

A. PALMROS.
 ROCK DRILL.
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1,052,373.

Patented Feb. 4, 1913.

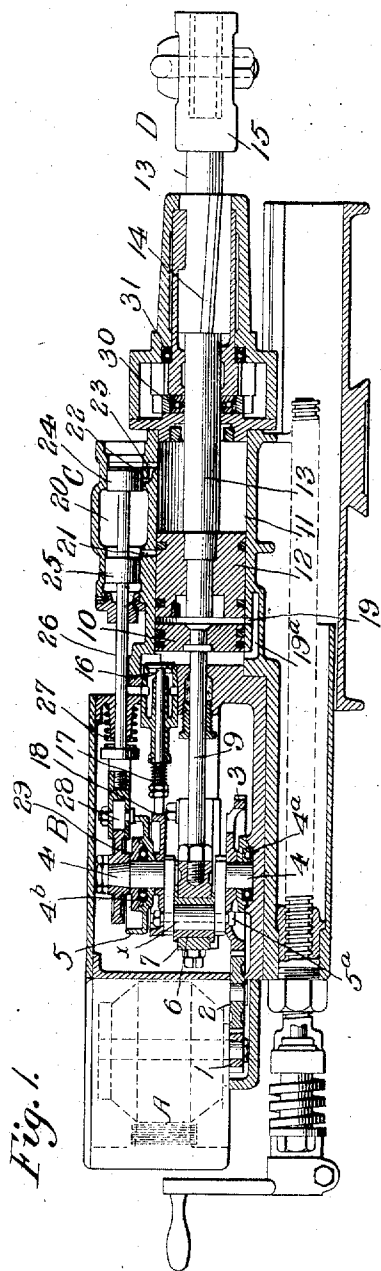


Fig. 1.

Witnesses
Jos. F. Collins.
J. M. Hynkeosp.

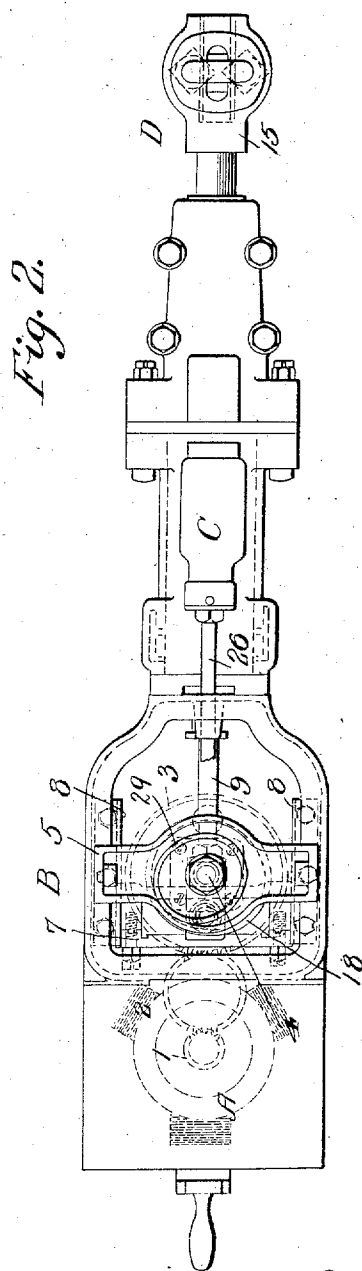


Fig. 2.

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UNITED STATES PATENT OFFICE.

ALEXANDER PALMROS, OF SYRACUSE, NEW YORK, ASSIGNOR TO THE PNEUMEELECTRIC MACHINE COMPANY, OF SYRACUSE, NEW YORK, A CORPORATION OF NEW YORK.

ROCK-DRILL.

1,052,373.

Specification of Letters Patent.

Patented Feb. 4, 1913.

Application filed April 6, 1908. Serial No. 425,483.

To all whom it may concern:

Be it known that I, ALEXANDER PALMROS, a citizen of Finland, and a resident of Syracuse, in the county of Onondaga, State of New York, have invented certain new and useful Improvements in Rock-Drills, of which the following is a specification.

My invention relates to percussion tools in which a fluid pressure medium developed in the machine is caused to act against the piston of a reciprocating bit-carrying element, to develop the working stroke therein, such for instance, as the machine described in my application Serial No. 289,127, filed November 25, 1905, wherein a constantly driven pressure-developing piston, by its retracting stroke, exercises retracting influence over the pressure-driven piston, and simultaneously compresses a body of air, until near completion of the retraction, when the compressed fluid is released into the space between the pistons and acts expansively against the pressure-driven piston to develop the working stroke.

More specifically, my present invention relates to means for aiding the retraction of the pressure-driven piston, by applying thereto a force more efficient than the mere atmospheric pressure acting against its forward face as the air is exhausted from its rear, such for instance, as the modified machine disclosed in my said application Serial No. 289,127, and claimed in my divisional application Serial No. 425,189, filed April 4th, 1908, wherein a fluid pressure storage chamber or valve chest is so connected, and so controlled in its connections with the housing cylinder of the pressure-driven piston, that fluid under pressure is received and stored during or after the working stroke, but delivered to the forward face of said piston during retraction.

My present invention consists in adapting these principles to a vertical machine such as a rock drill; also in certain novel features of construction whereby the several objects are attained; also certain novel features of construction of other parts of a machine of this general type, all of which will be hereinafter fully described and particularly pointed out in the claims.

While some of the features of my present invention are applicable to percussion tools for various industrial purposes, the feature of reinforced retraction is particularly use-

ful in machines used in positions where the weight of the fluid pressure-driven reciprocating parts is largely or wholly opposed to the retracting movement, and some of the details of my present invention are specially designed for this type of machine. I have, therefore, shown my improvements embodied, by way of illustration, in a machine designed to perform the functions of and to be operated after the manner of an ordinary rock-drill.

In said drawings, Figure 1 is a longitudinal section through the machine in the plane of the axes of the pistons and the feed screw. Fig. 2 is an exterior view seen from a position above Fig. 1.

The several parts of the complete machine may be represented by A, B, C and D, A being the prime mover, preferably of a rotating type in the form of an electric motor, B being the mechanism for translating rotary motion into a right-line reciprocating movement, C being the portion for developing and utilizing air pressure expansively, and D being the tool carrying element.

Motion from the electric motor or other prime mover is transmitted through pinions 1, 2 and 3 to a crank shaft 4, which is journaled in ball bearings 4^a 4^b, located respectively in the casing of a converting mechanism and a transverse strut 5 therein, while the crank of said shaft has bearing in a block 6 that slides transversely in a cross-head 7 fitted between guides 8 in said casing. As the crank revolves, the block 6 yields transversely to the transverse portion of its travel, while its full stroke in the direction of the axis of the machine is imparted to the cross-head 7. 9 represents a piston rod rigidly connected at its rear end with the cross-head 7, and at its forward end with the driving or compressing piston 10, which is suitably housed in the cylinder 11 of the air compressing and utilizing element of the machine. Also housed in the cylinder 11 is a driven piston 12 to which is connected the rod 13 of the tool carrying element, which works through a known type of rifle bearing 14, so as to impart a step-by-step rotation to the rod and carries on its extreme end a bit socket 15, these parts making up the tool carrying element D.

Communicating with the rear end of cylinder 11, that is the end thereof adjacent the

driving gear is an air inlet port, having a check valve 16 held normally closed by a spring 17 and having the rear end of its rod in impingement with a cam 18 mounted on the crank shaft 4. When the piston 10 moves forward, valve 16 is positively opened by the cam 18 and thus admits a full charge of air, notwithstanding the loading of the valve by the spring 17; moreover, the means thus provided for positively opening the valve insures its opening at the right moment. After the piston 10 has completed its forward stroke and returns, it compresses the body of air behind it up to great density; at the same time its forward stroke has exhausted the air between the pistons to such an extent that suction is exerted on the piston 12 and the pistons move rearward together.

The part of the cylinder located to the rear of piston 10 will in the following be designated as the "compression chamber," and the part of the cylinder between pistons 10 and 12 as the "expansion chamber."

When the pistons on the rearward stroke reach the position shown in Fig. 1, a port 19 is uncovered by the piston 10, and releases into the space between the pistons that is the expansion chamber the highly compressed body of air that now escapes from behind piston 10 through the bypass 19, and piston 12 is driven forward with great force under the expansive action of this air, and delivers the working stroke of the machine.

20 represents a storage chamber which communicates with the expansion chamber, through a port 21 and with the space forward of the driven piston through port 22. Said forward space also communicates through a port 23 with atmosphere which permits the escape of air in advance of the driven piston during its working stroke. Located in the storage chamber 20 and fitted in the cylindrical portions thereof are slide valves 24, and 25, whose stem 26 extends rearward and is brought under the influence of a spring 27, which tends to move the valves rearward and terminates in an anti-friction bearing head 28 which receives a cam 29 on the upper end of the crank shaft 4. Cam 29 is designed so as to close the ports 21 and 22 during the working stroke of the piston 12, but to open port 23 at such time, so that piston 12 receives the full driving force of the expanding body of air. At the completion of said stroke, however, the cam permits the valve to move rearward under the action of spring 27 a sufficient distance to open port 21 so that when the piston 12 is followed up by the forward movement of piston 10, the comparatively dense air between the pistons is displaced through port 21 into the chamber 20 and said chamber becomes charged with

air which is increased in density in inverse ratio to the reduction in its volume resulting from being displaced from the relatively large space between the cylinders into the small storage chamber. Before piston 10 begins to return, valve 16 is permitted to close under the action of its spring and the parts are now in position to repeat the cycle of movements already described. But cam 29 has in the meantime rotated to a point which moves valves 24 and 25 to their forward limit, closing the charging port 21 and the exhaust port 23, and opening discharge port 22 between chamber 20 and the forward end of cylinder 11. The piston 12 is thus subjected to a positive drive in the rearward or retracting direction under the action of the expanding body of air in the chamber 20.

It will be understood that in a rock drill to which my invention is shown adapted, the general position of the parts is vertical so that the weight of the reciprocating members, together with such length of bit or rod extension as may be used in practice, has to be overcome during the retracting stroke of the machine. In this connection, a positive rearward or upward drive becomes very important in keeping up the promptness of piston stroke which is essential to the success of a percussion machine.

30 represents an anti-friction bearing which guides the reciprocating tool-carrying rod 13 and 31 represents an anti-friction bearing which supports vertically and guides laterally the rifle member 14 when rotating during the forward stroke of the machine.

Claims—

1. In a percussion machine, the combination of a positively reciprocated piston, a second piston adapted to percussively actuate a tool, a cylinder in which said pistons are housed, said cylinder providing a compression chamber in rear of said positively reciprocated piston, said positively reciprocating piston developing driving pressure in said compression chamber for said second piston, means releasing the pressure so developed against the second piston and a positively actuated and timed valve, opening the compression chamber to the atmosphere previous to compression for supplying the pressure medium.

2. In a percussion machine, the combination of a positively reciprocated piston, a second piston adapted to percussively actuate a tool, a cylinder in which said pistons are housed, said cylinder providing a compression chamber in rear of said positively reciprocated piston and an expansion chamber between said pistons, said positively reciprocating piston developing driving pressure in said compression chamber for said second piston, means releasing the

pressure so developed into the expansion chamber and a positively actuated and timed valve, opening the compression chamber to the atmosphere previous to compression for supplying the pressure medium.

3. In a percussion machine, the combination of a positively reciprocated piston and a piston adapted to percussively actuate a tool, a compression chamber in which the positively reciprocated piston develops driving pressure for the tool actuating piston, an expansion chamber in which pressure so developed acts expansively against the tool actuating piston, means releasing the pressure medium into the expansion chamber and a positively actuated timed valve, supplying pressure-medium to said compression chamber; and means for exhausting fluid medium from in front of the tool actuating piston during the expansion action of the pressure medium.

4. A machine of the class described comprising independently reciprocable tool-operating and fluid-compressing pistons, a cylinder in which said pistons are fitted, providing a tight compression chamber in rear of the compressing piston, and an expansion chamber between the pistons, said cylinder also having a by-pass adapted to conduct fluid from said compression chamber to said expansion chamber and means for exhausting fluid directly into the atmosphere in advance of the tool operating piston during its entire forward stroke, whereby the percussion stroke of the tool operating piston is developed by the expansive action of the pressure fluid medium, and means for conducting fluid under pressure to the front of the tool operating piston for retracting said piston.

5. In a percussion machine, the combination of a positively reciprocated piston and a piston adapted to percussively actuate a tool, a compression chamber in which the positively reciprocated piston develops driving pressure for the tool actuating piston, an expansion chamber in which pressure so developed acts expansively against the tool actuating piston, means releasing the pressure medium into the expansion chamber and a positively actuated timed valve, supplying pressure-medium to said compression chamber; and means for exhausting fluid medium from in front of the tool actuating piston during the expansive action of the pressure medium, and thereafter supplying a portion of the expansively acting pressure medium, under pressure to the forward face of the tool actuating piston.

6. In a percussion machine, the combination of a positively reciprocated piston and a piston adapted to percussively actuate a tool, a compression chamber in which the positively reciprocated piston develops driving pressure for the tool actuating piston, an

expansion chamber in which pressure so developed acts expansively against the tool actuating piston, means releasing the pressure medium into the expansion chamber and a positively actuated timed valve, supplying pressure-medium to said compression chamber; and means for exhausting fluid medium in front of the tool actuating piston during the expansive action of the pressure medium, and thereafter supplying a portion of the expansively acting pressure medium, under pressure, to the forward face of the tool actuating piston during an in-stroke of the compressing piston.

7. In a fluid pressure driven percussion tool, the combination of a fluid pressure-driven tool-actuating piston, a fluid compressing piston positively driven, a positively driven valve mechanism for periodically supplying air to the system, and means conducting a portion of the fluid medium under pressure developed by the compressing piston on its pressure-developing stroke to that side of the pressure driven piston opposite to the side receiving pressure to develop the percussion stroke.

8. A machine of the class described comprising a casing provided with a cylinder, operating mechanism within the casing, tool operating and fluid compressing pistons independently reciprocable in said cylinder, an auxiliary chamber adjacent said cylinder in which air is compressed by the out-stroke of said compressing piston, positively driven means for periodically admitting compression fluid within said cylinder, said fluid adapted to be compressed on the in-stroke of the compressing piston whereby to effect the percussion stroke of the tool operating piston, and means operable through the operating mechanism for admitting the compressed air within the auxiliary chamber into the cylinder whereby to retract the tool operating piston.

9. In a percussion machine, the combination of a fluid pressure-driven tool-carrying element, a fluid pressure-developing means, an inlet valve for the fluid pressure-developing means, means holding said valve normally closed, actuating mechanism for the fluid pressure-developing means, and a cam carried by the actuating means and constructed to open the inlet valve.

10. In a percussion tool, the combination of a suitably housed tool-carrying piston, a suitably housed fluid pressure-developing piston, a storage chamber having ports for communication with the housing of the fluid pressure-driven piston at points on opposite sides thereof when the piston is in its forward position, a separate port between the housing and the atmosphere adjacent the forward end of the housing, valves controlling the respective ports, an actuating mechanism for the fluid pressure-develop-

ing piston, and a cam carried by said actuating mechanism controlling the positions of said valves.

11. In a vertical percussion implement, the combination of the fluid pressure-driven tool-carrying piston, performing its percussion stroke in the direction of gravitation, means for exhausting fluid to the atmosphere in advance of said tool-carrying piston during its percussion strokes, a fluid pressure-developing means, an actuating mechanism for the fluid pressure-developing means, a pressure fluid storage chamber having a passage communicating with the lower face of the pressure-driven piston, means opening communication between the storage chamber and said lower face of the fluid pressure-driven piston, during retraction of the latter, and means supplying pressure fluid to said chamber from the pressure-developing means.

12. In a percussion tool, the combination of a suitably housed fluid pressure-driven

piston, means developing fluid pressure to drive the same, a storage chamber constructed with cylindrical portions at opposite ends thereof, valves fitted in said cylindrical portions, ports at the ends of said storage chamber controlled by said valves and communicating between said chamber and said housing of the pressure-driven piston on opposite sides of the latter when in its forward position, a port communicating with the atmosphere at the forward end of said housing controlled by one of said valves, mechanism for operating the fluid pressure-developing means and means through which said operating mechanism also operates the valve of the pressure fluid storage chamber.

The foregoing specification signed at Syracuse, N. Y., this 23 day of March, 1908.

ALEXANDER PALMROS.

In presence of two witnesses:

ELLA M. DOUGALL,
HARRY BARRY.

DISCLAIMER.

1,052,373.—*Alexander Palmros*, Syracuse, N. Y. **ROCK-DRILL.** Patent dated February 4, 1913. Disclaimer filed September 19, 1913, by the patentee, with concurrence of the assignee, *The Pneumelectric Machine Company*.

Enters this disclaimer—

“To that part which is included in claims 4 and 11 of this patent, which is in the following words, to wit:

“4. A machine of the class described comprising independently reciprocable tool-operating and fluid-compressing pistons, a cylinder in which said pistons are fitted, providing a tight compression chamber in rear of the compressing piston, and an expansion chamber between the pistons, said cylinder also having a by-pass adapted to conduct fluid from said compression chamber to said expansion chamber and means for exhausting fluid directly into the atmosphere in advance of the tool operating piston during its entire forward stroke, whereby the percussion stroke of the tool operating piston is developed by the expansive action of the pressure fluid medium, and means for conducting fluid under pressure to the front of the tool operating piston for retracting said piston.

“11. In a vertical percussion implement, the combination of the fluid pressure-driven tool-carrying piston, performing its percussion stroke in the direction of gravitation, means for exhausting fluid to the atmosphere in advance of said tool-carrying piston during its percussion strokes, a fluid pressure-developing means, an actuating mechanism for the fluid pressure-developing means, a pressure fluid storage chamber having a passage communicating with the lower face of the pressure-driven piston, means opening communication between the storage chamber and said lower face of the fluid pressure-driven piston, during retraction of the latter, and means supplying pressure fluid to said chamber from the pressure-developing means.”

OFFICIAL GAZETTE, September 30, 1913.

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12. In a percussion tool, the combination of a suitably housed fluid pressure-driven

piston, means developing fluid pressure to drive the same, a storage chamber constructed with cylindrical portions at opposite ends thereof, valves fitted in said cylindrical portions, ports at the ends of said storage chamber controlled by said valves and communicating between said chamber and said housing of the pressure-driven piston on opposite sides of the latter when in its forward position, a port communicating with the atmosphere at the forward end of said housing controlled by one of said valves, mechanism for operating the fluid pressure-developing means and means through which said operating mechanism also operates the valve of the pressure fluid storage chamber.

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“11. In a vertical percussion implement, the combination of the fluid pressure-driven tool-carrying piston, performing its percussion stroke in the direction of gravitation, means for exhausting fluid to the atmosphere in advance of said tool-carrying piston during its percussion strokes, a fluid pressure-developing means, an actuating mechanism for the fluid pressure-developing means, a pressure fluid storage chamber having a passage communicating with the lower face of the pressure-driven piston, means opening communication between the storage chamber and said lower face of the fluid pressure-driven piston, during retraction of the latter, and means supplying pressure fluid to said chamber from the pressure-developing means.”

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