J. REDINGTON.

AIR OR STEAM ROCK DRILL.

APPLICATION FILED MAY 19, 1909.

971,638. Patented Oct. 4, 1910.

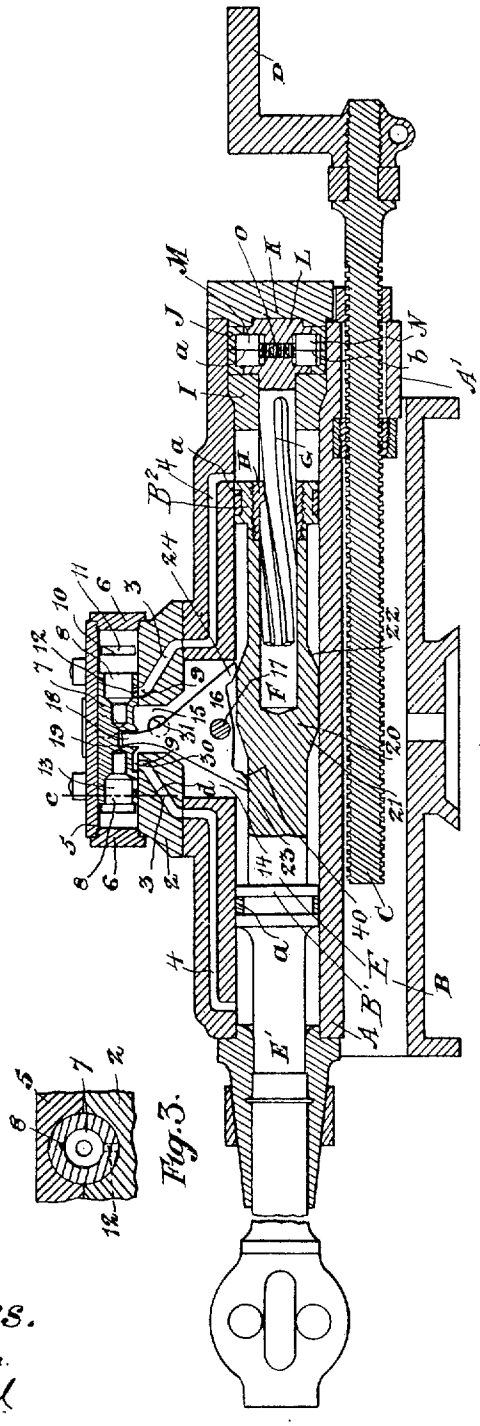

Fig. 1.

Fig. 3.

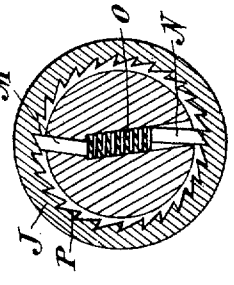

Fig. 2.

Witnesses.

Wm. S. Jordan.

N. Langfield

Inventor.

J. Redington

by Geo. N. Carpenter Atty.

UNITED STATES PATENT OFFICE.

JOHN REDINGTON, OF COBALT, ONTARIO, CANADA.

AIR OR STEAM ROCK-DRILL.

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Application filed May 19, 1909. Serial No. 496,955.

To all whom it may concern:

Be it known that I, JOHN REDINGTON, a subject of the King of Great Britain, residing at Cobalt, in the county of Nipissing and Province of Ontario, Canada, have invented certain new and useful Improvements in Air or Steam Rock-Drills, of which the following is a specification.

My invention relates to improvements in air or steam rock-drills, and relates more particularly to that class of drill in which a piston-valve is used, and the objects of my invention are, firstly, to construct the piston-valve and valve-chest so as to prevent undue and uneven wearing of these parts, and to so regulate the reciprocating movement of the piston-valve so as not to close at any time either of the main intake ports, and so maintain the balance of the valve, thereby reducing to a minimum the friction between the rocker and the piston-valve; the rocker and its pin, and the rocker and the piston; secondly, because of the perfect balancing of the piston-valve, to enable the piston to give short strokes as well as long strokes, under the full pressure of the motive fluid, and this without in any way interfering with the usual manner of feeding the drill to the rock; thirdly, to so construct the rocker and the boss carried by the piston so that at no time will there be any possibility of the piston-valve being moved so as to close either of the main intake ports; fourthly, because of the balancing of the piston-valve, and the reducing to a minimum of the friction between the rocker and the parts contacting therewith, before enumerated, and between the rocker and its pin, to enable the piston-valve to be moved so as to give a full quick opening of the ports leading to and from the cylinder and so overcome the great disadvantage of air freezing, as freezing troubles are largely caused by the comparatively slow opening of ports which results in constricting the channel for the air for an appreciable length of time, and fifthly, to provide as direct a course as possible for the motive fluid to and from the cylinder so as to prevent freezing, and the construction of my invention will be hereinafter particularly described, and the parts I claim as new will be pointed out in the claims.

Figure 1 is a central longitudinal section through a rock-drill constructed according to my invention. Fig. 2 is an enlarged cross-section on the line *a*—*b*, Fig. 1, and Fig. 3 is a cross-section on the line *c*—*d*, Fig. 1, through one end of the piston-valve and part of the valve-chest showing the unbroken bearing surface for the whole circumference of the ends of the piston-valve.

In the drawings, like characters of reference indicate corresponding parts in each figure.

My drill will be preferably built so that the head B^2 of the piston will be cushioned against a body of the motive fluid so as to prevent the impact of this head against the bearing-block I. The tappet legs of the rocker and the boss carried by the piston, are so proportioned in relation to each other, that when the boss strikes against either of the tappet legs, the full and quick opening of the ports leading from the valve-chest into the cylinder, and from the cylinder to the exhaust, is assured, and there is no possibility of the piston-valve having an overthrow. From the foregoing it is very clear that the piston-valve in my rock-drill is moved to reverse the direction of flow of the motive fluid under pressure before the piston reaches the limit of its movement.

A is the cylinder, of any suitable construction, and same is mounted to have longitudinal movement in the shell B. Mounted within the cylinder A is the elongated piston E, to which is secured or formed part thereof, the piston-rod E^1. This piston is hollowed out or chambered as shown at F so as to receive the rotating bar G. H is the rotating nut held in the piston and co-acting with the said rotating bar.

I is a bearing block mounted within the cylinder and in which is the bearing for the rotating bar G.

a are any suitable packing rings held in the heads of the piston E.

Any suitable pawl and ratchet may be used for the rotating bar G. My preferred construction of device for this purpose consists of a ratchet ring J fitted in one end of the cylinder and held in place by the back-head cover K against the bearing-block I. The head L of the rotating bar is chambered so as to receive the pawls M and N and the spring O which is positioned between these pawls to keep them in engagement with the teeth P of the ratchet ring J.

2 is the air-chest which is suitably attached to the cylinder A, and 3 are the ports in said

air-chest. The ports 3 register with the ports 4 formed in the cylinder A. These sets of ports alternately receive the motive fluid from the valve-chest and act also as exhaust ports, as will be hereinafter more fully understood.

5 is the valve-chest, the ends of which are closed by any suitable means, as by means of the valve-plugs 6.

Mounted to have reciprocating movement within the valve-chest 5 is the piston-valve 7. Each end 8 of the piston-valve 7 is provided with an extended bearing surface which bearing surface is unbroken by any port or opening in the valve itself. Upon referring to Fig. 1 it will be seen that the inner surface of the air-chest 2 between the mouth 9 of each port 3 and the inner sides 10 of the main intake ports 11 is unbroken by any port or opening, thus providing a uniform bearing surface for the ends of the said piston-valve. It will also be noticed from the said figure that the upper side of the piston-valve 7 is unbroken by any port and that the surface of the valve-chest against which the upper side of said piston-valve operates is also unbroken by any ports. The unbroken bearing surface for the ends of the piston-valve 7 will be seen particularly upon referring to Fig. 3. This figure shows that the whole of the circumference of each end of the said piston valve between the ports 12 (formed in each end of said piston-valve and opening into the chambers 13 formed in said piston-valve), and the outer edges of the ends 8, are unbroken, thereby preventing any possibility of any slight wearing in the bearing of the valve destroying its balance.

Mounted in the chambers 14 and 15 formed respectively in the cylinder A and air-chest 2, is the rocker 16 which is mounted on a pivot-pin 17 mounted in the cylinder A. The tappet 18 of the rocker 16 operates in the recess 19 formed in the piston-valve 7.

The piston E is provided substantially midway its heads B^1 and B^2, with a boss 20 having the tapered ends 21 and 22. The surface of this boss between its tapered ends is parallel to the surface of the piston at each end of the boss. The tapered ends 21 and 22 of the boss engage respectively with the tappet legs 23 and 24 of the rocker 16, in order to operate said rocker, and so reciprocate the piston-valve. At no time does the piston-valve 7 close either of the main intake ports 11, and therefore the pressure of the motive fluid is substantially the same at each end of this valve, thus assisting toward the balancing of the same. Now by constructing the piston-valve and its valve-chest with unbroken bearing surfaces, the balancing of my piston-valve is assured at all times.

To illustrate the operation of my drill, when the piston is working full stroke: Fig. 1 shows the piston moving inward. Now when the tapered end 22 of the boss 20 strikes the tappet leg 24, the rocker 16 is moved so as to shoot the piston-valve 7 into the position shown. This causes the port 12 to register with the mouth 9 of the ports 3 and 4 leading to the upper end of the cylinder, and uncovers the port leading from the end of the cylinder in which operates the piston-rod E^1, and allows the exhaust therefrom. The piston will continue inward toward the bearing-block I until its momentum is overcome by the body of motive fluid imprisoned between the head B^2 and said bearing-block, and it will then move outward so that as the head B^2 moves into the position shown, the motive fluid under pressure will rush into the cylinder from the port 4 leading to the upper end thereof, and drive the piston outward. In a short space of time, the tapered end 21 of the boss 20 strikes the tappet leg 23, and so moves the rocker 16 which shoots the piston-valve 7, to cut off the supply of motive fluid into the upper end of the cylinder; open the exhaust therefrom, and at the same time open the necessary ports to cause the motive fluid under pressure to pass into the end of the cylinder in which operates the piston-rod E^1. The described operations are of course repeated as the piston reciprocates. As the rocker is moved around its pivot-pin 17, the leg not in contact with the boss 20, contacts with the piston, and positively prevents any overthrow of the piston-valve 7, and so positively insures the full opening of the ports leading to and from the cylinder A. In order to reduce to a minimum any injurious strains and the generation of undue friction, when either end of the boss contacts with its respective tappet-leg, it will be understood that the angle of the bevel of the said ends will be such as to produce the desired result. The corners of the tappet-legs 23 and 24, where they come in contact with the beveled ends 21 and 22 of the boss 20, are cut off or beveled, as shown at 40 so as to provide ease of movement between the boss and the tappet-leg it is in contact with. Because of the construction already described, when either end of the boss 20 strikes a blow against the tappet-leg co-acting therewith, the piston-valve is given a quick movement, thus insuring a quick full opening of the necessary ports, and so prevent any freezing troubles with compressed air, and also permit the full pressure of the motive fluid to pass through the proper ports into the cylinder. Were my piston valve 7 not thoroughly balanced, it will be understood that before it could be moved the desired distance, the highest point of the boss would have to contact with one of the tappet legs,

and so force the piston-valve to the limit of its movement. But as my piston-valve is thoroughly balanced, it is shot to either end of the valve-chest immediately the rocker is struck. This ease of movement of the piston-valve brings into play the minimum amount of pressure on the pivot pin 17.

The piston-valve 7 is chambered as shown at 30. As before mentioned, the pairs of ports 3 and 4 alternately act as intake and exhaust ports. In the position of the piston shown in Fig. 1, the motive fluid is exhausting from the end of the cylinder in which the piston-rod E^1 operates, through exhaust ports 4 and 3 opening thereinto, by one of the chambered portions 30 into the chamber 15, and out therefrom through the exhaust port 31. The ports 3 and 4 provide the motive fluid with comparatively straight paths into and out of the cylinder, and thus reduce to a minimum any troubles caused by the freezing of compressed air. The piston can of course move to the limit of its stroke, and in such case the surface of the boss between its beveled ends will be moved well under either of the tappet legs. Now in order to produce a short stroke of the piston, and to speed the same up, it is only necessary to advance the tool by the regular method of feeding by the medium of the feed screw C, and its handle D, thus bringing the drill, (not shown) closer to the rock. The reciprocating movement of the piston, in order to permit the drill to work, must be of such length as to move the rocker 16 so as to manipulate the piston valve, and it will be understood by one skilled in this art, that the piston in my drill will move the rocker so as to manipulate the valve without having to move to the limit of the stroke. Now it is clear to one skilled in this art that by reason of my invention, the piston will be operated under the full pressure of the motive fluid whether it be moving its full stroke or under that. The position of the mouth 9 of each port 3, is essentially between the main intake ports 11, and the piston-valve 7 essentially reciprocates between said intake ports, and as each end of this piston-valve is chambered and provided with a port 12, this port essentially operates between the main intake ports 11 and the mouth 9 of the ports 3 at each end of the valve, and at different times moves into alinement with said mouths. The distance between the inner edges of the tappet legs 23 and 24 is at least equal to, but preferably greater than, the distance between the outer ends of the tapered ends 21 and 22, of the boss 20, so that when either tappet leg is quickly struck by its tapered end of the boss, the other tappet-leg will strike against the piston at the base of, or beyond, the other tapered end of the boss, thus giving the necessary movement to the piston-valve to cause the full, quick opening of the necessary ports, and yet prevent the possibility of any overthrow of the piston-valve.

From the foregoing part of my specification, it will be understood clearly that the piston-valve is operated to reverse the direction of flow of the motive fluid in advance of the change in direction of movement of the drill. Now it is impossible to reverse the direction of flow of the motive fluid, as just stated, unless the piston-valve be balanced so as to be moved under the momentum generated therein. It will now be clear how very important the balancing of my piston-valve is in not only obtaining short strokes of the piston, but also where the piston is working on a long stroke. In order to get a short stroke, the friction between the piston-valve and the rocker; the rocker and the piston, and the rocker on its pin, must be reduced to a minimum, and the pressure of the motive fluid so distributed within the valve-chest, as to prevent the same from exerting any unbalanced pressure against any portion of the piston-valve.

In the claims of this specification I use the term "valve-chest" as including the valve-chest and the air-chest, as the term denotes a chambered element of a rock-drill provided with intake and exhaust ports, and in which operates a piston-valve.

While I have described what I consider to be the best embodiment of my invention, I desire to be understood that the principles can be embodied in different forms, and I desire not to be limited beyond the requirements of the prior art and the terms of my claims.

What I claim as my invention is:

1. A device of the class described comprising an engine cylinder provided with intake-exhaust ports, a closed valve casing having main intake ports positioned adjacent the opposite ends thereof, said latter ports being at all times completely open, said intake-exhaust ports opening into said casing, a piston valve within said casing and adapted to reciprocate therein and having a chamber in each end thereof open at opposite ends of the piston, the walls of each of said chambers having an intake port therethrough, an open exhaust port, said valve piston having opposite cut-away portions intermediate said intake ports thereof, one of said cut-away portions positioned between said exhaust port and a cylinder intake-port upon a movement of the valve piston in either direction.

2. A device of the class described comprising an engine cylinder provided with intake-exhaust ports, a closed valve casing having main intake ports positioned adjacent the opposite ends thereof, said latter portions being at all times completely open, said intake-exhaust ports opening into said casing, a piston valve within said casing and

adapted to reciprocate therein and having a chamber in each end thereof open at opposite ends of the piston, the walls of each of said chambers having an intake port therethrough adapted to register singly and alternately with the intake-exhaust ports upon the reciprocation of the piston, an open engine exhaust port, said valve piston having opposite cut-away portions intermediate said intake ports thereof and affording communication between said exhaust port and one of the cylinder intake-exhaust ports upon the limit of movement of the valve piston, a reciprocatory piston within said engine cylinder, a pivoted member in engagement with the valve piston, said member adapted to rock upon the reciprocation of the engine piston and actuate the valve piston thereby.

3. A device of the class described comprising an engine cylinder provided with intake-exhaust ports, a closed valve casing having main intake ports positioned adjacent the opposite ends thereof, said latter ports being at all times completely open, said intake-exhaust ports opening into said casing, a piston valve within said casing and adapted to reciprocate therein and having a chamber in each end thereof open at opposite ends of the piston, the walls of each of said chambers having an intake port therethrough, an open exhaust port, said valve piston having opposite cut-away portions intermediate said intake ports thereof, one of said cut-away portions positioned between said exhaust port and a cylinder intake-exhaust port upon a movement of the valve piston, a reciprocating piston within said cylinder, a boss having tapered ends and a cylindrical intermediate portion and positioned upon said latter piston, a rocker provided adjacent the cylinder and having lower spaced apart tappet legs extending within the cylinder, said legs having beveled ends adapted to contact the tapered ends of the boss and to slidably engage the cylindrical portion thereof, said piston valve having a recess positioned between the walls of the cut-away portions thereof, said rocker having an upper tappet leg freely positioned within said recess whereby a reciprocation of the engine piston reverses the flow of the motive fluid in advance of the change in the direction of movement of said piston.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN REDINGTON.

Witnesses:

BURNETT WEBSTER,

CLARK DAWSON.