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E. B. BOYER.

PNEUMATIC TOOL.

APPLICATION FILED AUG. 13, 1904.

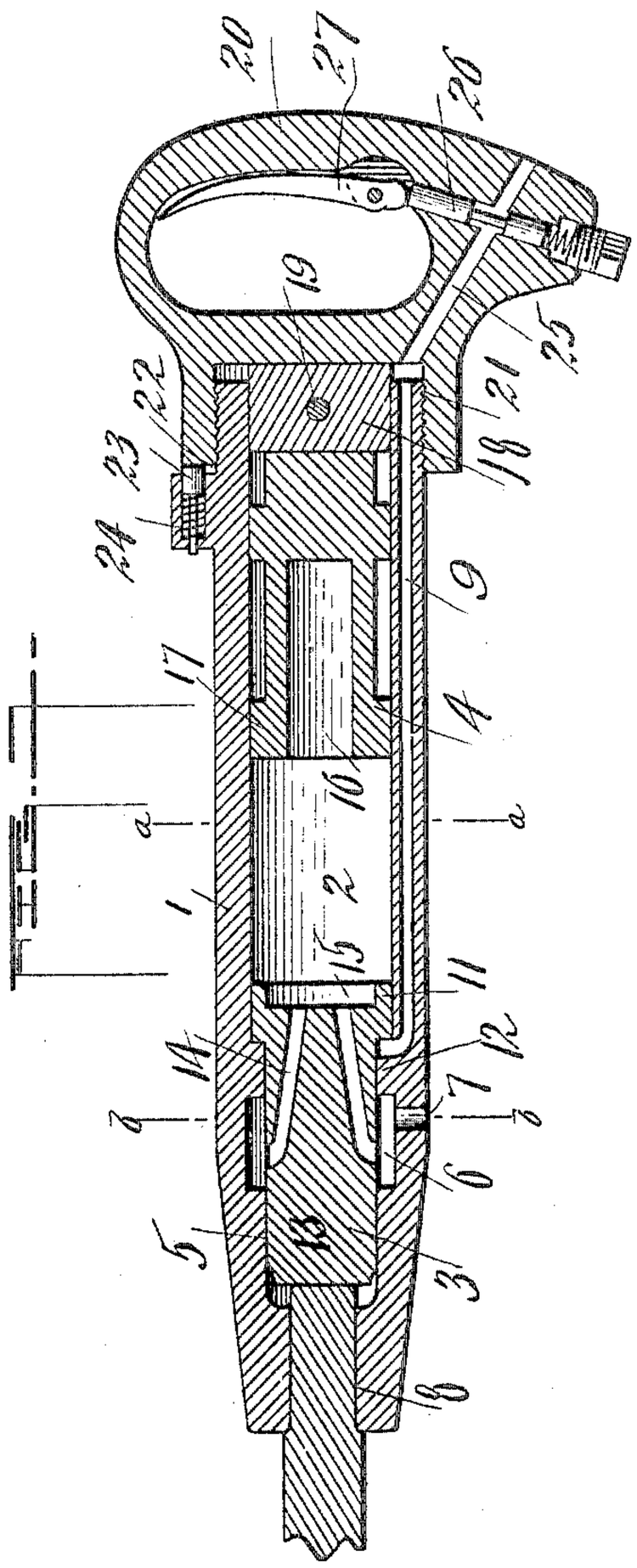

FIG. 1.

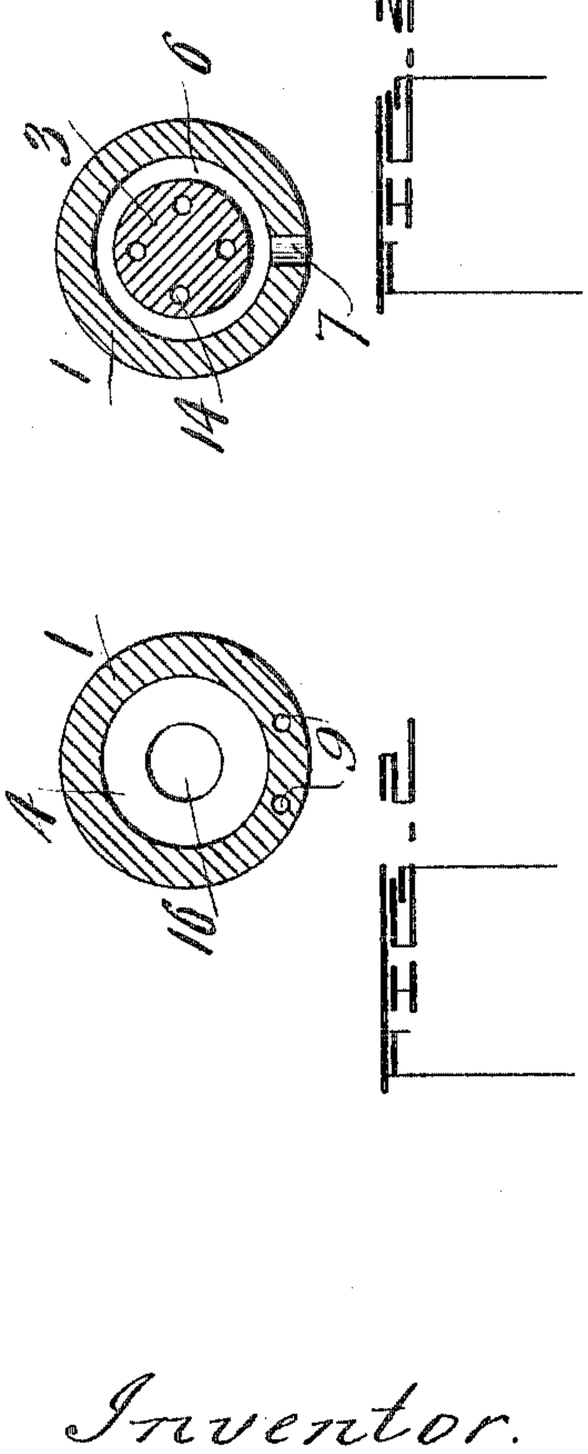

FIG. 3.

FIG. 2.

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PNEUMATIC TOOL.

No. 804,449. Specification of Letters Patent. Patented Nov. 14, 1905.

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To all whom it may concern:

Be it known that I, EDWARD B. BOYER, a citizen of the United States, residing at Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Pneumatic Tools; 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.

This invention has reference to pneumatic tools wherein a portable device is provided for use as a hammer or cutting-tool and for riveting or corking.

The object which I have in view is to provide a pneumatic tool which is simple and economical in construction, of a minimum number of parts, and consuming less of the motive power than machines of this type usually employ.

That the invention may be more fully understood reference is had to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view of a pneumatic tool constructed in accordance with my improvements, showing the hammer-piston in the act of delivering a blow and the supplemental piston in the extreme rearward position preparatory to being sucked forward. Fig. 2 is a cross-section as the same would appear on the line *a a* of my tool. Fig. 3 is a cross-section as the same would appear on the line *b b* of my tool.

I have illustrated one of the many forms in which my invention may be constructed.

1 denotes a casing having a cylindrical bore (of three different diameters) extending longitudinally through the same. One of the chambers is indicated at 2, in which the hammer-piston 3 and the supplemental piston 4 operate.

6 is an exhaust-chamber from which the exhaust passes out through the port or opening 7, it being an enlargement of the part 5 of the bore of the cylinder. The third opening (indicated as 8) is at the forward end of the device and is adapted to receive the shank of the tool to be operated upon. The casing is further provided with air-passages 9, communicating with the chamber or opening 2.

The hammer-piston 3 has portions corresponding to the chambers 2 and 5 of the casing. It has the enlarged head 11, forming a piston-head, against which the force is applied, the same fitting the wall of the chamber 2, and the reduced body portion 13 operating in the chamber 5. 12 is an offset between the chambers 2 and 5 and at the point of entrance of air into the casing. The body of the piston is provided with a series of ports 14, having their front ends arranged to communicate with the chamber 5 and their rear ends communicate with the chamber 2 through the annular chamber 15 in the piston. The arrangement of the passages 9 and the openings into the chamber 2 in front of the head 11 of the hammer-piston is such that air is constantly applied upon the head of the piston for the purpose of moving the same rearward in the casing. The rearward movement of the piston brings the forward openings of the ports 14 coincident with the forward openings of the passages 9, so as to permit the air or other motive force to pass to the chamber 2 at the rear of the hammer-piston and in front of the supplemental piston for the purpose of driving the hammer-piston to a striking position and the supplemental piston to the rearward position, as shown in Fig. 1. When the hammer-piston reaches this striking position, the motive fluid rushes out of the ports 14 and the chamber 5 and exhausts through the port 7. The supplemental piston 4 is approximately of the same length as and has a stroke substantially as long as the stroke of the hammer-piston 3.

The preferred form of the supplemental piston 4 is that shown in the figures having the elongated tubular chamber 16, with the annular flanges 17 engaging the wall of the opening 2. The body of the piston is reduced and the flanges provided to lessen the weight of said piston. The open end of the chamber 16 in the piston faces the rear end of the piston 3, this chamber providing for the expansion of the motive fluid to reciprocate the pistons in opposite directions in the casing.

The rear end of the casing is closed by a plug 18, which is held in place by a pin 19.

20 denotes a handle having a threaded connection with the casing, as at 21. The face of the handle is serrated, as at 22, and engaged by a plug or pin 23, yieldingly held by a spring 24 for locking the handle in its proper position on the casing. The handle is provided with an air-inlet 25, communicating with the passages 9, and provided with a throttle-valve 26, a lever 27 being provided for operating upon the valve to control the action of the same.

It will be seen from an inspection of the drawings that I have all the good qualities of

a single-acting piston and that the movements of such piston are counterbalanced by the supplemental piston. It will be further noted that the air used to force the hammer-piston rearwardly in the casing is at the end of the rear stroke admitted into the chamber 2 and there either alone or with an additional supply causes the piston to move forward to deliver its blow.

The use of two passages or ducts 9 in the casing is a matter of preference rather than a necessity, the aim being to produce a device which shall be strong, durable, and light of weight. However, any number may be employed, as desired.

In operation assuming the pistons to be at the ends of their inward strokes—that is, with their inner ends adjacent—the motive fluid enters the chamber 2 through the ducts 9 and 14, driving the pistons in opposite directions, the hammer-piston to deliver a blow to the tool and the supplemental piston to compress the air or fluid in the chamber in the rear of said piston, the result being that the impulse or shock which would be received by the cylinder owing to the sudden stopping of the forward motion of the hammer-piston and changing of its direction of travel at the front end of the cylinder is compensated for by the similar sudden stopping and changing of the direction of travel of the supplemental piston at the opposite end of the cylinder. When the pistons are at the ends of their outward strokes from the center of the chamber 2, the hammer-piston is moved rearwardly by motive fluid from the ducts 9 entering between the head 11 of the said piston and the rear end of the offset 12, and the supplemental piston is driven forward by the expansion of the compressed fluid in the chamber 2 behind its rear walls. The hammer-piston moves rearwardly until the front ends of the ducts 14 communicate with the ports of the inlet-passages 9, when the same motive fluid which is operating on the front face of the head 11, together with such additional amount as is necessary, is permitted access to the chamber 2 through the said ducts 14, and the pistons within said chamber are again actuated, as above set forth.

It will be noted that I have provided a supplemental piston of simple construction without any ducts therethrough for the admission of the motive fluid at either end thereof and that this piston is actuated in one direction by the motive fluid supplied to the chamber 2 and in the opposite direction by the expansion of the fluid behind it, which is compressed during the rearward movement of the said piston.

I am aware of the fact that a pneumatic tool has been devised employing two pistons moving in opposite directions and adapted to counterbalance the impulsive actions of each other upon the cylinder-heads, but wherein both pistons are driven forwardly and rearwardly by motive fluid supplied from an external source to the chambers in which they are operated and each piston is provided with ducts leading therethrough and each end of the cylinder has inlet-ducts for admitting motive fluid to the opposite working faces of each piston and outlet-ducts for the escape of said fluid; but I believe myself to be the first to have devised a pneumatic tool having oppositely-moving counterbalancing-pistons of which the hammer-piston is driven by motive fluid both forwardly and rearwardly and the supplemental piston is imperforate and is driven in one direction by the same fluid which is acting upon the hammer-piston and in the opposite direction by the expansion of fluid compressed in the rear of said supplemental piston during its rearward stroke.

While in the drawings for the sake of illustration I have shown one manner of constructing a tool embodying my improvements, it will be understood that I do not limit myself to the precise details of construction, as many of these may be varied without departing from the spirit of my invention.

What I claim is—

1. The combination of the cylinder, the hammer-piston arranged to reciprocate in one end thereof, means for supplying motive fluid to actuate the said piston in both directions, and the supplemental imperforate piston arranged to reciprocate in the other end of said cylinder.

2. The combination of the cylinder, the hammer-piston arranged to reciprocate in the front end thereof, the supplemental imperforate piston arranged to reciprocate in the rear end thereof, means for supplying motive fluid to the cylinder between said pistons and an exhaust-duct for permitting the escape of said fluid from the cylinder.

3. The combination of a cylinder, the imperforate piston arranged to reciprocate in one end of said cylinder, the hammer-piston arranged to reciprocate in the other end of said cylinder, means for supplying motive fluid to the said cylinder between said pistons to cause them to move in opposite directions, the hammer-piston to deliver a blow and the imperforate piston to compress the air in the cylinder behind it, the said compressed air serving to cause the forward movement to said piston, the exhaust-duct for permitting the escape of motive fluid from the cylinder and means for supplying motive fluid in front of said hammer-piston to drive it rearwardly.

4. The combination of the cylinder, the hammer-piston adapted to reciprocate in one end thereof and having a passage-way therethrough for the introduction of motive fluid to and its exhaust from said cylinder, the cylinder-inlet duct, the outlet-duct, and the imperforate piston arranged to operate in the rear end of said cylinder and to be driven in

one direction by the motive fluid admitted between it and said hammer-piston and in the opposite direction by the air compressed by it within the cylinder during its rearward stroke.

5. The combination of a cylinder, the hammer-piston adapted to reciprocate in one end thereof and having a passage-way therethrough for the introduction of motive fluid to and for its exhaust from said cylinder, the cylinder-inlet duct, the outlet-duct at the front end of the cylinder, and the piston-like body arranged to reciprocate freely in a chamber at the other end of the cylinder, that part of said chamber behind said piston-like body being substantially closed against the passage of air, substantially as set forth.

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

EDWARD B. BOYER.

Witnesses:
CHAS. N. LA PORTE,
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