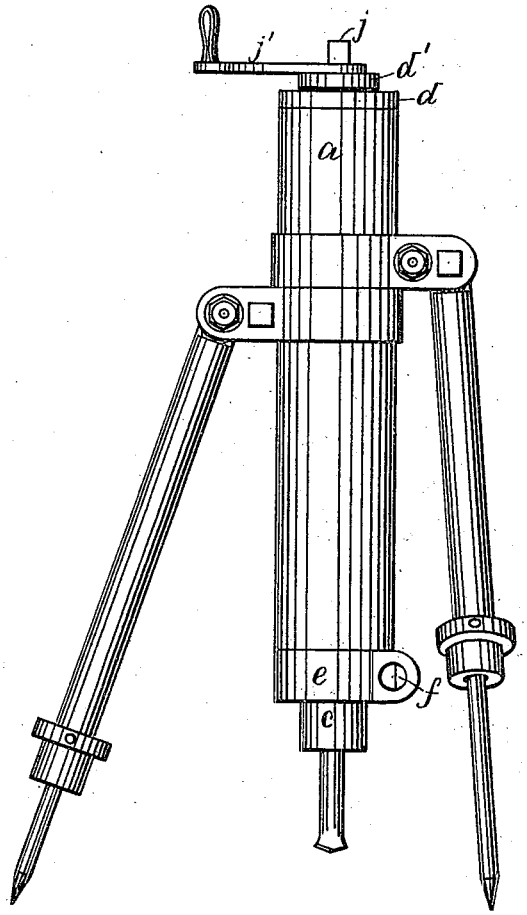
2 Sheets—Sheet 1

J. B. JOHNSON.

ROCK-DRILL.

No. 186,735. Patented Jan. 30, 1877.

Fig. 1



Witnesses:

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John A. Dougherty

Inventor:

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by

Alban Andrew.

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2 Sheets—Sheet 2.

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Fig. 5.

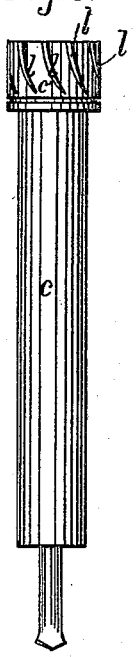


Fig. 2.

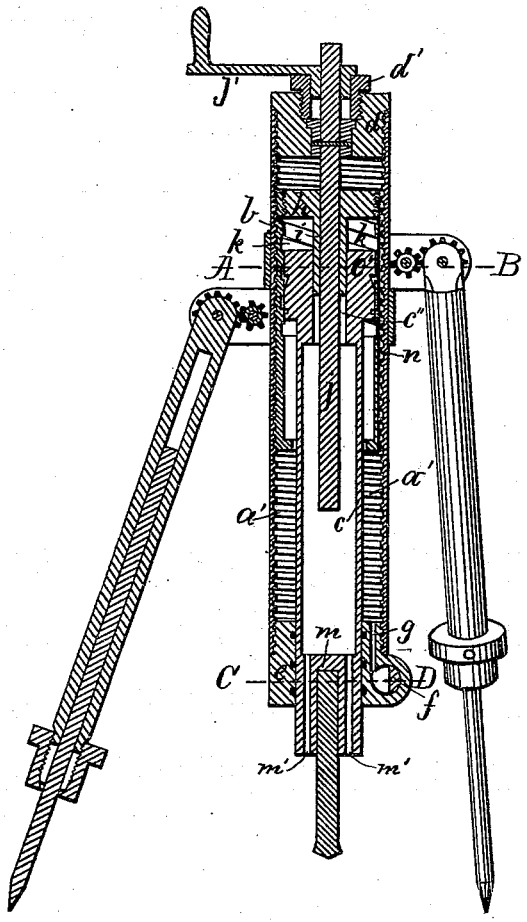


Fig. 3.

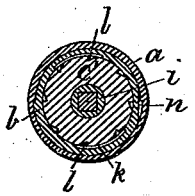
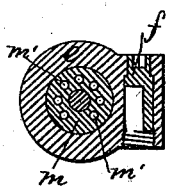


Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES B. JOHNSON, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF HIS RIGHT TO EDWARD G. HIGHT AND EDWARD F. LITTLEFIELD, OF SAME PLACE.

IMPROVEMENT IN ROCK-DRILLS.

Specification forming part of Letters Patent No. **186,735**, dated January 30, 1877; application filed July 24, 1876.

To all whom it may concern:

Be it known that I, JAMES BROWN JOHNSON, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Rock-Drills; and I do hereby declare that the following is a full, clear, and exact description thereof, which 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 letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rock drills; and consists of a smooth outside cylinder, secured in its proper position by means of suitable rests or supports. The said cylinder is provided on its inside circumference with a coarse female screw-thread, and has a head in each end, the lower head being provided with a bearing and stuffing-box for the hollow reciprocating piston, and is also provided with a valve and port for the admission of the steam or compressed air that is used as motive power.

Inside of the screw-threaded outer cylinder is located a traveling cylinder, provided on its outside periphery with a screw-thread fitting into the female thread of the outer cylinder. The said traveling cylinder is open in its lower end, and provided in its upper end with a head secured thereto, which head has a downward-projecting hollow exhaust-pin, that fits into a perforation made in the head of the hollow reciprocating piston. The inside of the traveling cylinder is provided in its upper part with grooves that are made in the form of a right-handed spiral, that serves for the admission of the steam or air to the space above the piston-head, and the upper portion of the piston-head is provided on its outside periphery with a set of left-handed spiral grooves, by which the piston is rotated a little toward the left during each stroke, at the same time that the traveling cylinder is rotated slightly toward the right, by which the drill is automatically fed forward and rotated around its axis during each stroke of the piston. The upper head of the outside cylinder is provided with a stuffing-box, through which projects the end of a square rotating bar having a crank in its upper end, and projecting through a square hole in the head of the traveling cylinder and its exhaust-pin, by which the position of the traveling cylinder can be adjusted before starting the drill, and by which the said cylinder can be fed downward or raised upward by hand, as may be required.

The lower end of the hollow reciprocating piston is provided with a series of perforations, through which the steam escapes in the direction of drill and against the hole that is being drilled, thus dampening the hole, and by its force blowing the grit away from the part of the piston exposed.

The traveling cylinder is provided on its entire outside length with a groove or flattened surface, (or more than one, if so required,) for the purpose of freely admitting the steam or other motive power above its upper head, so as to produce an equilibrium on the said cylinder, by which it can be raised or lowered with the least possible power.

The object of making the external part of the outer cylinder plain and smooth is so that the weights generally used to steady the drill may be secured on any part of the entire length of the said cylinder. The tripod or column clamps may be adjusted in any position at pleasure, which cannot be done on the ordinary rock drills in which the cylinder is uneven or provided with projecting parts.

On the accompanying drawings, Figure 1 represents a side elevation of my improved rock-drill. Fig. 2 represents a central longitudinal section. Fig. 3 represents a cross-section on the line A B, shown in Fig. 2. Fig. 4 represents a cross-section on the line C D, shown in Fig. 2; and Fig. 5 represents a side elevation of the reciprocating piston.

Similar letters refer to similar parts wherever they occur on the different parts of the drawings.

a represents the outer cylinder, and *b* represents the inner or traveling cylinder. *c* represents the hollow reciprocating piston, with its piston-head *c'*. *d* represents the upper head, secured to the outer cylinder *a*, and provided with a suitable stuffing-box, *d'*. *e* is the lower head for the cylinder *a*, which head

is provided with a valve or cut-off, *f*, and port *g*, through which the compressed air or steam enters.

The outer cylinder *a* is made of metal, and is perfectly cylindrical and plain on its exterior, and provided with an interior female screw-thread, *a'*, as shown, into the ends of which are screwed the heads *d e* aforesaid.

The cylinder *b* is open in its forward end, and is closed at its back end by means of the head *h*, that is provided with the projecting exhaust-pin *i*, that enters freely the central perforation *c''* in the piston-head *c'*. The outer circumference of the cylinder *b* is provided with a screw-thread, corresponding to the female thread in the cylinder *a*, and traverses said cylinder through its whole length, when rotated by hand by the square rotating bar *j*, that passes out through the back end of the cylinder *a*, and is provided with a crank, *j'*. The front end of the bar *j* passes through a square hole in the exhaust-pin *i*, and into the hollow interior of the piston *c*. The cylinder *b* has a set of grooves, *k k*, extending from the middle of its interior length to the back head *h*. These grooves serve as ports to admit the steam to the rear of the piston-head *c'*, as well as automatically rotating the said cylinder slightly during each forward stroke of the piston, so as to produce an automatic feed. These grooves are made in the form of a right-handed spiral. The piston-head *c'* is provided with left-handed spiral grooves *l l*, so that the grooves in the cylinder *b* and the grooves in the piston-head *c'* cross each other at about right angles, by which arrangement the piston *c* is rotated to the left, and the cylinder *b* is rotated to the right, a little during each stroke of the drill, thereby producing both an automatic feed and rotation of the drill by the rush of the steam or air through the spiral grooves to the exhausted space above the piston.

The piston *c* is a hollow tube, the lower end of which forms a head, *m*, provided with perforations *m' m'*, through which the steam or compressed air escapes after performing its work. *n* represents a longitudinal groove or flattened surface of the cylinder *b*, by which the steam is allowed to enter the upper space above the cylinder *b*, so as to produce an equilibrium on both sides of said cylinder *b*.

The operation of this my improved drill is as follows: Compressed air or steam, being admitted to the cylinder *a*, passes freely to the cylinder *b*, both above and below it, as described. The drill is forced upward by the steam or compressed air acting upon the annular enlargement on the under side of the piston-head *c'* when the exhaust-pin is out of the piston-head, and the upper space above the piston-head is in open communication with the atmosphere. The piston and piston-head continue to move upward till the latter enters the grooved part of the cylinder *b*, when the steam or compressed air rushes up through said grooves to the space above the piston-head, and about the same time the exhaust-pin enters the space in the piston-head, by which the exhaust is closed, so as to allow the steam-pressure above the piston to force it downward with a force equal to the difference between the lower and upper area of the piston-head, multiplied by the pressure of the steam or compressed air. The admission of steam or air pressure above the piston-head is cut off as soon as the piston-head commences to enter the lower smooth part of the cylinder *b*, which happens previous to the disengagement of the exhaust-pin from its recess in the piston-head, and the piston completes the remainder of its downward stroke by the expansion of the steam above the piston-head. The steam or compressed air is liberated from the upper space of the cylinder *b* as soon as the piston-head has passed by the exhaust-pin, when the steam or compressed air passes freely down the hollow piston-head and piston, and escapes through the perforations in the lower end of the piston.

The cylinder *b* is recoiled around its axis a little to the right, producing the feed of the drill, at the same time as the piston, piston-head, and drill are rotated a little to the left, producing a rotation of the drill around its axis by the peculiar construction of the grooves in the upper part of the cylinder *b* and piston-head *c'*, which recoil and rotation take place during the cushioning of the backward stroke of the piston-head.

After the steam or compressed air has escaped from the upper part of the cylinder *b*, the piston is cushioned by the constant pressure on the under side of the annular enlargement of the piston-head, and the piston commences again its backward stroke, and the operation being repeated a reciprocating motion is thus imparted to the piston, its head, and the drill. Should hard places be encountered in the rock, the cylinder *b* will advance farther than the rock is cut, until the forward stroke of the piston is somewhat shortened, when the space for the steam or compressed air to be filled behind the piston-head will be lessened; consequently the rush of the steam or compressed air through the grooves *k k* will be less forcible, causing the recoil of the cylinder *b* to be lessened, when it will feed ahead more slowly until the drill has cut away such hard obstacle, when it will proceed as usual.

It will be seen that by the construction of the grooves all round the periphery of the piston-head and the cylinder *b*, and the peculiar manner of the construction of the exhaust-pin and the hollow piston, all parts work in equilibrium.

When the forward end of the cylinder *b* is fed forward so far that it meets the head *d* it will close the port in the latter, and thus automatically stop the drill when it has arrived at the end of its feed.

Having thus fully described the nature, construction, and operation of my invention, I wish to secure by Letters Patent, and claim—

1. A rock-drill provided with a smooth exterior cylinder, for the purpose of attaching the clamps or weights at any desirable place, substantially as set forth and described.

2. In combination with the internal screw-thread of the outer cylinder *a* in a rock-drill, the inner cylinder *b*, working in equilibrium therein, substantially as set forth and described.

3. In combination with the cylinder *b*, its steam-grooves *k k*, and exhaust-pin *i*, the piston-head *c'*, provided with its grooves *l l*, and open piston *c*, as shown, for the purpose set forth and described.

4. In combination with the cylinder *b* and its grooves *k k*, the piston-head *c'*, with its grooves *e e*, for the purpose of automatically feeding and rotating the drill, substantially as set forth and described.

5. In combination with the cylinder *b*, exhaust-pin *i*, and the piston *c*, and piston-head *c'*, the feed-bar *j*, as and for the purpose set forth and described.

6. A rock-drill in which all the working parts are inclosed and protected in an outside plain cylinder, *a*, substantially as and for the purpose set forth and described.

7. A rock-drill cylinder, *a*, in which a reciprocating motion is produced by the movement of the piston *c* in a cylinder, *b*, having ports or grooves *k k* around its periphery, and extending a part of its length, in combination with the exhaust-pin *i*, the whole being so constructed as to produce reciprocation of the piston *c* without the use of valves or ports the whole working in equilibrium, as set forth and described.

In testimony that I claim the foregoing as my own invention I have affixed my signature in presence of two witnesses.

JAMES BROWN JOHNSON.

Witnesses:

ALBAN ANDRÉN,

HENRY CHADBOURN.