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C. K. PICKLES.

PNEUMATIC HAMMER.

(Application filed Jan. 27, 1900.)

(No Model.)

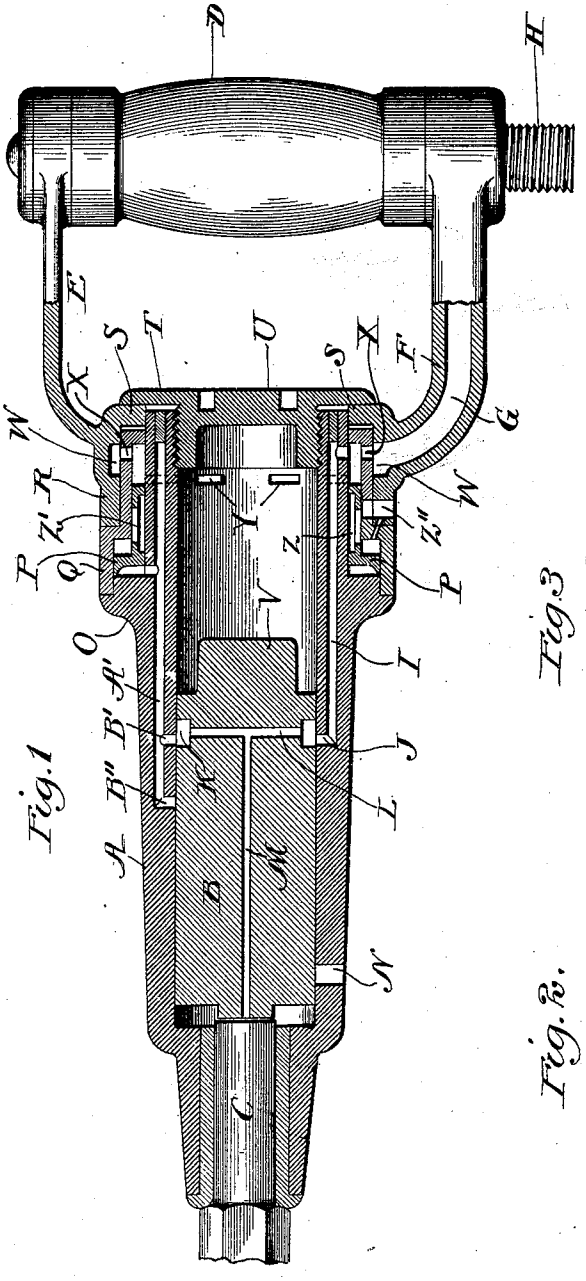


Fig. 1.

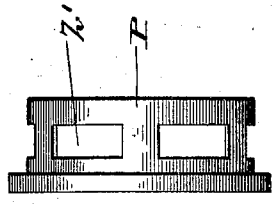


Fig. 3.

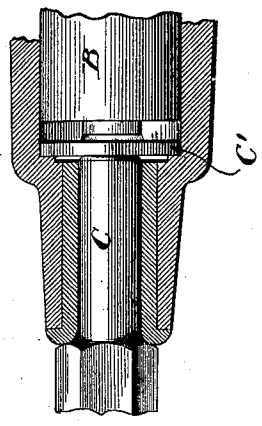


Fig. 2.

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UNITED STATES PATENT OFFICE.

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PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 707,350, dated August 19, 1902.

Application filed January 27, 1900. Serial No. 2,992. (No model.)

To all whom it may concern:

Be it known that I, CHARLES K. PICKLES, a citizen of the United States of America, residing at the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Pneumatic Hammers, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to tools of familiar type known as "pneumatic hammers," in which a reciprocating piston driven by compressed air operates as a hammer or striker to deliver blows to the shank of a chisel or other working tool inserted in the front end of the cylinder in which said piston reciprocates; and it has for its principal object the provision of a novel and efficient means for alternately admitting and exhausting the motive fluid at the opposite ends of the piston-chamber to produce the reciprocations of the piston and under which the piston operates as its own valve for the front end of the piston-chamber, while an independent valve is employed for controlling the admission and exhaust of the motive fluid at the rear end of the piston-chamber.

In the accompanying drawings, Figure 1 represents a middle longitudinal section of a pneumatic hammer embodying my invention with the parts in the position they occupy as the piston approaches the front end of its stroke; Fig. 2, a side elevation of the valve which controls the admission and exhaust of the motive fluid at the rear end of the piston-chamber; and Fig. 3, a sectional detail of the front end of the tool, showing the employment of a metallic disk in the front end of the piston-chamber.

The same letters of reference are used to indicate corresponding parts in the several views.

A represents the cylinder or barrel of the tool containing the piston-chamber, in which reciprocates the piston B, adapted to contact at the end of its forward stroke with the shank of the working tool C, inserted in the contracted bore of the front end of the barrel A. A grasping-handle D is secured to the rear end of the tool by means of upper and lower connecting-arms E F, through the lower one of which is formed a passage G for conveying the motive fluid from the main inlet H to the valve-chamber and forward piston-chamber of the tool. A passage I, constantly communicating at its rear end with the inlet-passage G, extends forward through the wall of the cylinder A and at its front end opens into the piston-chamber by a port J. The piston is provided near its rear end with a circumferential groove K, into which open the outer ends of a diametrical passage L, formed in the piston and having communication with the rear end of a central longitudinal passage M, extending forward entirely through the piston. Under this construction and arrangement of the parts it will be seen that whenever the piston approaches the forward end of its stroke, as in Fig. 1, thereby bringing its circumferential groove K into register with the port J of the live-air passage I, motive fluid will pass through the piston to the front end of the piston-chamber and drive the piston rearward. As the piston moves rearward its groove K will be carried out of register with the port J, thereby cutting off the motive fluid from the front end of the piston-chamber, and at about the same time the front end of the piston will pass rearward of and uncover an exhaust-port N in the wall of the cylinder, permitting the motive fluid which had been admitted to the front end of the piston-chamber to escape to the atmosphere. The further rearward movement of the piston will be effected by its acquired momentum, due both to the action of the motive fluid and to the rebound of the piston from its contact with the shank of the working tool C. It will thus be seen that the piston constitutes its own valve for controlling both the inlet and the exhaust of the motive fluid at the front end of the piston-chamber, so that to produce the necessary reciprocations of the piston back and forth it is simply necessary to provide a suitable valve for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, and the particular form and arrangement of valve

illustrated in the present instance for such purpose may now be described.

About half-way between its middle and rear end the cylinder A is provided with a circumferential flange O, whose rear face forms the front wall of the valve-chamber which contains the cylindrical valve P, Fig. 3, snugly fitting and reciprocating upon the exterior of the cylinder A in rear of the flange O and by its reciprocations controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, as hereinafter explained. The flange O upon the cylinder A is provided upon its periphery with a rearwardly-facing annular shoulder to receive the front end of the valve-casing Q, whose rear end fits the exterior of the cylinder A and the space within which constitutes the valve-chamber in which reciprocates the valve P. Surrounding and fitting this valve-casing Q and abutting against a rearwardly-facing shoulder formed thereon is a sleeve or ring R, formed integral with the arms E F, by which the handle D is connected to the tool. This sleeve or ring R is provided at its rear end with an inturned flange S, fitting the exterior of the rear end of the cylinder A and adapted to be engaged by the periphery of a flanged cap-nut T, which is screwed into the internally-threaded rear end of the cylinder A and serves to clamp the parts together. This cap-nut is provided with a central bore U, opening into the rear end of the piston-chamber and adapted at the rear end of the stroke of the piston to receive a central projecting boss V upon the rear end of the piston B and cushion the latter at the rear end of its stroke.

The sleeve or ring R surrounding the valve-casing Q is provided with an internal circumferential groove W, which communicates at its lower side with the main inlet-passage G, and is therefore constantly filled with live air while the tool is in operation. This groove W communicates by constantly-open ports X with the interior of the rear end of the valve-chamber, so that there is a constant pressure upon the rear end of the valve P tending to force it forward. The valve-chamber communicates with the rear end of the piston-chamber by a series of ports Y, extending through the cylinder A, which ports serve alternately as inlet and exhaust ports for the rear end of the piston-chamber. The valve P is provided with an internal circumferential groove Z, which communicates with the ports Y when the valve is in rearward position, but is cut off from such communication when the valve is in the forward position. (Shown in Fig. 1.) This internal circumferential groove in the valve P also communicates, through the ports Z', formed in the shell of the valve, Fig. 3, with exhaust-ports Z'', extending through the valve-casing Q and ring or sleeve R at the under side of the tool. When the valve is in forward position, Fig. 1, its rear end is forward of the ports Y, connecting the valve-chamber with the rear end of the piston-chamber, thereby placing the rear end of the piston-chamber in communication through said ports with the rear end of the valve-chamber, which latter, as before stated, is constantly filled with live air, and live air will therefore be admitted at such time to the rear end of the piston-chamber to drive the piston forward, as in Fig. 1. When, however, the valve P is shifted to rearward position, its internal circumferential groove Z will be brought into register with the ports Y, and the latter will be cut off by the rear end of the valve from the live-air supply in the rear end of the valve-chamber, and as the circumferential groove Z is in communication with the exhaust-ports Z'' the rear end of the piston-chamber will be placed in communication with the exhaust to permit the rearward movement of the piston. The shifting of the valve rearward for this purpose is effected by means of a passage A', connecting the forward end of the valve-chamber (containing the larger pressure area of the valve) with a port B', opening into the piston-chamber opposite the port J at the front end of the live-air passage I. When the piston in its forward movement reaches the position shown in Fig. 1, its groove K will place the ports J and B' in communication, and thereby admit motive fluid to the front end of the valve-chamber, which fluid there acting upon the larger forward pressure area of the valve will overcome the constant pressure upon the smaller rear end of the valve and shift the valve rearward, with the results above described. When the piston approaches the forward end of its stroke and brings its groove K into register with the port J and B', the motive fluid will not only be admitted to the valve-chamber to shift the valve, but will also be admitted through the passages L M in the piston to the front end of the piston-chamber to drive the piston rearward, as heretofore explained, and as the piston approaches the rear end of its stroke its forward end will pass rearward of and uncover a second port B'', by which the passage A' also communicates with the piston-chamber at a point in front of the port B' and the front end of the valve-chamber be thereby placed in communication with the front end of the piston-chamber and with the exhaust-opening N, with the result that the valve will be shifted forward again by the constant pressure upon its rear end and the motive fluid thereby admitted to the rear end of the piston-chamber to drive the piston forward again.

The essential feature of my invention as thus far described consists in the employment of the passages in the piston, whereby the piston operates as its own valve for the front end of the piston-chamber, in conjunction with the valve mechanism I have described or any other suitable valve mechanism for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-

chamber. Such being the case, it will be understood that my invention is not restricted to the employment of the particular valve mechanism illustrated for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, and, in fact, such valve mechanism is not materially different from that illustrated and described and claimed in Letters Patent No. 630,818, heretofore granted me on August 8, 1899. In the present instance, as explained, the piston operates as its own valve for controlling both the inlet and the exhaust of the motive fluid at the front end of the piston-chamber; but it may be employed (when constructed as shown and described) simply to control the inlet of the motive fluid at the front end of the piston-chamber, the exhaust being controlled in the usual or any suitable manner by the independent valve, which also controls the inlet and exhaust at the rear end of the piston-chamber.

I am aware that it is not broadly new in pneumatic hammers to employ a piston which operates as its own valve to control the inlet and exhaust of the motive fluid at the front end of the piston-chamber, in conjunction with an independent valve for controlling the inlet and exhaust at the rear end of the piston-chamber, such a combination of piston and valve and such a general mode of operation being illustrated, for instance, in Letters Patent of the United States No. 549,102, granted to Joseph Boyer on November 5, 1895; but in the Boyer tool referred to the piston is a differential piston, and the manner in which the piston operates as its own valve for controlling the inlet and exhaust of the motive fluid at the front end of the piston-chamber differs specifically from that which I have illustrated and described in the present instance.

The second feature of my present invention relates to the employment of a metal disk C′ in the front end of the piston-chamber adapted to receive the blow of the piston and transmit it to the shank of the working tool. This disk C′ is placed in fixed position in the front end of the piston-chamber, its forward face resting adjacent its periphery upon a marginal rim formed upon the shoulder of the cylinder-wall, and it is of such thickness as to possess but little, if any, resiliency. Under some conditions and circumstances it will be advantageous to employ such disk C′ intermediate the piston and tool-shank instead of permitting the piston to contact directly with the tool-shank, as in Fig. 1.

Having thus fully described my invention, I claim—

1. In a pneumatic hammer, a cylinder containing a live-air passage opening into the piston-chamber by a suitable port, a piston reciprocating in said chamber and provided with a passage whose rear end is brought into communication with the live-air port at the forward end of the stroke of the piston and serves to admit the motive fluid, through the piston, to the front end of the piston-chamber, to drive the piston rearward, in combination with an independent valve located in a chamber separate from the piston-chamber and operating to control the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

2. In a pneumatic hammer, a cylinder containing a live-air passage opening into the piston-chamber by a suitable port, a piston reciprocating in said chamber and provided with a circumferential groove adapted to register with said port as the piston approaches the forward end of its stroke, and with a central longitudinal passage communicating at its rear end by a lateral passage with said groove and extending forwardly through the piston, and serving to convey the motive fluid through the piston to the front end of the piston-chamber, to drive the piston rearward, in combination with an independent valve operating to control the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

3. In a pneumatic hammer, a cylinder containing a live-air passage opening into the piston-chamber by a port about midway of the length of said chamber, a piston reciprocating in said chamber and provided near its rear end with a circumferential groove adapted to register with said port at the end of the forward stroke of the piston, and with a transverse passage communicating with said groove and with a longitudinal passage extending forwardly through the piston from said transverse passage, for the purpose of conveying the motive fluid through the piston to the front end of the piston-chamber, in combination with an independent valve located in a chamber separate from the piston-chamber for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

4. In a pneumatic hammer, a cylinder containing a live-air passage communicating at its rear end with the source of supply and opening at its forward end into the piston-chamber by a port about midway of the length of said chamber, a piston reciprocating in said chamber and provided near its rear end with a circumferential groove adapted to register with said live-air port at the end of the forward stroke of the piston, and with a passage communicating at its rear end with said groove and extending forwardly through the piston, for conveying the motive fluid through the piston to the front end of the piston-chamber, in combination with an independent differential valve for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, said valve being shifted in one direction by a constant pressure upon its smaller area, and in the opposite direction by motive fluid admitted to its larger area through a passage extending through the cylinder-wall and opening

into the piston-chamber by a port which is placed in communication with the live-air port by the groove in the piston at the end of the forward stroke of the latter, substantially as described.

5. In a pneumatic hammer, a cylinder containing a piston-chamber having a uniform diameter throughout its length, a piston of corresponding diameter reciprocating in said chamber and operating as its own valve to control the inlet of the motive fluid to the front end of the piston-chamber, in combination with an independent valve located in a chamber separate from the piston-chamber for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

6. In a pneumatic hammer, a cylinder containing a piston-chamber of uniform diameter throughout its length, a piston of corresponding diameter reciprocating in said chamber, and provided with a circumferential groove and a central longitudinal passage coöperating with a live-air passage and port in the cylinder-wall to cause the piston to operate as its own valve for controlling the inlet of the motive fluid at the front end of the piston-chamber, in combination with an independent valve for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

7. In a pneumatic hammer, a cylinder containing a piston-chamber of uniform diameter throughout its length, a piston of corresponding diameter reciprocating therein and operating as its own valve to control the inlet of the motive fluid to the front end of the piston-chamber, in combination with an independent annular valve reciprocating in the line of movement of the piston in a chamber separate from the piston-chamber for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, substantially as described.

8. In a pneumatic hammer, a cylinder containing a piston-chamber of uniform diameter throughout its length, a piston of corresponding diameter reciprocating therein and operating as its own valve to control the inlet of the motive fluid to the front end of the piston-chamber, in combination, with a differential annular valve reciprocating in the line of movement of the piston for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber, said valve being shifted in one direction by constant pressure of the motive fluid upon its smaller area, and in the opposite direction by motive fluid intermittently admitted to its larger pressure area through a passage in the cylinder-wall placed in communication with the live-air supply by a groove in the piston at the end of the forward stroke of the latter and opened to the exhaust at the end of the rearward stroke thereof, substantially as described.

9. In a pneumatic hammer, the combination of the cylinder A containing the live-air passage I opening into the piston-chamber by the port J, the piston B provided with the passage L M and groove K coöperating with the port J, and the differential valve P controlled by the piston through the passage A′ connecting the valve-chamber with the piston-chamber, substantially as described.

10. In a pneumatic hammer, the cylinder A provided with the live-air passage I and port J, passage A′ communicating at its rear end with the valve-chamber and opening at its forward end into the piston-chamber by the two ports B′ B″, and an exhaust-port N for the front end of the piston-chamber, in combination with the piston B provided with the passage L M and with the groove K coöperating with the ports J and B′, and the differential valve P controlled by the piston through the medium of the passage A′, substantially as described.

11. In a pneumatic hammer, the combination of the cylinder having the tool-receiving bore at its forward end, to receive the shank of the working tool, and the intermediate disk of non-resilient material located wholly within and fitting the forward end of the piston-chamber and closing said opening, substantially as described.

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