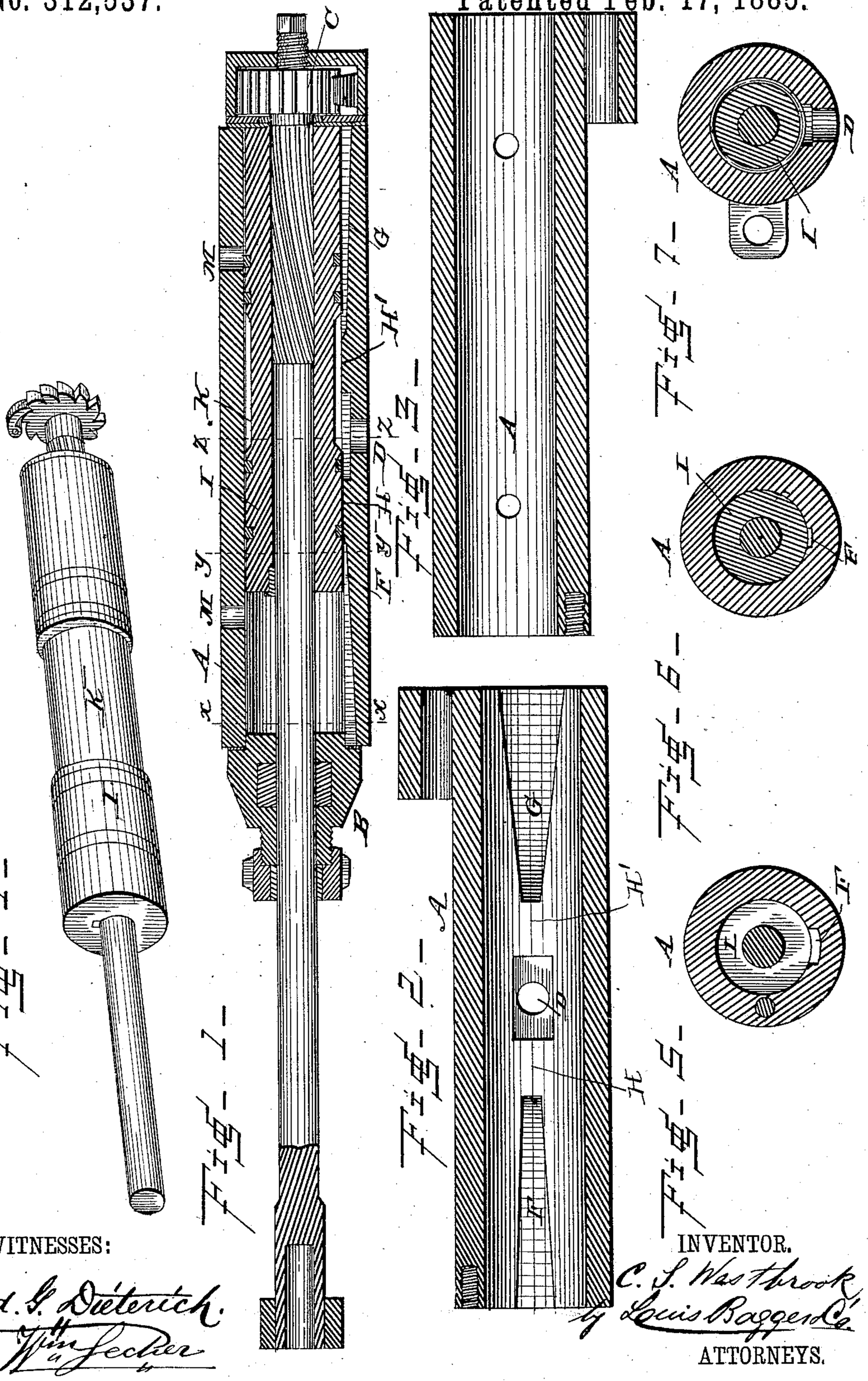
(No Model.)

C. S. WESTBROOK.

ROCK DRILL.

No. 312,537. Patented Feb. 17, 1885.



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ROCK-DRILL.

SPECIFICATION forming part of Letters Patent No. 312,537, dated February 17, 1885.

Application filed June 16, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. WESTBROOK, a citizen of the United States, and a resident of Spragueville, in the county of St. Lawrence and State of New York, 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 of the invention, 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, which form a part of this specification.

My invention relates to that class of cylinders known as "valveless" cylinders, and more particularly to the form of the piston to the cylinder, and to the ports and channels in the cylinder, by which, when actuated by suitable power, the reciprocating motion of the piston lets in and cuts off the impelling medium and opens and closes the exhaust-ports without the aid of valves.

The object of my invention is to afford a simple and compact apparatus for obtaining motive power and force from steam, compressed air, gas, or other kind of vapor, for use in all classes of engines in which a short rapid forward stroke of the piston is desirable. This object is accomplished by making the cylinder, ports, and piston in the form shown in the accompanying drawings, which represent the invention applied to a rock-drill, and in which—

Figure 1 is a longitudinal sectional view of the cylinder; Fig. 2, a similar view taken at right angles to Fig. 1; Fig. 3, a similar view looking in the opposite direction, the piston being removed in both these latter views; Fig. 4, a view of the piston; and Figs. 5, 6, and 7 are cross-sections on the lines *x x*, *y y*, *z z*, Fig. 1.

Similar letters refer to corresponding parts throughout the several views.

A is a metal cylinder, of ordinary construction and of any desired dimensions. In the present case, where the invention is applied to a rock-drill, one head of this cylinder is provided with a stuffing-box, B, Fig. 1, of suitable construction, through which the piston-rod (here the drill-shaft) passes, while through the other cylinder-head is passed the steep threaded screw and ratchet C usual in rock-drills, for giving the required turn to the piston and drill. In practice any other suitable device may be substituted therefor; and where the cylinder is used in any other form of motor, except in the case of a steam-hammer, the steep screw and ratchet will be dispensed with, and the piston-rod will work through stuffing-boxes at either or both ends of the cylinder, as may be found convenient. The impelling medium is supplied to the cylinder through the inlet-pipe D, which may be of any suitable material and dimensions, opening into the cylindrical side walls of the cylinder A, as shown in Fig. 1. The position of the supply-pipe will be determined by the character of the stroke which the piston is designed to make. In Fig. 1 the supply-pipe is so placed that a line drawn vertically through its center will intersect the central point of the line representing the distance traversed by the piston. It will vary in position according as one stroke of the piston is designed to be slower than the other, as hereinafter specified.

In my invention the piston I is made substantially in the form shown in Fig. 1, with the annular groove or recess K at its center. In practice the piston is cast in one solid piece, of any suitable metal, and turned down in the central portion of its cylindrical surface K, so that its diameter there shall be less than at its extremities, as seen in Fig. 4. The length of the piston will vary according to the length of the stroke, size of cylinder, &c. F and G, Fig. 1, are similar channels or grooves, serving as feed-ports cut in the interior side walls and at either end of the cylinder, as shown in Fig. 1, in any convenient longitudinal vertical plane, but preferably in that which intersects the center of the inlet-pipe D, as shown in the views. The dimensions of these grooves will vary with the character of the engine in which the cylinder is used, and their function is to convey the impelling medium from the space between the enlarged portions of the piston alternately into the spaces between these portions and the heads of the cylinder.

M M are the exhaust-ports, of any convenient size and shape, which may be placed at any point in the side walls, where they will be uncovered by the two piston-heads alter-

nately at the end of each stroke. I prefer, however, to place them, as shown in Figs. 1 and 2, in the vertical plane of the feed-ports.

The operation of the cylinder is as follows, reference being had to Fig. 1, which shows the invention so arranged as to give the short quick stroke desirable in a rock-drill: The impelling medium enters through the port D into the space K, between the enlarged portions of the piston, and the latter, according to its position in the cylinder, will move either forward or backward. In either case such motion will uncover one of the grooves G or F, allowing the impelling medium to pass into the space between the piston and cylinder-heads, driving back the piston until such time as the piston-head reaches the end of the channel. Thereupon the impelling medium will be cut off, and the piston may be driven farther by expansion; or the other end of the piston may be arranged to uncover the channel F at the moment the channel G is cut off, and before the enlarged or double portion of the piston cuts off the supply by the channels F and G it will alternately uncover the exhaust-ports M M and allow the exhaust to escape.

In the case shown in the drawings it will be seen that a small amount of the impelling medium will remain in the forward end of the cylinder at the end of each stroke, which will be compressed by the piston at the next stroke in the opposite direction, serving as a cushion for the piston, and, by its expansion, aiding in starting it in the reverse direction, and at the same time be of such inconsiderable volume as not to weaken the force of the stroke. In the case of a rock-drill it is preferable to make the channel in the forward portion of the cylinder shorter and narrower than the channel in the rear end of the same, for the purpose of admitting a smaller portion of the impelling medium into that end than into the rear end, a smaller volume of the same being necessary to enable the piston to accomplish the return-stroke than the forward stroke.

I am aware that attempts have been made to construct a valveless cylinder for use in rock-drills and steam-hammers; but such attempts have hitherto been unsuccessful, great difficulty being found in starting the piston on the return or upward stroke. In all such cases the cylinder has been constructed with covered ports only open at the ends, or with ports of equal lengths. In my invention I make the ports in the form of open grooves or channels cut in the inner wall of the cylinder itself and tapering in form, so that the amount of impelling medium entering the cylinder is gradually increased as the stroke continues. I further make the ports shorter and narrower at the forward end of the cylinder and broader and larger at the rear end, the object being to increase the force of the forward or downward stroke and to compress the small amount of impelling medium arranged to be left remaining in the forward end of the cylinder at the end of the forward or downward stroke, which will enable the piston to rebound and commence its backward or upward stroke even before the direct supply commences to operate on the piston. I find that by making the ports in the form of channels opened gradually throughout their entire length by the piston itself, the impelling medium is much more quickly and easily supplied than when covered ports are used which only open at the end of each stroke. In cases where the stroke is very long, and the exhaust-ports consequently close together, and the piston does not revolve in its cylinder, it will be found advisable not to turn down the central portion of the piston on the surface opposite the inlet, to prevent connection between the inlet and exhaust ports through the space around the smaller portion of the piston, which would cause the supply to be drawn off from the channels G and F.

As before stated, the dimensions of the parts will be modified according to the result aimed at. Where, for example, the expansion of the impelling medium is largely relied upon or utilized, as in the case where a slow and constant stroke is desired, the channels may be made correspondingly short, and the length of the piston will be reduced to a minimum, care being taken not to reduce it to such an extent that the piston will fail to cover the exhaust-ports during its stroke. The friction may be diminished and the passage of the impelling medium facilitated by cutting a recess in the upper portion of the inner cylindrical walls at the point where the supply-pipe enters, as shown in Figs. 2 and 3, making this recess virtually a continuation of the channels F and G, which are intercepted by the shoulders H and H'.

I claim as my invention—

1. In a valveless cylinder for use in rock-drills, steam-hammers, and other forms of engines, the hereinbefore-described combination, consisting of the cylinder, the inlet and exhaust ports, substantially as described, the feed-ports cut in the form of open grooves on the inner surface of the cylinder, and commencing near the inlet-port and extending to either extremity of the cylinder, and the piston having a recess at or near its middle, arranged to connect the port alternately with both of the feed-ports.

2. In a valveless cylinder for use in rock-drills, steam-hammers, and other forms of engines, the hereinbefore-described combination, consisting of the cylinder, the inlet-port, substantially as described, the feed-ports cut in the form of open grooves on the inner surface of the cylinder and extending from a point near said inlet-port to either end of the cylinder, the exhaust-port on the opposite side of the cylinder, and the piston with a recess at or near its middle, arranged to alternately connect the inner ends of the feed-port with the inlet-port and to uncover the exhaust-ports at the end of each stroke.

3. In a valveless cylinder for use in rock-

drills, steam-hammers, and other forms of engines, the hereinbefore-described combination, consisting of the cylinder, the inlet-port at or near its middle formed into a recess in its inner wall, the feed-port cut in the form of open grooves or channels in its inner walls, extending from a point near said recess, separated therefrom by shoulders or bridges to either end of the cylinder, the exhaust-ports, substantially as shown, and the piston having an annular recess at or near its middle, arranged to connect the feed-ports alternately with the inlet-ports and to alternately uncover the exhaust-ports at the end of each stroke.

4. In a valveless cylinder for use in rock-drills, steam-hammers, and other forms of engines, the hereinbefore-described combination, consisting of the cylinder, the inlet-port formed into a recess in its side walls at or near its center, the feed-ports cut in the form of open grooves or channels at its side walls, extending from a point near said recess, separated therefrom by bridges or shoulders to either end of said cylinder, and increasing in dimensions at either end, the exhaust-ports, substantially as described, and the piston with an annular recess at or near its middle, arranged alternately to connect the feed-ports with the inlet-ports and to uncover the exhaust-ports at the end of each stroke.

5. In a valveless cylinder for use in rock-drills, steam-hammers, and other forms of engines, the hereinbefore-described combination, consisting of the cylinder, the inlet-port formed into a recess in its inner wall, the exhaust-ports, substantially as shown, the feed-ports in the form of open channels or grooves cut in its inner wall, commencing near said recess and separated therefrom by bridges or shoulders, and extending toward either extremity of the cylinder, said feed-ports at the forward end being shorter and of smaller dimensions than that at the other end, and the piston having an annular recess at or near its center, arranged alternately to connect the feed-ports with the inlet-ports and to uncover the exhaust-ports at the end of each stroke.

6. In a valveless steam-cylinder, the herein-described cylinder-ports, in combination with the piston, said feed-ports increasing in area as they are uncovered by the piston throughout its stroke, admitting the impelling medium in gradually-increasing volume to act upon the piston, as and for the purpose shown and set forth.

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

CHARLES S. WESTBROOK.

Witnesses:
J. O. SHELDON,
H. W. SUDDS.