston rod or stem of a rock-drill, provided with the spherical guide B, in combination with the spherical socket plate or head A, having an elongated opening through it, the clamp *e*, and screw *f*, substantially in the manner and for the purpose described.

2. The combination of the hand-feed nut, the screw-threaded piston-rod of a rock-drill, the spherical guide B, and the spherical socket plate or head A, substantially as and for the purpose herein described.

3. The combination of the piston rod or stem of the rock-drill, the spherical guide, the spherical socket plate or head, and the tripod with legs hinged to the socket plate or head and made with a joint below their hinging-joint, which joint is at right angles to the said hinging-joint, substantially as and for the purpose described.

4. The combination of the stationary piston-rod, having a feed-screw formed on it, the spherical guide, the feed-nut, and a steam or air cylinder, carrying the drill-tool, substantially as described.

5. The combination of the movable cylinder, open at one end and closed at the other, and having a drill-holder formed on its closed end, the piston having its steam or air chest, and inlet and outlet passages in communication with passages in the one end of the piston-rod, and the valve fitted within the piston and entirely within the cylinder, and operated by contact with the inner sides of the heads of the cylinder, all as and for the purpose herein described.

6. The combination of the movable cylinder carrying the drilling-tool, the stationary piston, the annular ratchet and annular pawl, attached respectively to the cylinder and the rod of the piston, the spiral feather, and the spring, substantially as and for the purpose described.

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Witnesses:

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