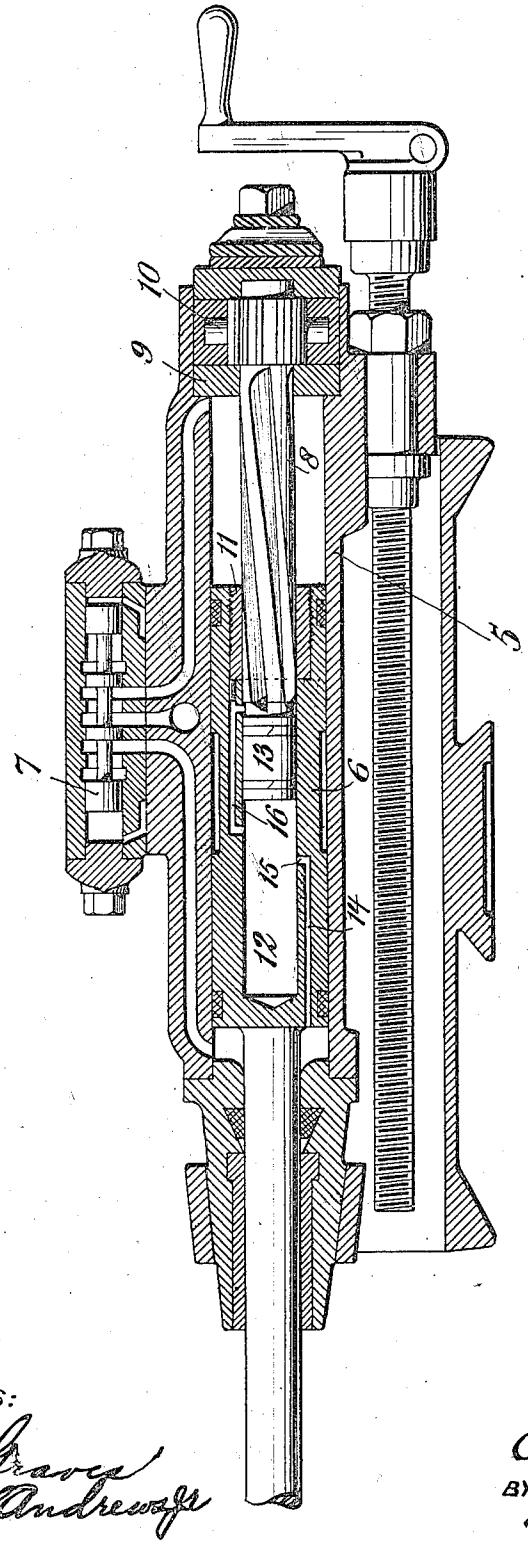
C. H. HAESELER.

POWER OPERATED PERCUSSIVE TOOL.

APPLICATION FILED MAR. 22, 1911.

1,004,874. Patented Oct. 3, 1911.



WITNESSES:

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POWER-OPERATED PERCUSSIVE TOOL.

1,004,874. Specification of Letters Patent. Patented Oct. 3, 1911.

Application filed March 22, 1911. Serial No. 616,110.

To all whom it may concern:

Be it known that I, CHARLES H. HAESELER, a citizen of the United States of America, and a resident of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Power-Operated Percussive Tools, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to power operated percussive tools such as rock drills, mining machines, power hammers, pile drivers and the like, the operation of which is effected by elastic motive fluid under pressure alternately admitted into a working cylinder upon opposite sides of a reciprocating piston freely mounted therein.

In copending applications Serial Number 578,149 filed August 20, 1910, and Serial Number 612,186 filed March 4, 1911, I have disclosed novel means for cushioning the working piston upon the return stroke, together with means for augmenting the force of the blow imparted upon the forward or working stroke, such means not only tending to increase the speed of movement of the piston but to decrease the amount of motive fluid consumed; and my present invention relates to a specific construction of mechanism adapted to effect this result.

In order that my invention may be thoroughly understood, I will now proceed to describe an embodiment thereof having reference to the accompanying drawing which comprises a view in central longitudinal section through a power rock drill constructed in accordance with my invention, and will then point out the novel features in claims.

The rock drill illustrated comprises in general a main working cylinder 5, a reciprocating piston 6 therein, a distributing valve 7 for admitting and exhausting motive fluid to and from the cylinder below and above the piston, and rotating mechanism by which step by step movements of rotation are imparted to the piston. The valve 7 is of the piston type and is operated in one direction or the other by fluid under pressure, at about the time the piston reaches the end of its stroke in either direction. The rotating mechanism comprises a rifle bar 8 secured against relative longitudinal movement in the upper head 9 of the drill, ratchet and pawl mechanism 10 by which movements of rotation of the said rifle bar are permitted in one direction but prevented in the other, and a nut 11 secured in the upper end of the piston 6 and fitted to the said rifle bar. The piston 6 has a cylindrical cavity 12 therein which receives the forward end of the rifle bar 8, and the said forward end of the rifle bar has affixed thereto, or formed as a part thereof, a small piston 13 which is fitted to the said cylindrical cavity 12, as will readily be seen by reference to the drawing.

In the normal operation of the tool, elastic motive fluid such as air or steam under pressure, is first admitted behind the piston to move the same forward, the working space in the main cylinder in front of the main piston being at such time opened to exhaust; then as the piston reaches the end of its forward stroke motive fluid is admitted in front of the piston to drive the same backward, previously employed motive fluid at the back of the piston being permitted at such times to pass to exhaust. In the forward movement of the piston the ratchet and pawl mechanism 10 permits the rifle bar 8 to rotate, the same being given a movement of rotation throughout a portion of a revolution by means of the coaction of the inclined grooves therein with the complementary portions in the nut 11, while upon the rearward or return movement of the piston 6 the ratchet and pawl mechanism holds the rifle bar stationary and a partial movement of rotation is imparted by the rifle bar to the piston.

The main piston 6 is provided at the forward end with a channel 14, the forward end of which opens directly into the space in the main working cylinder 5 in front of the piston 6, while the rear end communicates through a cross passage 15 with the cylindrical cavity 12 in front of the cushioning piston 13 when the main piston is in its forward position. When the main piston is in its forward position there will be free admission of motive fluid under pressure from the forward end of the main cylinder, through the channel 14 and cross passage 15, to the cylindrical cavity 12. As the main piston moves backward the cross passage 15 will be overridden by the cushioning piston 13 whereby the remaining motive fluid in the cavity 12 will be locked up therein so that throughout the remainder of the rearward movement of the main piston such motive fluid will be compressed.

As this air is compressed throughout a considerable portion of the entire length of the stroke of the piston, it will follow that the motive fluid will be compressed to a high degree, and the motive fluid thus compressed will act as an efficient cushioning means to absorb the momentum of the piston and parts carried thereby in each rearward movement. It will of course be understood that the portion of the stroke throughout which the motive fluid is compressed in the cylindrical cavity 12, will depend upon the position of the cross passage 15, which cross passage may be made to enter the cavity 12 nearer to, or farther from, the cushioning piston 13 when the main piston is in its forward position, as is shown in the drawing, as may be desired. If it enters the cylindrical cavity at a point close to the cushioning piston, when the main piston is in its forward position, then the motive fluid will be compressed during the entire return movement of the main piston. As shown the main piston is permitted to move throughout the first part of its return movement before such compression takes place in order that the initial portion of the return movement shall not be opposed by the compression of the motive fluid. In addition to preventing the return movement being opposed by the work done in compressing motive fluid, I have also shown a relief passage 16 by which even the tension of the motive fluid may itself be released at the time of the initial rearward movement of the main piston. The motive fluid in the cavity 12 will discharge through this channel 16 to the rear of the cushioning piston 13 whence it will pass between the rifle bar 8 and the nut 10 to the rear of the main piston 6, and so to exhaust. The distance between the point at which the passage 16 enters the cylindrical cavity 12 and the front end of the cushioning piston 13 when the main piston is in its most forward position is quite short, so that very quickly after its first rearward movement the port opening to such relief passage will override the cushioning piston 13 and escape cut-off therethrough. Preferably there is a short distance between the point at which the relief passage 16 enters the cavity 12 and the point at which the cross-passage 15 enters the cavity 12 so that in the movement of the main piston from the point at which the port of the passage 16 is closed up, to the point at which the cross-passage 15 is closed, motive fluid will be entering through the channel 14 and the cross-passage 15 into the cavity 12 to build up pressure therein, to nearly, if not quite the full motive fluid pressure. In the remaining part of the movement of the piston 13 this motive fluid, which will have been entrapped directly the cross-passage 14 was closed, will be compressed for cushioning and other purposes, as has been explained above.

The points at which the two passages or channels enter the cylindrical cavity 12 may of course be varied both with respect to each other and with respect to the position of the cushioning piston 13 when the main piston is at the end of its forward stroke. The relative cross-sectional areas of the passages may also be varied to suit different conditions and requirements, it being understood that in any event there must be no large channel such as will permit free or unlimited discharge of motive fluid from the main cylinder in front of the main piston. As shown the channel 13 is of very small capacity and this is the preferred construction, the passage being in the nature of a bleeding passage such as will supply the cavity 12 without appreciably lowering the pressure in the main cylinder in front of the main piston.

What I claim is:

1. In an elastic fluid operated percussive tool, the combination with a main cylinder and a percussive piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a cushioning piston mounted in the cylindrical cavity and held against relative longitudinal movement therein, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel the rear end of which enters the cylindrical cavity and the forward end of which is in open free communication with the main cylinder in front of the percussion piston, the rear end of the said channel being in a position to be over-ridden by the cushioning piston in the rearward movement of the main piston.

2. In a rock drill, the combination with a main cylinder and a percussion piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a longitudinally stationary bar carried by the rear head of the main cylinder and projecting forwardly into the said cylindrical cavity, a cushioning piston carried by the forward end of the said bar and fitted to the said cylindrical cavity, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel, the rear end of which enters the cylindrical cavity and the forward end of which is in open free communication with the main cylinder in front of the percussion piston, the rear end of the said channel being in a position to be over-ridden by the cushioning piston in the rearward movement of the main piston.

3. In an elastic fluid operated percussive tool, the combination with a main cylinder

and a percussion piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a cushioning piston mounted in the cylindrical cavity and held against longitudinal movement therein, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel the rear end of which enters the said cylindrical cavity and the forward end of which is in open communication with the main cylinder in front of the piston, and with another channel the forward end of which enters the cylindrical cavity and the rear end of which communicates with the cylinder to the rear of the percussion piston, the forward end of the second said channel and the rear end of the first said channel being arranged to be over-ridden by the cushioning piston in the rearward movement of the main piston.

4. In an elastic fluid operated percussive tool, the combination with a main cylinder and a percussion piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a cushioning piston mounted in the cylindrical cavity and held against longitudinal movement therein, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel the rear end of which enters the said cylindrical cavity and the forward end of which is in open communication with the main cylinder in front of the piston, and with another channel the forward end of which enters the cylindrical cavity and the rear end of which communicates with the cylinder to the rear of the percussion piston, the forward end of the second said channel and the rear end of the first said channel being arranged to be successively over-ridden by the cushioning piston in the rearward movement of the main piston.

5. In a rock drill, the combination with a main cylinder and a percussion piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a longitudinally stationary bar carried by the rear head of the main cylinder and projecting forwardly into the said cylindrical cavity, a cushioning piston carried by the forward end of the said bar and fitted to the said cylindrical cavity, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel the rear end of which enters the said cylindrical cavity and the forward end of which is in open communication with the main cylinder in front of the piston, and with another channed the forward end of which enters the cylindrical cavity and the rear end of which communicates with the cylinder to the rear of the percussion piston, the forward end of the second said channel and the rear end of the first said channel being arranged to be over-ridden by the cushioning piston in the rearward movement of the main piston.

6. In a rock drill, the combination with a main cylinder and a percussion piston freely mounted therein and having a cylindrical cavity projecting inward from the rear end thereof, of a longitudinally stationary bar carried by the rear head of the main cylinder and projecting forwardly into the said cylindrical cavity, a cushioning piston carried by the forward end of the said bar and fitted to the said cylindrical cavity, and means for admitting elastic motive fluid under pressure to the cylinder, the said percussion piston being provided with a channel the rear end of which enters the said cylindrical cavity and the forward end of which is in open communication with the main cylinder in front of the piston, and with another channel the forward end of which enters the cylindrical cavity and the rear end of which communicates with the cylinder to the rear of the percussion piston, the forward end of the second said channel and the rear end of the first said channel being arranged to be successively over-ridden by the cushioning piston in the rearward movement of the main piston.

In witness whereof, I have hereunto set my hand this 20th day of March, 1911.

CHARLES H. HAESELER.

Witnesses:
F. B. GRAVES,
LYMAN S. ANDREWS, Jr.