No. 724,811. PATENTED APR. 7, 1903.

J. F. CLEMENT.

IMPACT TOOL.

APPLICATION FILED OCT. 13, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

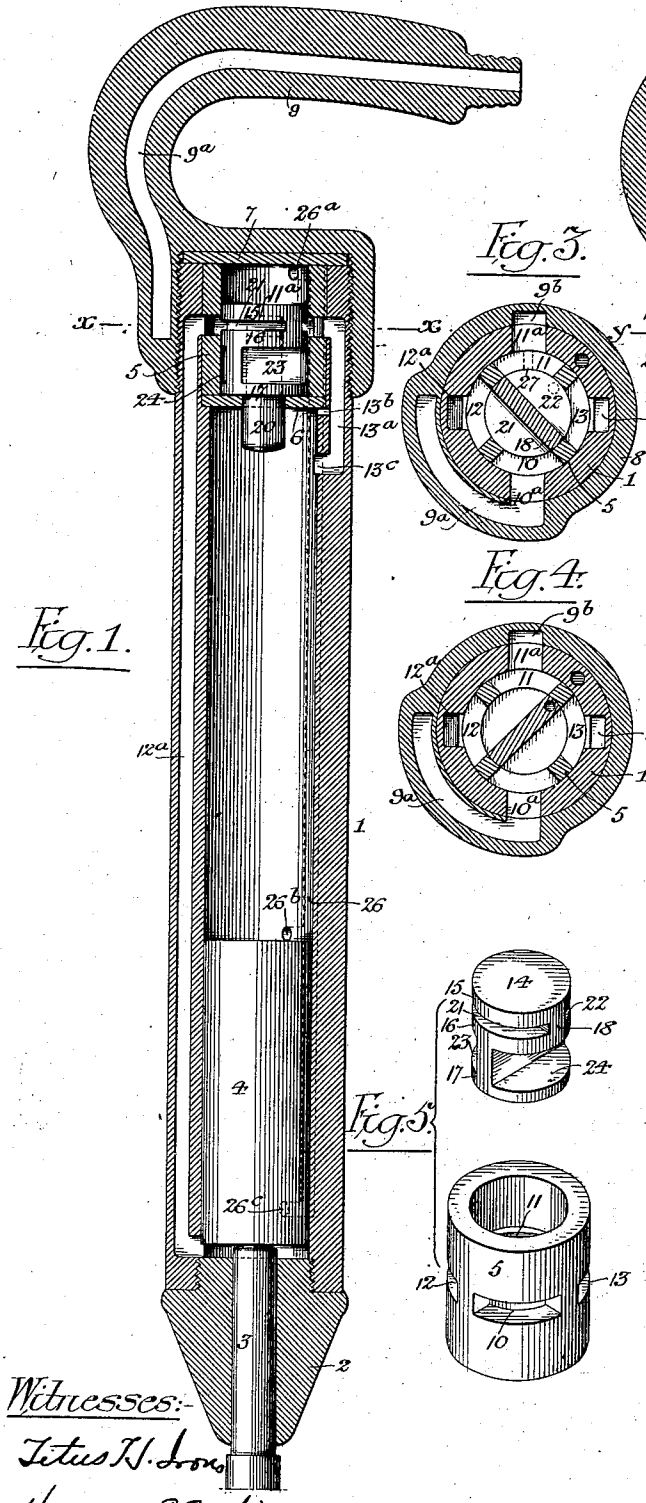


Fig. 1.

Fig. 3.

Fig. 4.

Fig. 5.

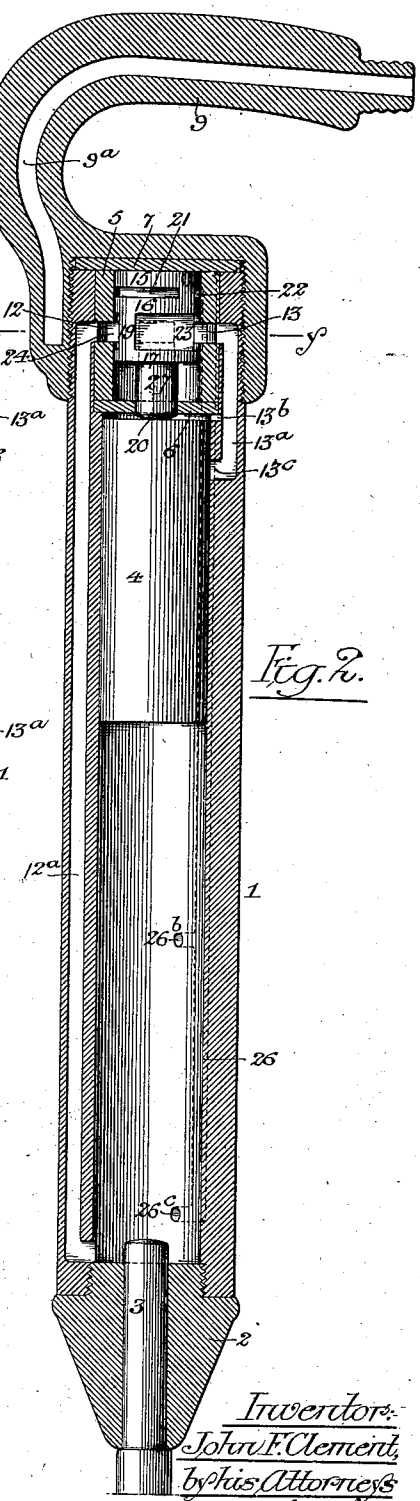


Fig. 2.

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NO MODEL.

2 SHEETS—SHEET 2.

Fig. 6.

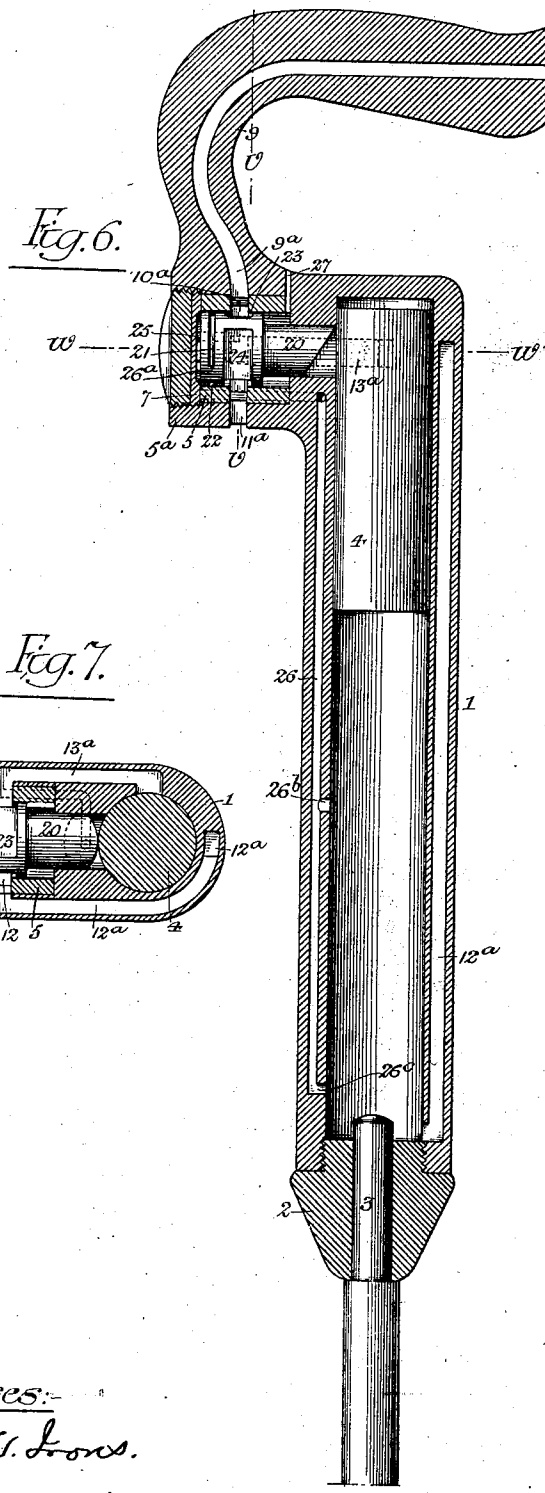


Fig. 8.

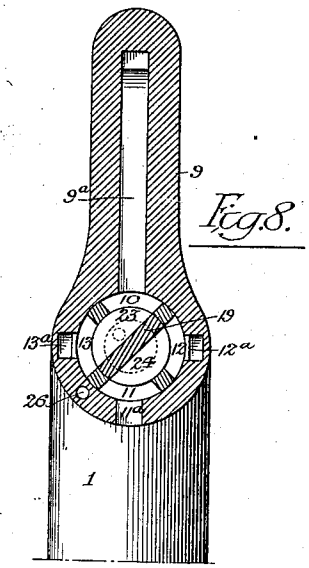


Fig. 7.

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UNITED STATES PATENT OFFICE.

JOHN F. CLEMENT, OF PHILADELPHIA, PENNSYLVANIA.

IMPACT-TOOL.

SPECIFICATION forming part of Letters Patent No. 724,811, dated April 7, 1903.

Application filed October 13, 1902. Serial No. 127,089. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. CLEMENT, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Impact-Tools, of which the following is a specification.

The object of my invention is to provide a simple form of valve mechanism for that class of impact-tools known as "long-stroke hammers" in which the reciprocating hammer is operated by air or other fluid under pressure.

In the accompanying drawings, Figure 1 is a longitudinal sectional view of an impact-tool constructed in accordance with my invention, showing the hammer at the forward end of the stroke. Fig. 2 is a similar view showing the hammer at the rear end of the stroke. Fig. 3 is a sectional plan view on the line *x x*, Fig. 1. Fig. 4 is a sectional plan view on the line *y y*, Fig. 2. Fig. 5 is a perspective view of the valve and valve-chest detached from each other and from the cylinder of the tool. Fig. 6 is a longitudinal section illustrating a modification of my invention. Fig. 7 is a sectional plan view on the line *w w*, Fig. 6; and Fig. 8 is a transverse section on the line *v v*, Fig. 6.

1 represents the cylinder of the tool, which has at the forward end a nose-piece 2, in which is free to play the stem 3 of the rivet-set or other tool which is to be acted upon by the hammer 4, the latter being fitted as snugly to the bore of the cylinder 1 as is compatible with its free reciprocating movement therein without permitting leakage of air around the hammer. To the rear end of the bore of the cylinder is fitted a valve-chest 5, which is confined between a forward washer 6, bearing against a shoulder in the cylinder, and a rear washer 7, which bears against the rear end of the cylinder and is confined thereto by the hub or boss 8 of the handle 9, to which is intended to be connected the flexible pipe for supplying air or other motive fluid under pressure, the handle having formed in it a passage 9^a for said motive fluid and also a passage 9^b for the escape of motive fluid from the tool. The valve-chest has formed in it four ports 10, 11, 12, and 13, the port 10 being diametrically opposite to the port 11, the port 12 diametrically opposite to the port 13, and the ports 12 and 13 at right angles to the ports 10 and 11.

The port 10 communicates with a port 10^a in the cylinder, and this port 10^a is constantly in communication with the supply-passage 9^a of the handle structure. The port 11 communicates with a port 11^a in the cylinder, which port is constantly in communication with the passage 9^b of the handle structure. The port 12 communicates with a passage 12^a, leading to the forward end of the cylinder, and the port 13 communicates with a passage 13^a, formed in the rear portion of the cylinder and having two communications with the bore of said cylinder—one through a port 13^b at the extreme rear end of said bore and the other through a port 13^c at a point slightly in advance of said rear end.

The valve 14 has three disks 15, 16, and 17, and between the disks 15 and 16 are passages 21 and 22, separated from each other by a diagonal partition 18, while between the disks 16 and 17 are passages 23 and 24, separated from each other by a diagonal partition 19, disposed at a right angle to the partition 18. The valve is prevented from turning in the valve-chest by means of a pin 25, projecting from the washer 6 into an opening in the valve, and the partitions 18 and 19 of the valve are so disposed that when the valve is in its forward position, as shown in Fig. 1, the passage 21 of the valve-casing connects the ports 10 and 12 and the passage 22 connects the ports 11 and 13, as shown in Fig. 3, while when the valve is in its rear position, as shown in Fig. 2, the passage 23 connects the ports 10 and 13 and the passage 24 connects the ports 11 and 12. In the cylinder 1 is also formed another passage 26, terminating at its rear end in a port 26^a at the rear end of the valve-chest, said passage having two communications with the bore of the cylinder, one of these communications being through a port 26^c, near the forward end of the bore, and the other being through a port 26^b, so located in the bore that it will be uncovered by the hammer 4 just as the latter has completed its forward stroke and delivered its blow upon the tool-stem 3.

The valve 14 has a contracted stem 20 projecting therefrom forwardly through the

washer 6, so that it will be struck up by the hammer as the latter approaches the rearward end of its stroke, whereby a corresponding rearward movement will be imparted to the valve. The forward end of the valve-chest is in constant communication through a passage 27 with the exhaust-port 11^a of the cylinder.

The operation of the tool is as follows: Supposing that the ports are in the position shown in Fig. 1, air or other motive fluid from the passage 9^a of the handle passes through the passage 10^a of the cylinder, the ports 10 and 12 of the valve-chest, and the passage 21 of the valve to the passage 12^a of the cylinder, whereby it is directed to the forward end of the cylinder, so as to drive the hammer 4 rearwardly therein, the rear end of the bore being open to the exhaust through the passage 13^a and the ports 13 and 11 of the valve-chest and the passage 22 of the valve. As the hammer approaches the rear end of its stroke it strikes the projecting stem 20 of the valve and moves the latter rearwardly in the chest to the position shown in Fig. 2, whereupon the flow of air is reversed, the air under pressure being now directed from the port 10^a of the cylinder through the ports 10 and 13 of the valve-chest and the passage 23 of the valve to the passage 13^a, so as to enter the rear end of the bore of the cylinder and drive the hammer 4 forwardly therein, the air from the lower end of the bore escaping through the passage 12^a to the exhaust-passage 11^a of the cylinder through the ports 12 and 11 of the valve-chest and the passage 24 of the valve, as shown in Fig. 4. Just as the hammer reaches the limit of its forward stroke and delivers its blow upon the tool it uncovers the port 26^b of the passage 26. Hence motive fluid under pressure passes through said passage 26 to the rear end of the valve-chest and drives the valve forwardly in said chest, the pressure upon the stem 20 of the valve not being sufficient to prevent or materially retard this forward movement of the valve, owing to the limited area presented by said stem. The parts are now again in the position shown in Fig. 1, and the operations before described are repeated.

It will be noted that the port 13^c is some distance in advance of the rear end of the cylinder. Hence as soon as it is covered by the hammer on the back stroke of the latter the escape of air from the rear end of the cylinder will be cut off except through the port 13^b, which is of such small area that it cannot freely vent the air thus trapped in the rear end of the cylinder. This body of air thus serves as a cushion to gradually retard the rearward movement of the hammer and finally bring it to a stop before it can forcibly strike the rear head of the cylinder or cause the valve to forcibly strike the rear end of the valve-chest, thus preventing shock or jar which would result from such forcible contact. The small port 13^b provides for the admission of motive fluid to the extreme rear end of the cylinder in order to insure the carrying forward of the rear end of the hammer beyond the port 13^c on the forward stroke in case the rebound of the hammer due to the expansion of the entrapped air is not sufficient to effect this result, as it may not be in some cases when the tool is being used with the valve-chest end downward.

In the tool shown in Figs. 6, 7, and 8 the valve-chest is disposed transversely to the bore of the cylinder and is contained in a boss 5^a, projecting laterally from the rear end of the cylinder, this boss also having the handle structure 9. The contracted stem 20 of the valve in this case has a beveled end projecting into the bore of the cylinder, so that the action of the hammer upon the said stem causes lateral movement of the valve outwardly in its chest, the inward movement being effected by the normal pressure of the motive fluid acting upon the rear face of the valve, as in the tool shown in Fig. 1.

In both of the tools shown the passage 27 provides for the free flow of air into and from the forward end of the valve-chamber as the valve moves forwardly and backwardly therein.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination, in an impact-tool, of a cylinder having a reciprocating hammer therein, a valve-chest at the rear end of said cylinder, a valve in said chest for controlling the flow of motive fluid into and from the cylinder, said valve having a forward portion of lesser diameter than the rear end of the valve to be struck by the hammer on the back stroke of the latter, means for cushioning the hammer at the end of said back stroke, and means for conveying motive fluid to the rear end of the valve-chest when the hammer reaches the forward end of its stroke, substantially as specified.

2. The combination, in an impact-tool, of a cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth with the cylinder some distance in advance of its rear end, a valve, movable in said chest, and serving, by its movement therein, to govern the flow of motive fluid into and from the cylinder, said valve having a contracted stem projecting forwardly into the cylinder, whereby it will be struck by the hammer on the back stroke of the latter, but said hammer will be cushioned and its movement arrested by the time the valve has completed its stroke, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

3. The combination, in an impact-tool, of a

cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth, by a contracted port, with the rear end of the cylinder, and, by a larger port, with said cylinder some distance in advance of said rear end, a valve, movable in said valve-chest, and serving, by its movement therein, to govern the flow of motive fluid into and from the cylinder, said valve having a contracted stem projecting forwardly into the cylinder whereby it will be struck by the hammer on the back stroke of the latter, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

4. The combination, in an impact-tool, of a cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth with the cylinder some distance in advance of its rear end, means for permitting free flow of air into and from the forward end of said valve-chest, a valve, movable in said chest, and serving, by its movement, to govern the flow of motive fluid into and from the cylinder, said valve having a contracted stem projecting forwardly into the cylinder whereby it will be struck by the hammer on the back stroke of the latter and will be moved rearwardly by said hammer while the latter is being cushioned at the back end of its stroke, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

5. The combination, in an impact-tool, of a cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth with the cylinder some distance in advance of its rear end, a valve movable in said chest and serving by its movement therein to govern the flow of motive fluid into and from the cylinder, said valve having passages in different planes, the passages in each plane being separated by a transverse partition and having also a contracted stem projecting forwardly into the cylinder whereby it will be struck by the hammer on the back stroke of the latter, but said hammer will be cushioned and its movement arrested by the time the valve has completed its stroke, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

6. The combination, in an impact-tool, of a cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth, by a contracted port, with the rear end of the cylinder, and, by a larger port, with said cylinder some distance in advance of said rear end, a valve movable in said valve-chest and serving, by its movement therein, to govern the flow of motive fluid into and from the cylinder, said valve having passages in different planes, the passages in each plane being separated by a transverse partition and having also a contracted stem projecting forwardly into the cylinder whereby it will be struck by the hammer on the back stroke of the latter, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

7. The combination, in an impact-tool, of a cylinder with reciprocating hammer therein, a valve-chest at the rear end of said cylinder, said valve-chest having ports, one communicating with the motive-fluid supply, another with the exhaust, a third with the forward end of the cylinder, and a fourth with the cylinder some distance in advance of its rear end, means for permitting free flow of air into and from the forward end of said valve-chest, a valve, movable in said chest, and serving, by its movement, to govern the flow of motive fluid into and from the cylinder, said valve having passages in different planes, the passages in each plane being separated by a transverse partition and having also a contracted stem projecting forwardly into the cylinder, whereby it will be struck by the hammer on the back stroke of the latter and will be moved rearwardly by said hammer while the latter is being cushioned at the back end of its stroke, and means for conveying motive fluid to the rear end of the valve-chest when the hammer has reached the forward end of its stroke, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN F. CLEMENT.

Witnesses:
F. E. BECHTOLD,
JOS. H. KLEIN.