De V. WOOD.

Rock-Drilling Machines.

No. 138,777. Patented May 13, 1873.

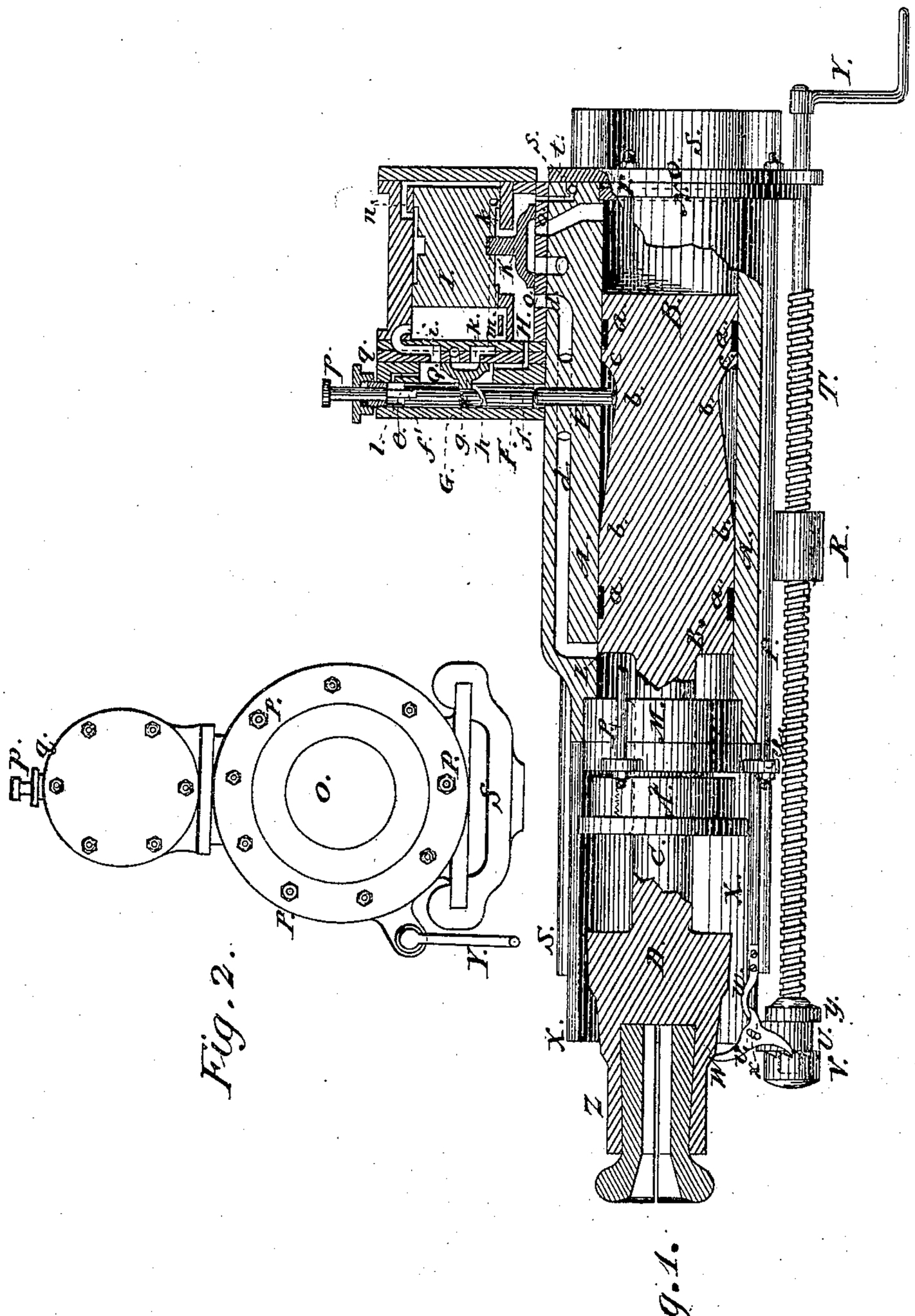

Fig. 2.

Fig. 1.

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## IMPROVEMENT IN ROCK-DRILLING MACHINES.

Specification forming part of Letters Patent No. **138,777**, dated May 13, 1873; application filed February 14, 1873.

*To all whom it may concern:*

Be it known that I, DE VOLSON WOOD, of the city of Hoboken, of the county of Hudson, in the State of New Jersey, have invented certain new and useful Improvements in Rock-Drilling Machines; and that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing forming a part of this specification.

The nature of my invention consists in certain improvements in the mode of operating the valve, whereby it is operated without shock, and is easily adjusted; also, in an improved feed; and also in certain other improvements whereby this class of machines is made more durable and efficient than those which have been heretofore made.

In the drawing, A A is a common steam-cylinder, having an extension, *x x*, for supporting certain working parts. B B is the piston, having its heads considerably separated from each other, for purposes hereafter described, and which are packed in any suitable way at *a a* so as to be steam-tight. The piston B B, the piston-rod C, and the tool-holder D constitute a single piece of metal. The angles where the piston-rod joins the other pieces should be carefully rounded, so as to avoid breakages at those points. The tool is attached at Z in any convenient manner. Between the heads B B the piston has a conical slope, *b b c*, for operating the valve, as will now be described. H is the main steam-chest, into which steam or other elastic motor is admitted in any suitable manner. The motor passes through the small passage *f*, or in any other convenient way, to the small steam-chest Q. The motor is also admitted into the space *e* behind the small piston F through the passage *f'*, or in any other convenient way. The plug or cylindrical piece E passes directly through the cylinder, and rests directly upon the sloping surface *b b*, before referred to, while the other end receives one end of the piston F, which, by being constantly pressed forward by the motor in *e*, keeps the plug E constantly pressed against the surface *b b*, for purposes hereafter described. The piston F has a groove, *g h*, for receiving the stem of the valve G, and thus serves the purpose of an ordinary valve-rod, causing the valve G to reciprocate with the piece F. The groove *g h* is spiral for purposes hereafter described. As the valve G reciprocates it opens and closes the ports *i* and *k* in the usual way, thus admitting and exhausting the motor on the opposite ends of the piston I, in the usual way, thus causing the piston I to reciprocate, taking with it the main valve K, which admits the motor to and exhausts it from the opposite ends of the main cylinder. The passage *d d* passes around the plug E in any convenient manner.

When the piston B B is driven backward, the slope *b b* forces the plug E and piston F upward, the latter taking with it the small valve G, which at the proper time opens the port *k*, causing the piston I and main valve K to move forward, thus properly opening the main ports, and admitting the motor behind the piston B B, by which means the piston and tool are driven forward and the blow is produced. As the piston moves forward the plug E, piston F, and valve G, are forced downward by the motor in *e*, as before described, and before the blow is struck the port *i* is properly opened, so as to reverse the main valve, as before described. In order to prevent the piston I from striking the ends of the cylinder at the end of its stroke, the passages *i* and *k* enter the cylinder a short distance from the ends, and are automatically closed by the piston passing over them, and at the same time opening the small ports or passages *m* and *n*, so as to admit the motor from the small chest into the end of the cylinder, and stop the piston I before it strikes the head.

The upper side of the groove, at *g*, is nearly or quite straight around for a portion of the circumference, so that when any part of that portion of it actuates the valve G it will reverse that valve at or near the same point of the forward stroke of the main piston B, and is so made that the small valve will be reversed only a short time before the blow is struck, and so that the forward stroke will be completed and the blow struck before the piston I moves far enough to open the port *d*, thus securing the full effect of the motor in

producing the blow at each forward stroke. By giving the valve K an extra amount of lead, as shown at *o o*, the small valve G may be reversed still earlier in the forward stroke of the piston B B, and the same result secured as that described above, thus making the movements less delicate.

By turning the piece F so as to bring different points of the spiral part *h* under the stem of the valve G, the valve G may be reversed at any desired point of the back-stroke of the piston B B by causing the piece F to move a greater or less distance before reversing said valve G, and thus ultimately reversing the main valve K at any desired point of the back-stroke, as before described, and thus regulating the length of the stroke of the main piston B B. The piece *p* is flat at its lower end, and enters a slot at the upper end of the piece F, and so made that the piece F may move freely on the flat part of *p*, by which means the piece F is prevented from rotating when the piece *p* is held in position. The upper end of the piece *p* passes through a stuffing-box, *q*, by which means the joint is rendered steam-tight, and at the same time friction is induced about the stem *p* for holding it in any desired position. The operator, by turning the piece *p*, necessarily turns the piece F, and thus adjusts the stroke, as before described, and which may be easily done when the machine is running at any speed.

On a portion of the circumference the sides of the groove *g* and *h* are nearly, or quite, parallel, and extend upward, so that by turning the piece F sufficiently the valve G may be raised so high that it cannot open the port *i* when the blow is struck, and the machine be thus suddenly stopped.

If from any cause the piston B B goes forward in the cylinder further than was intended, the plug E will move up the slope *b c*, thus reversing the valves, as before described, admitting the motor behind the piston and keeping it pressed forward against the forward head until the machine is fed forward on the ways, as will be hereafter described. In this way repeated successive blows upon the forward head may be prevented, and hence breakages often avoided.

In my experiments I operated the small valve in a variety of ways, the main object being to operate both valves without shock and produce the blow before the main valve was reversed. By operating the valve from a bearing between the piston-heads I am able to make the device more simple and durable than by any other arrangement.

The piece F might extend down to the surface *b b*, and the plug E be omitted. It might also be forced downward by a metallic or other spring instead of the motor spring at *e*. The valve G might also be adjusted by a nut working on a thread or other equivalent device instead of the spiral part *h*.

By the arrangement thus described I avoid all perceptible shock in operating the valves; also, I secure a quick and full opening of the main ports; also, I avoid cushioning the blow at the end of the forward stroke; also, the length of the stroke may be adjusted when the machine is running at any speed; also, the machine may be stopped quickly by the device which adjusts the valve; also, delicacy in the valve movement is avoided; also, an automatic stoppage of the machine is secured when the piston advances too far in the cylinder; also, a dead-center is avoided.

I am aware that the last result is secured by double valves in certain steam-pumps and other direct-action machines; but it results in a saving of time in this class of machines, which must be often stopped and started many times a day.

To prevent the piston from striking the rear head O a false head, N, is fitted into the cylinder so as to leave a space, *r*, between the two heads, into which the motor is admitted through the passage *t*, and which is prevented from escaping by the poppet-valve *s*. This forms an elastic buffer for stopping the piston without shock upon the main head O. The forward head M is secured by long rods P P, the subject of which constitutes the substance of another application of even date.

In this application I make no attempt at an automatic feed, but instead thereof I make a regulated hand-feed.

R is a nut, which is secured to the ways S S, and through which passes the screw T T. The screw is secured to the machine by passing through a cylindrical hole in the ear U, which is on the extension X, before referred to, and having suitable projections or shoulders V and Y on each side of said ear. By turning the screw the proper way the machine may be moved forward or backward on the ways. When the click *v*, which is pivoted at *x*, and forced into bearing by a spring, *w*, engages the ratchet V, which may also serve as a bearing, it prevents the screw from being turned forward; but when the drilling advances so far that the projection W strikes the click *v*, and disengages it from the ratchet, the operator by pressing upon the crank Y, or other suitable device, may turn the screw forward, and thus force the machine forward until the click again engages the ratchet. By this arrangement I secure a regular intermittent hand-feed, and avoid a large amount of machinery which has heretofore been found necessary in producing an automatic feed, and by reducing the regulating parts to a short thick piece like *v*, almost entirely remove breakages from this part of the machine.

By separating the piston-heads B B, as described, I am enabled to get bearing-surfaces which are entirely within the cylinder, and which are sufficiently separated from each other to guide the piston and drill without

depending upon the bearing in the head for that purpose; and hence the head may be made as light as possible consistent with strength. The bearing thus being within the cylinder, it may be made comparatively thin without danger of bursting it on account of the side pressure of the piston, which may be due to a glancing blow of the drill or other cause.

The mode of rotating the tool is not described in this specification.

Having described my invention, I claim—

1. The combination of the main valve K, piston I, valve G, piece F, and conical surface *b b*, arranged and operated substantially as described, and for the purposes herein set forth.

2. The combination of the valve G, the spiral groove *g h* in the valve-rod F, and the adjusting-rod *p* or its equivalent, arranged and operated substantially as described, for the purpose of regulating the stroke of the piston B B.

3. The inclined sides *b b* and *b c*, arranged between the heads of the piston B B, in combination with the rod E, valve-stem F, and valve G, as and for the purposes specified.

4. A regulated hand-feed, consisting of the combination and arrangement of the crank Y or its equivalent, screw T, ratchet V, click *v*, and projection W, substantially as described.

5. In a direct-acting rock-drilling machine, the false head N, arranged to form a space, *r*, in combination with the valve *s* and passage *t*, as and for the purposes specified.

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Witnesses:
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