(No Model.)

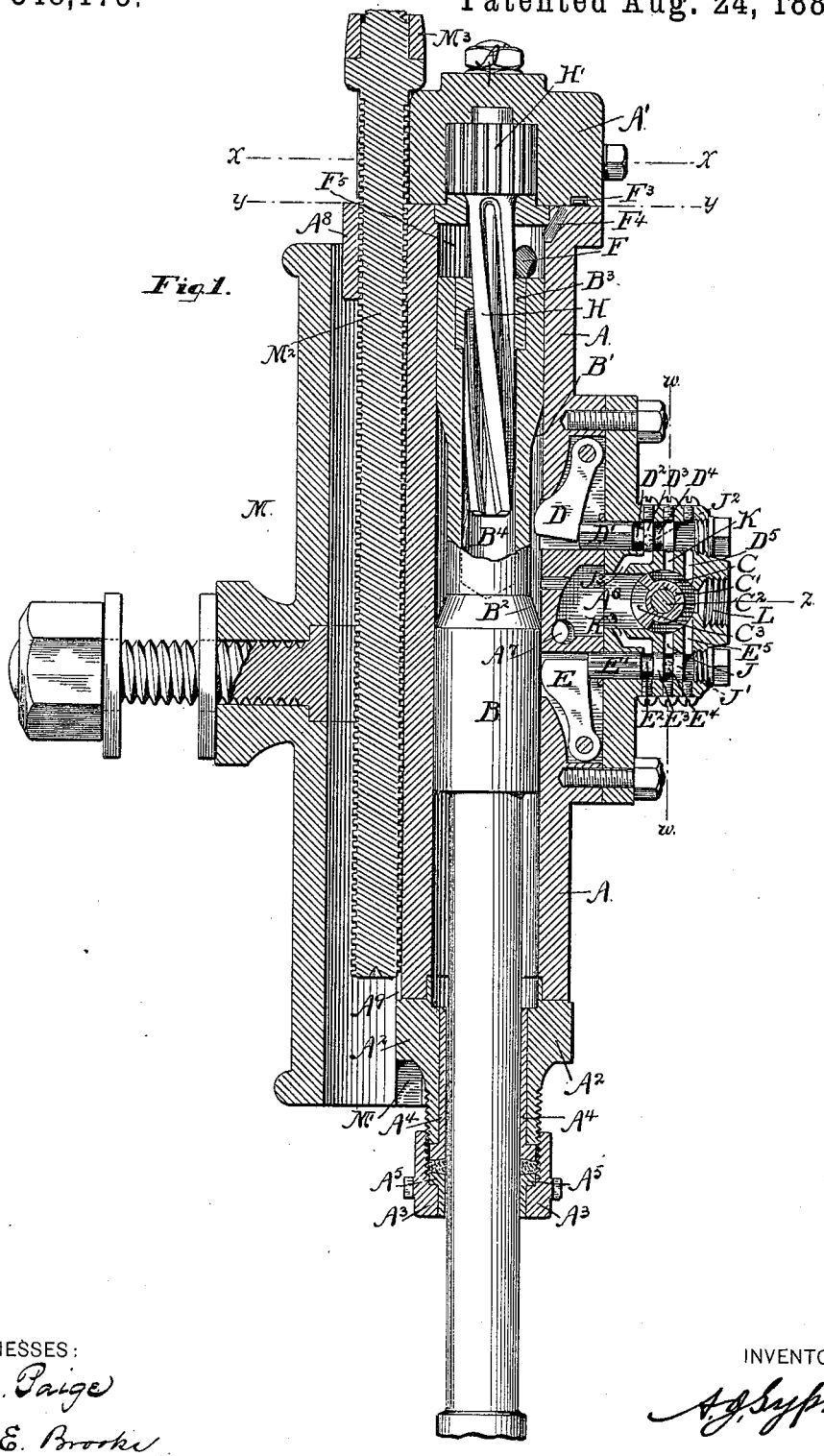
3 Sheets—Sheet 1.

A. J. SYPHER.

STEAM ROCK DRILL.

No. 348,175. Patented Aug. 24, 1886.

Fig. 1.



WITNESSES:

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STEAM ROCK DRILL.

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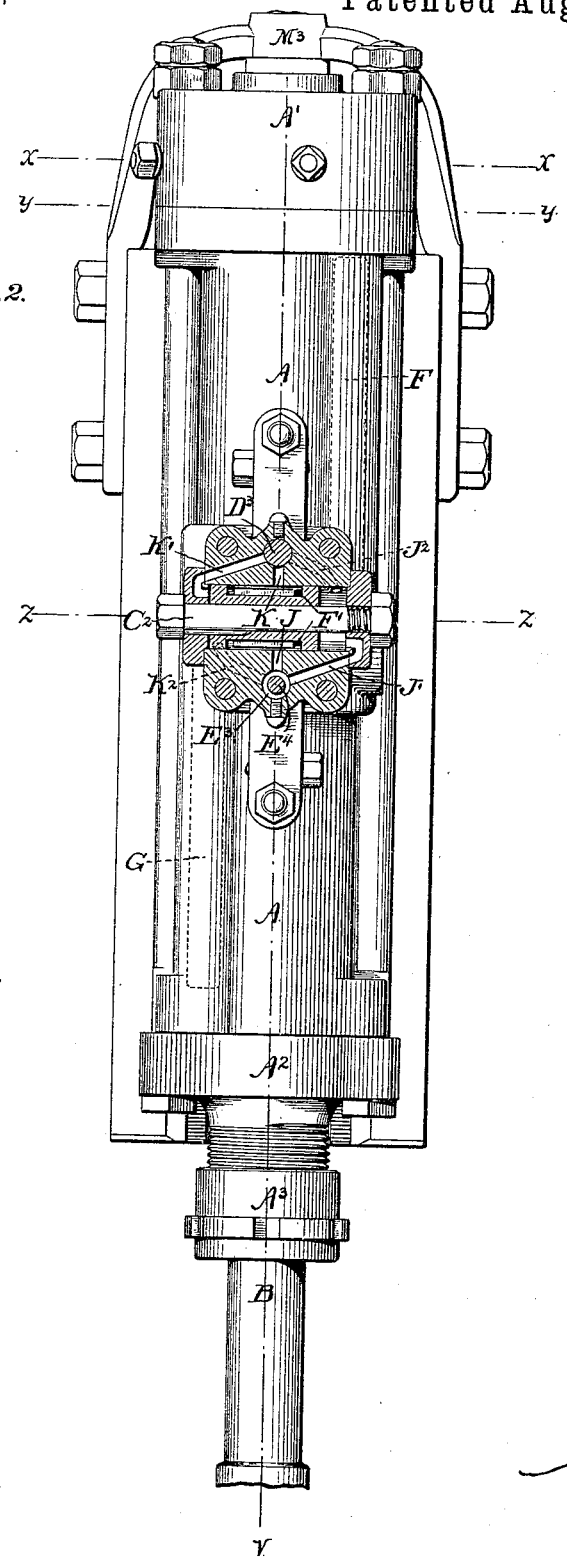
Fig. 2.



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3 Sheets—Sheet 3.

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STEAM ROCK DRILL.

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Fig. 3.

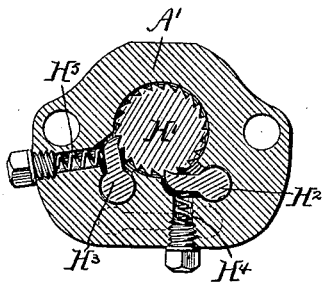


Fig. 4.

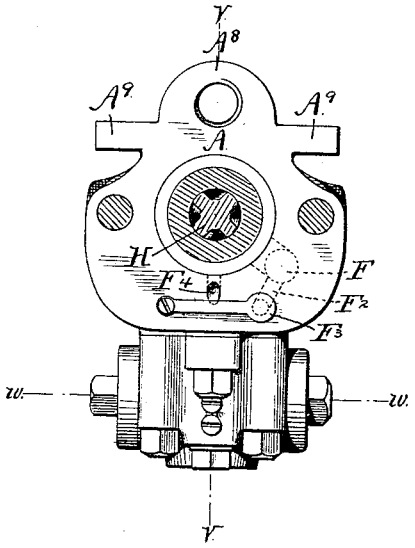
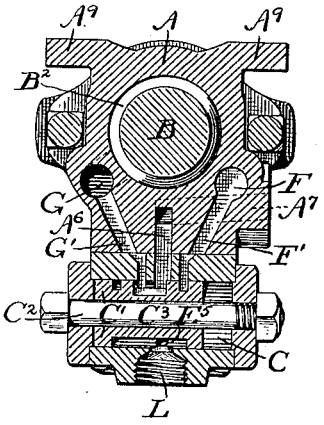


Fig. 5.



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UNITED STATES PATENT OFFICE.

ABRAHAM J. SYPHER, OF IRON MOUNTAIN, MISSOURI.

STEAM ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 348,175, dated August 24, 1886.

Application filed January 18, 1886. Serial No. 188,883. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM J. SYPHER, a citizen of the United States of America, and residing at Iron Mountain, in the county of St. François and State of Missouri, have invented certain Improvements in Steam Rock-Drills, of which the following is a specification.

The nature of my invention is as follows:

The first part of my invention consists of the combination of tappets or lifters, pins, and the two small auxiliary balance-valves, in connection with the two gradual tapers or inclines on piston and steam ports or passages to the main plunger-valve, the object of this combination and of those parts of my invention being to exhaust steam from one end of the main valve and to at the same time admit live steam at the other end alternately, thereby causing the main valve to move back and forth, admitting and exhausting steam alternately to front and back end of cylinder without concussion, the movement being gradual without jar or knock, thereby saving wear and breakage.

The second part of my invention consists in the combination of the spring-valve with the ports or passages for steam from the main ports or side pipe to the back end of the cylinder, (behind the piston,) in connection with the placing of the opening for the admission of steam into the cylinder through a side pipe, say one and a half inch from the inside of the back head, thus forming a steam-space for the purpose of forming an elastic steam-cushion, to prevent the piston from striking the back head. The spring-valve will admit steam free to fill the cushioning-space; and in case the compressed steam thus admitted is not sufficient to start the piston, steam will continue to pass through these openings until the piston passes the main opening, which is at least one and one-half inch from the end of the cylinder, as before stated. In case the momentum of the piston (with the added weight of the drill and piston) compresses the steam to a greater density than that of the boiler-pressure, (which is very common in all drills,) the spring-valve at the back end of the cylinder, immediately under the head, closes and prevents the escape of steam through the small ports or holes back into the boiler, thereby forming a perfectly elastic cushion. By this device the striking of the back cylinder-head by the piston is prevented. I also make a like space at the front end of the cylinder; but there the extra valve and ports for admitting steam behind the piston are not necessary, because, when the drill is properly fed, it strikes the rock if not fed fast enough, instead of striking the front cylinder-head, as is the case in other drills. In my drill the piston will cushion on steam, and the attendant is thus notified that the drill is not fed fast enough.

The third part of my invention consists in the placing of the side pipes or steam-passages from the main valve to the ends of the cylinder somewhat to the sides of the cylinder, so that the steam-ports can be placed lengthwise of the cylinder, in order to admit of the placing of the main plunger-valve crosswise on the cylinder and at right angles with its greater axis, thereby forming and securing a true balance-valve, whether drilling vertically or at any angle.

In the drawings, Figure 1 is a central vertical section on the line V, shown in Figs. 2 and 4. Fig. 2 is a front view showing section on line W, shown in Figs. 1 and 4. Fig. 3 is a top view of section of upper head on line X, shown in Figs. 1 and 2. Fig. 4 is a top view or plan of section on line Y, shown in Figs. 1 and 2. Fig. 5 is a top view of section on line Z, Figs. 1 and 2. The feed screw is shown only in Figs. 1 and 2.

The same letters of reference apply to the same parts in the several figures.

A is a steam-cylinder.

B is a piston.

C is the main steam-chest.

C′ is the main plunger-valve.

F and G, Figs. 1, 2, 4, and 5, are steam-passages leading from the main valve C′ to the ends of the cylinder.

D and E, Fig. 1, are lifters in connection with and operated by gradual tapers B′ and B^2 on the piston B.

D′ and E′ are pins, turned smaller at their upper ends, for purposes hereinafter mentioned, that move the small auxiliary balance-valves D^3 and E^3, thereby exhausting steam from each end of the main valve C′ through ports or holes J^2 and K^2, and admitting steam through the small holes or ports J and K to the opposite ends of the main valve C′ alter-

nately, thereby causing the main valve C′ to move back and forth, admitting and exhausting steam at the front and back ends of the main cylinder alternately.

F^2 and F^4 are steam ports or holes for the purpose of admitting steam for cushioning behind the piston, and in case the compressed steam in the cushioning-space is not sufficient to carry the piston back beyond the main port F to admit steam for that purpose.

In Figs. 1 and 4, F^3 is a spring-valve, which admits steam through the ports F^2 and F^4 to supply steam for cushioning, and also for starting and carrying the piston back beyond the main port F, as above described and shown in the drawings. When the density of the steam in the cushioning-space exceeds that of the boiler-pressure, the spring-valve F^3 closes, thereby securing or confining the steam in the space in the end of the cylinder immediately under the head, forming a perfect steam-cushion.

F and G are side pipes or steam-passages leading from main valve C′ to the ends of the cylinder, being placed somewhat on side or quartering of the cylinder, as shown in the drawings, Figs. 2, 4, and 5, for admitting and exhausting steam alternately at the opposite ends of the main cylinder.

C′ is the main plunger-valve placed crosswise at right angles with the greater axis of the cylinder, as represented in the drawings, Figs. 1 and 5.

The lifters D and E, operated by the inclines B′ and B^2, move the pins D′ and E′, having their ends turned smaller than the body of the pins for the purpose of securing a continuous opening or steam-passage through the exhaust-holes J^2 and J^3 or K^2 and K^3 to main exhaust pipe or port from cylinder A, so that when the valves D^3 and E^3 are raised by the pins D′ and E′ by means of the lifters D and E, operated by the inclines B′ and B^2 on the piston B, steam will exhaust from the ends of the main plunger-valve C′, alternately through the holes J^2 and J^3 or K^2 and K^3 around the small end of the pin D′ or E′ into the main exhaust-port from cylinder A, thereby relieving the pressure on one end of the valve C′ at the same instant steam is admitted to the opposite end of valve C′ through holes J and J′ or K and K′ around the recess or neck in valves D^3 or E^3. The slides A^9 on the cylinder A fit in grooves M′ of a back, M, the drill being adjusted by means of a feed-screw, M^2, working through a nut, A^8, on the back of cylinder A, and having a bearing in an arch, M^3, attached to the back M. The screw M^2 is turned by means of a crank, which is omitted in the drawings.

The balance-valve E^3 is constructed with the neck or recess E^4 for the purpose of securing a continuous opening through J and J′, so that when the valve E^3 is moved in the manner above described, to exhaust steam through K^2 and K^3, steam will pass from the steam-chest C, through J, around the neck or recess E^4 in valve E^3, through J′ to the opposite end of the main valve C′, causing the valve S to move to the opposite end of steam-chest C, exhausting steam through side pipe G, and admitting steam at and through side pipe F, to the back end of main cylinder A, which forces the drill forward to deliver the blow.

D′ D^2 and D^3 D^4 are duplicates of E′ E^2 and E^3 E^4, to exhaust steam through the ports or holes J^2 and J^3 and to admit steam through ports or holes K and K′ in producing the reverse or backward movement of the drill, as described in case of the forward stroke.

D^5 and E^5 are holes leading from the steam-chest C, admitting steam on top of valves D^3 and E^3 for the purpose of moving the valve D^3, pin D′, lifter D, and valve E^3, pin E′, and lifter E in position to be acted upon by the inclines B′ and B^2 upon the piston B.

The operation is as follows: When the piston B has moved on its backward or return stroke such a distance that the incline B′ no longer acts on the lifter D, the steam, coming through hole D^5, forces the valve D^3 down or in until the larger parts of valve D^3 close the ports or holes K K′ and J^2 J^3.

F^2 and F^4 are ports or passages leading from the side pipe F to the steam-chamber F^5 in the end of the cylinder for the purpose of admitting steam from the main side pipe F through the spring-valve F^3 into the chamber F^5, thus forming a steam-cushion to prevent the piston striking the head of the cylinder. The steam-chamber F^5 is formed by placing the opening of the steam-passage F about one and a half inch from the end of cylinder A. The steam in chamber F^5 serves also to start the piston and to carry it beyond the port or opening of passage F.

The front cylinder-head, A^2, is constructed of one piece and is bored out larger than the piston-rod, so as to pass over the enlarged or chuck end of the piston-rod.

A^4 and A^5 are split bushings, reducing the gland and stuffing-box to the size of the piston-rod where it works through the packing.

A^3 is a solid stuffing-box.

A^5 is a split bushing, reducing the boring in the box to the size of the piston-rod where it works through the packing.

The port or pipe G enters cylinder A about one inch inside of the cylinder-head A^2, for the purpose of securing a space into which steam or air is compressed from the cylinder, forming a steam-cushion at the front end of the cylinder, to prevent the piston striking the front cylinder-head. The feed of the drill is so regulated that the full force of the blow is delivered before the relieving force of the cushion begins to operate.

The drill is secured to the piston-rod by any of the well-known devices in use.

In the above description steam has been assumed to be the motor.

The drill may be driven by compressed air, and in that case the functions assigned to steam in this description would be performed by air.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a rock-drill, the combination of the lifters D E, inclines B′ B^2 on the pistons, and the valves D^3 E^3, substantially as set forth.

2. In a rock-drill, the combination of the lifters D E, pins D′ E′, inclines B′ B^2 on the piston, and the valves D^3 E^3, substantially as set forth.

3. In a rock-drill, the combination of the lifters D E, inclines B′ B^2 on the piston, pins D′ E′, and the balance-valves D^3 E^3, substantially as set forth.

4. In a rock-drill. the combination of the lifters D E, inclines B′ B^2 on the pistons, pins D′ E′, balance-valves D^3 E^3, having neck or recess D^4, openings K K′, and the valve C′, substantially as shown and described.

5. In a rock-drill, the combination of the lifters D E, pins D′ E′, inclines B′ B^2 on the piston, valves D^3 E^3, exhaust holes or ports J^2 J^3 K^2 K^3, and the plunger-valve C′, substantially as shown and described.

6. In a rock-drill, the combination of the lifters D E, pins D′ E′, inclines B′ B^2 on the piston, valves D^3 E^3, and the ports or holes D^5 E^5, substantially as shown and described.

7. In a rock-drill, the combination of the spring-valve F^3, ports F^2 F^4, leading from side pipe, F, to the steam-chamber F^5, side pipes, F G, quartering on the cylinder and admitting and exhausting steam alternately at the opposite ends of the main cylinder, and the steam-chamber F^5, substantially as shown and described.

8. In a rock-drill, the cylinder A, having side-pipes, F G, quartering thereon, and admitting and exhausting steam alternately at the opposite ends of the main cylinder, substantially as shown and described.

9. In a rock-drill, the combination of the cylinder A, piston B, having inclines B′ B^2, valve C′, and the side pipe, G, having opening inside of front cylinder head, A^2, substantially as shown and described.

10. In a rock-drill, the combination of the main valve crosswise on the cylinder, steam ports or openings lengthwise of the cylinder, and the main steam-passages placed quartering on the cylinder and admitting and exhausting steam alternately at the opposite ends of the main cylinder, substantially as shown and described.

A. J. SYPHER.

Witnesses:
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J. R. SYPHER.