E. S. WINCHESTER.

ROCK DRILLING MACHINE.

No. 181,386. Patented Aug. 22, 1876.

Fig. 1.

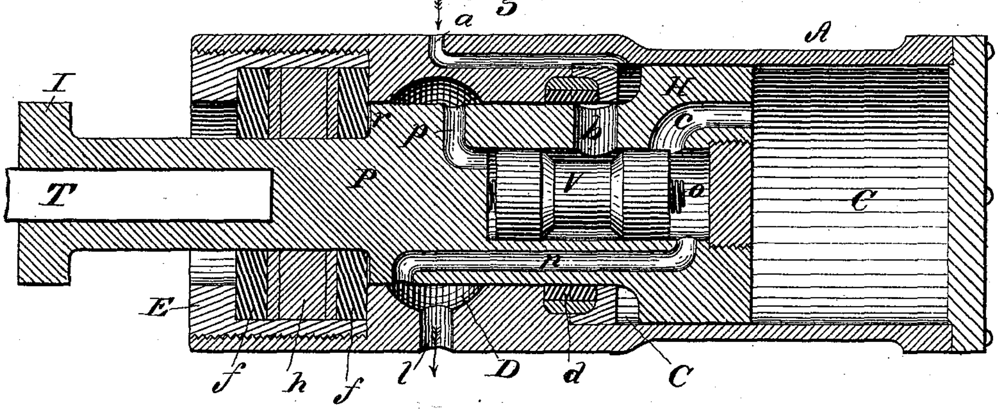


Fig. 2.

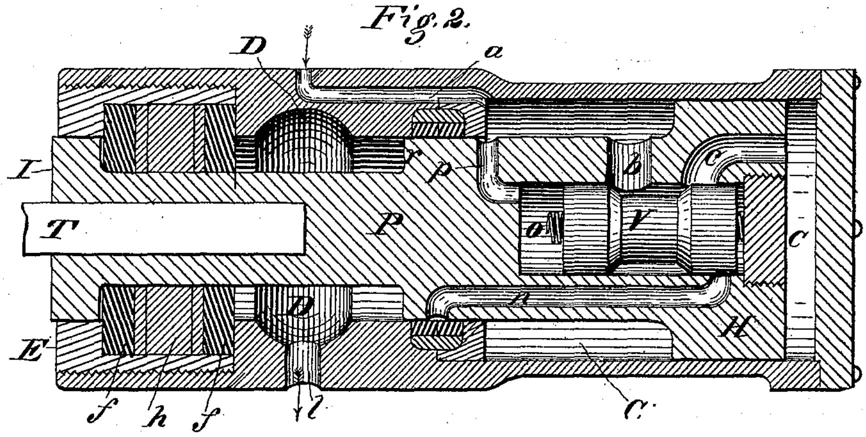
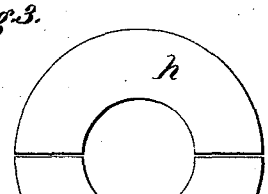


Fig. 3.



Witnesses:

Dom. J. Twitchell

Will W. Dodge

Inventor:

E. S. Winchester,

by Dodge & Son

Attys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

EDWARD S. WINCHESTER, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN ROCK-DRILLING MACHINES.

Specification forming part of Letters Patent No. **181,386,** dated August 22, 1876; application filed June 20, 1876.

To all whom it may concern:

Be it known that I, EDWARD S. WINCHESTER, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Rock-Drilling Machines, of which the following is a specification:

My invention consists of certain improvements in rock-drills, as hereinafter more fully described, the object being to produce a drill that shall be more compact and capable of being used in a more restricted space than those hitherto made, and which shall be made without any outside steam-chamber, and with its valve located within or upon the piston, so as to be operated by the momentum of the piston.

Figure 1 is a longitudinal section, showing the piston at one end of its stroke; Fig. 2 is similar view, showing the piston at the opposite end of its stroke, and Fig. 3 is a view of a piece detached.

In order to construct a drill on my plan, I provide a cylinder, A, having a chamber, C, extending about one-half its length, in which the piston-head H is to play, the extended portion being bored out of smaller diameter, as a guide for the piston, a part of its length, with an annular recess or chamber, D, for the escape-steam, and having at its end beyond this a recess for the insertion and retention of a buffer or elastic ring for the piston to strike against as it plays back and forth. The piston-head H is fitted to play in the steam-chamber C, the steam pressing on its entire surface for the downstroke, while on the return-stroke the steam operates on the projecting portion only. The inlet-port by which the steam enters the chamber C below the piston consists of a passage, *a*, which may be made at any point in the cylinder A, so as to enter at the front or lower end of the chamber, while the escape-port *l* is a simple hole opening out from the annular chamber D, which surrounds the lower part or neck of the piston, as shown in the drawings.

The piston has a longitudinal cavity made centrally in its upper portion, in which is placed a sliding balanced valve, V, as shown. This valve consists simply of a metallic plug or short rod of such a diameter as to slide easily to and fro in the bore or cavity in which it is held in the cylinder, said valve being turned off or reduced in diameter at its center for about one-third of its length, more or less, thus leaving an annular space at its center, into which the steam enters from chamber C through a hole, *b*, bored through the side of the piston, below its head H, as shown, the steam in this annular space thus pressing equally in opposite directions on the valve, thereby rendering it a balanced valve. From this cavity or valve-chamber within the piston one or more passages, *c*, extends out through the end of the piston-head H, opening into the steam-chamber C above or behind the piston; and from near the upper end of the valve-chamber another passage, *n*, extends along in the wall of the piston to near its lower end, where it opens out through the side, so that when the piston is down this passage *n* will connect with the annular chamber D, as shown in Fig. 1, this chamber D having an outlet, *l*, as previously described, and as shown in the drawings.

For the purpose of assisting to start the valve upward I make another passage, *p*, which extends from the outside of the piston to the lower or front end of the valve-chamber, as shown in Figs. 1 and 2, the outer end of this opening being so located that it will be brought within the steam-chamber only when the piston has reached the limit of its upstroke, or nearly so, as shown in Fig. 2, and so that it will permit the escape of steam therefrom into the waste steam-chamber D, when the downstroke is nearly completed, as shown in Fig. 1.

In each end of the valve V is a cavity, in which a spiral spring, O, may be secured to act as a buffer, when the valve strikes, to relieve it of the shock, if required.

In the drawings I have shown the valve and its chamber as circular in cross-section, that being the simplest and easiest of construction; but it is obvious that they may be rectangular or of other form, if desired, and operate the same.

With the cylinder, piston, and valve constructed as above described, the operation will be as follows: Supposing the piston and valve to be down, as represented in Fig. 1, the steam will enter through the inlet-passage *a* into the chamber C under the head H, which will cause the piston to rise. When it reaches the end of its stroke, and is suddenly stopped, the momentum imparted to the valve V will cause it to slide to the upper end of its chamber, this movement being assisted by the steam entering through the passage *p*, and pressing against the lower end of the valve. As the valve is thus moved it will close the passage *n*, at the same time opening the passage *c*, and permitting the steam to pass from the chamber C below the head H in through the hole *b* into the annular space around the valve V, and from thence through passage *c* into the chamber C above the piston, thereby starting the piston back on its downstroke. As soon as it has moved down a very short distance the steam is shut off from the passage *p* behind the valve, and as it reaches the limit of its stroke the valve is again shifted by its momentum, thus opening the passage *n*, which permits the steam above the piston to escape into chamber D, and thence out into the atmosphere through opening *l*, the mouth of passage *p* entering the chamber D just before the stroke is completed, thereby relieving the valve from the steam-pressure at its lower end, and leaving it free to move, as described.

In this manner the parts will continue to operate the valve, shifting its position at the end of each stroke by its momentum, without any other aid, except that of the steam entering behind it through passage *p*, and which is designed more especially to overcome the weight of the valve, when the drill is in a perpendicular position, or nearly so.

In an engine constructed to be used solely in a horizontal position this passage *p* may be omitted; but I prefer to use it, inasmuch as it affords also a sure means of shifting the valve to start the engine, in case it should be stopped at the end of its upstroke, it only being necessary in such case to let on the steam, which would instantly lift the valve, thereby admitting the steam to the upper end of the chamber C, which would at once force the piston down, after which the valve would be operated by its momentum, as before described.

It will at once be seen that whenever the piston is stopped at any part of its stroke, either on the up or down stroke, the valve will be instantly shifted, which is a very important feature in rock-drills, for the reason that if the drill be fed forward faster than the tool cuts it is necessary that the valve should reverse before the piston has completed its full stroke, or it will stop.

It will be observed also that the ports are so arranged as to change the stroke on the upward movement of the piston just before piston has traveled the entire length of the cylinder-chamber, thus allowing the piston to cushion on the steam in the end of the chamber above the piston-head. Another important result of this construction is that the valve does not move to open the exhaust-port until the tool has struck the rock, the blow being delivered with a full head of steam on the piston, thus greatly increasing its efficiency.

In this class of machines much difficulty has been experienced in connecting the drill or cutting tool to the piston in such a manner that they would stand the severe tests without breaking, and also in arranging the buffers against which the piston strikes.

In my present invention I construct the piston with a solid extension, which terminates in an enlargement or solid head, I, which is made integral with the rest of the piston, instead of being screwed on or otherwise fastened thereto, there being a longitudinal hole bored in the projecting end for the reception of the drill or tool T, as shown.

The buffer consists of two rubber disks or rings, *f f*, with an intervening steel ring, *h*, as shown in Figs. 1 and 2. As this ring *h* cannot be slipped over the head I of the piston-rod, it is made in halves, as shown in Fig. 3. To secure the buffer in place, I provide a tubular sleeve, E, which is bored out internally so as to receive the buffer, as shown in Figs. 1 and 2—this sleeve E being screwed into the end of the cylinder, and thereby securing the buffer firmly in place between the shoulder formed on the interior of the sleeve and a corresponding shoulder formed on the interior of the cylinder.

As shown in the drawings, the piston-rod is provided with an annular shoulder, *r*, which, as the piston is forced down, comes in contact with the buffer, while on the upstroke the head or collar I strikes against the opposite side of the buffer.

By this construction the rubber cushions or rings *f* are supported by the steel ring *h*, the force of the blow on the rubber being transmitted to the ring *h*, which, being solid and unyielding, distributes the force over its whole face, and transmits it to the ring *f* on the opposite side, thus utilizing the elasticity of both rubber rings at each stroke, this method of supporting the rubber rings also preventing them from being cut or worn, as they would be, were not the metallic ring interposed.

By this construction it will also be seen that while the buffer is protected from injury by being inclosed within the extension of the cylinder, it is at the same time located outside of the steam-chamber, where none but the exhaust steam comes in contact with it, the exhaust-chamber being open to the atmosphere. It will also be seen that the rubber is also where the oil used to lubricate the piston-head does not come in contact with it, and that it is thus protected from the injurious effect of the live steam, the oil, and the particles of stone or similar material. It will also be seen that by this arrangement, the shoulders of the piston, instead of striking against any portion of the metal, strike on the rubber rings of the buffer on each side, thereby preventing the destructive action that occurs where the metallic parts come in direct contact.

I have shown a packing-ring, *d*, inserted in a recess in the interior of the cylinder A, but any other style of packing may be used, if preferred.

As nearly all the drill can be made by lathe-work, it is cheap to construct; but far more important is its compactness, by which I am enabled to produce an effective operating-machine, so small that it can be readily handled by a single person and used in almost any crevice, cut, or vein which is large enough to admit a man or operator, the entire length of the machine being but about eighteen inches, thus especially adapting it for use in mining operations, and in places where the drills ordinarily made cannot be used for want of room.

Another advantage is, the absence of valve-levers, stems, rods, cams, &c., by which the number of wearing parts and the liability of breakage, as well as first cost, are materially reduced.

While I have described it as being operated by steam, it will, of course, be understood that it may be operated by compressed air in the usual manner, such being the prevailing method at the present time in mines and similar places.

Having thus described my invention, what I claim is—

1. An engine having its valve carried with the piston, and operated by the momentum imparted thereto by the movement of the piston, substantially as described.

2. In combination with the cylinder A, provided with suitable steam-passages, the piston P, having the valve V fitted in a cavity therein, substantially as described, whereby the valve is operated wholly or mainly by the momentum imparted to it by the movements of the piston, as set forth.

3. In combination with a valve arranged to be operated by the momentum imparted to it by the movement of the piston, the inlet or port *p*, to admit steam or air to assist in moving or sustaining the valve, as set forth.

4. The buffer, composed of the rubber or elastic rings *f f*, with the interposed metallic ring *h*, in combination with the piston having shoulders thereon, arranged to strike against the rubber on opposite sides, as set forth.

5. A rock-drill having a buffer located within an extension of the cylinder and outside of the steam-chamber, substantially as described.

EDWARD S. WINCHESTER.

Witnesses:
C. O. L. DILLAWAY,
M. S. WINCHESTER.