No. 695,664. Patented Mar. 18, 1902.

C. B. ALBREE.

MOTOR FOR TOOLS.

(Application filed May 18, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

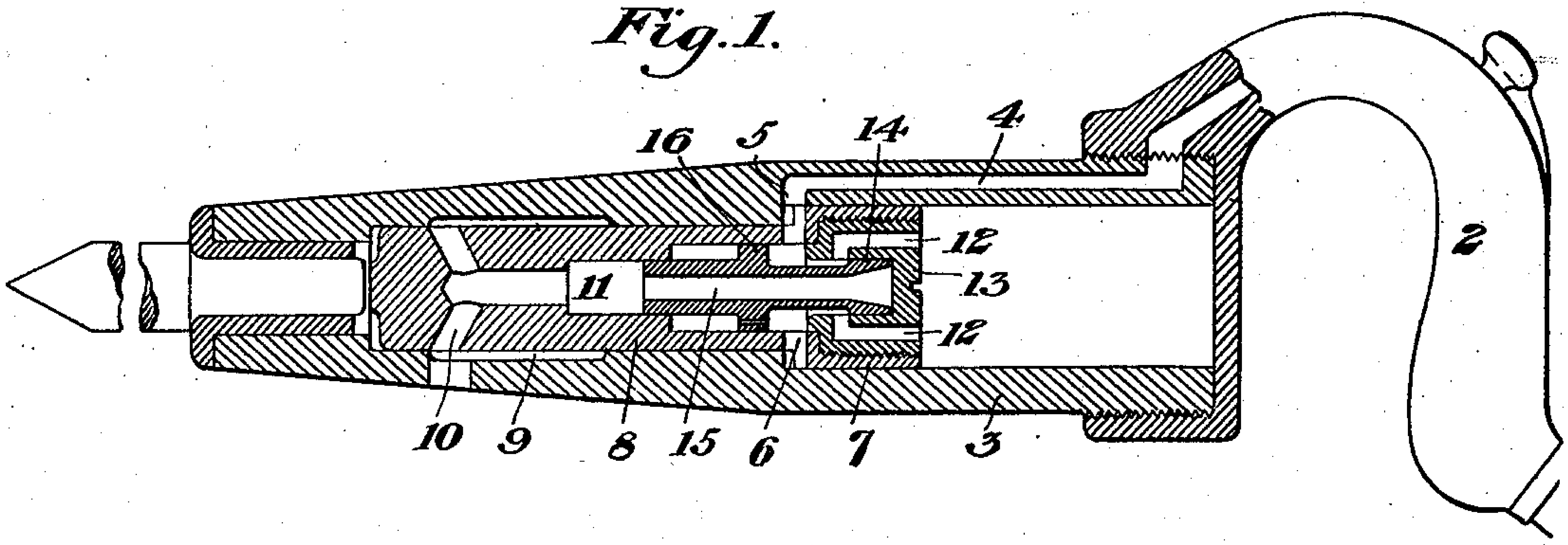


Fig. 2.

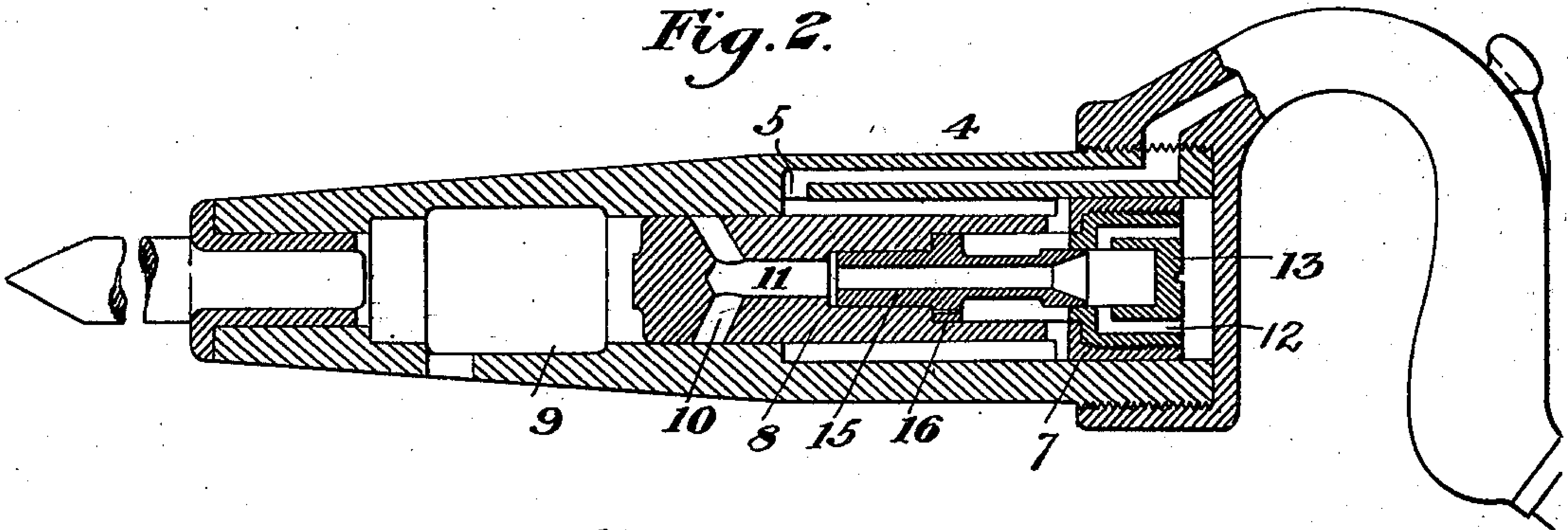


Fig. 3.

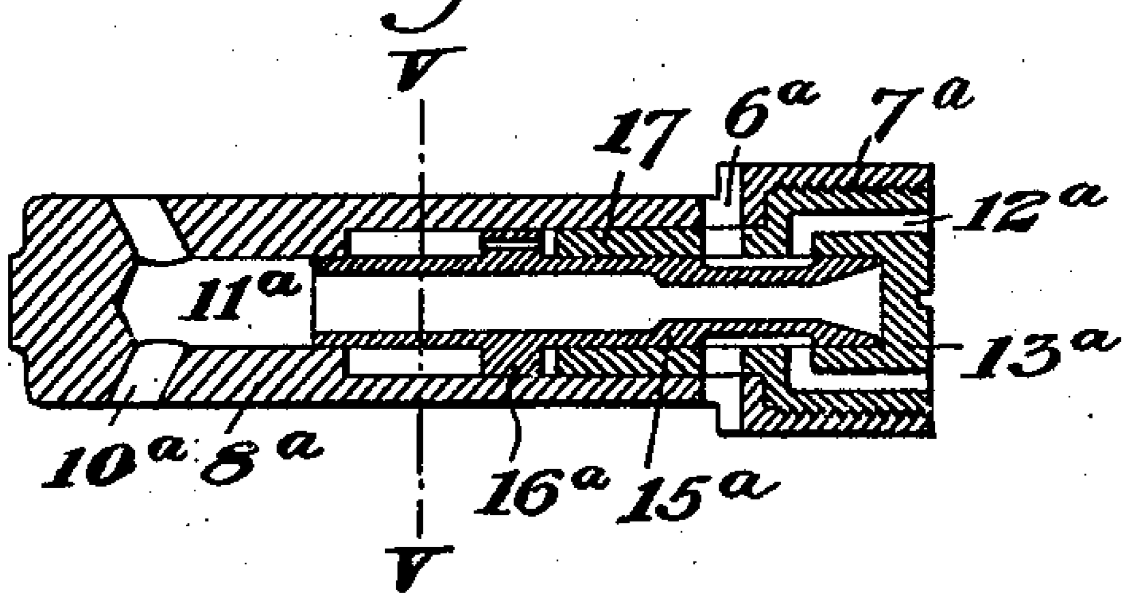


Fig. 5.

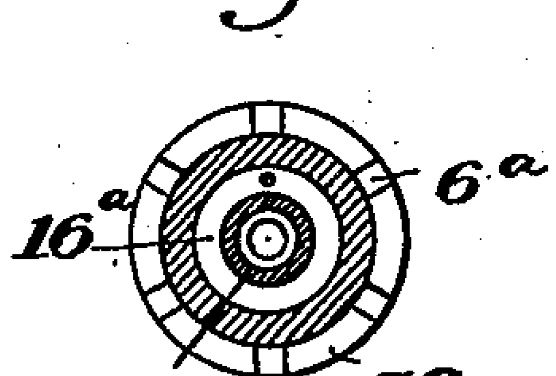


Fig. 4.

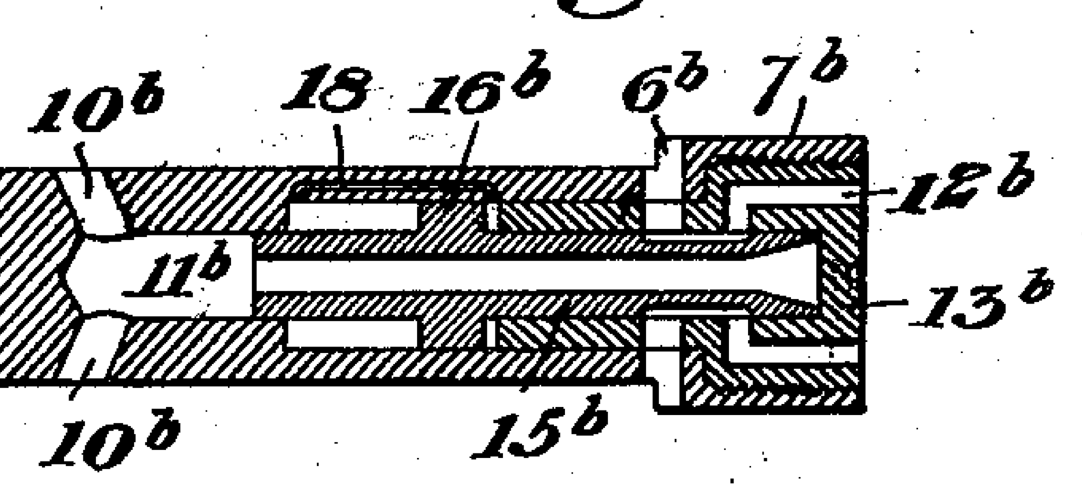
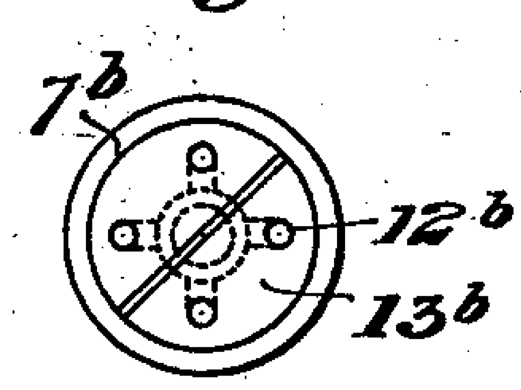


Fig. 6.



WITNESSES

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No. 695,664. Patented Mar. 18, 1902.

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MOTOR FOR TOOLS.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 7.

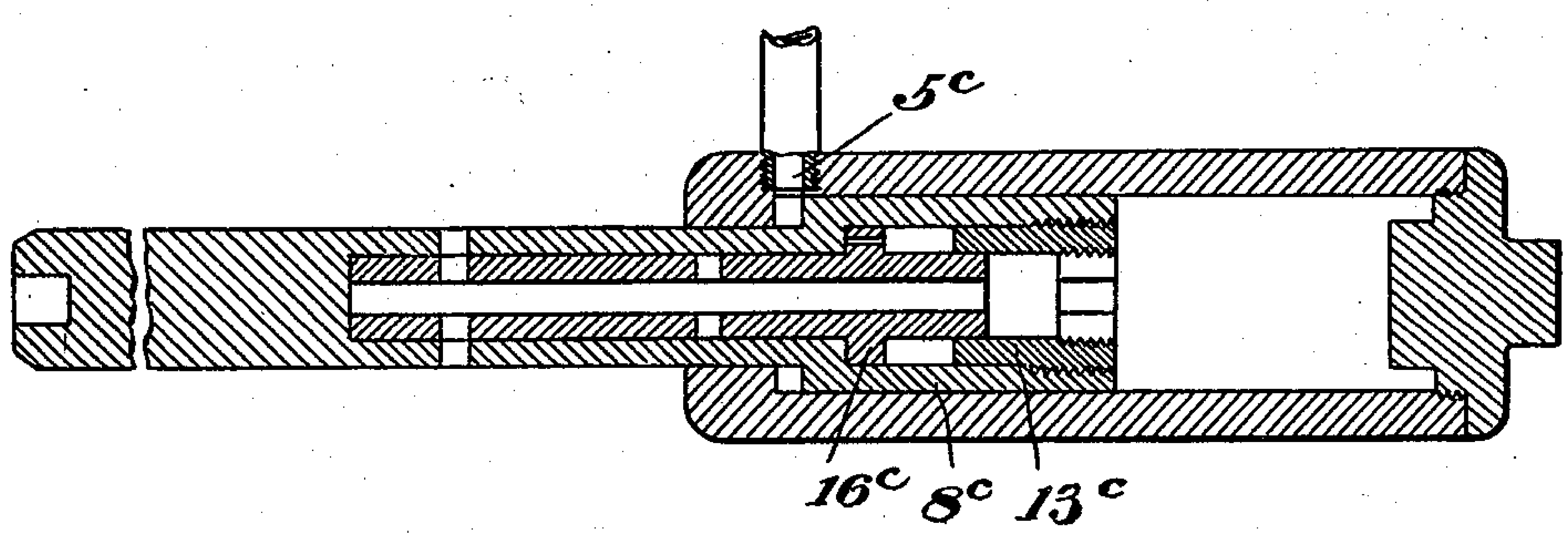
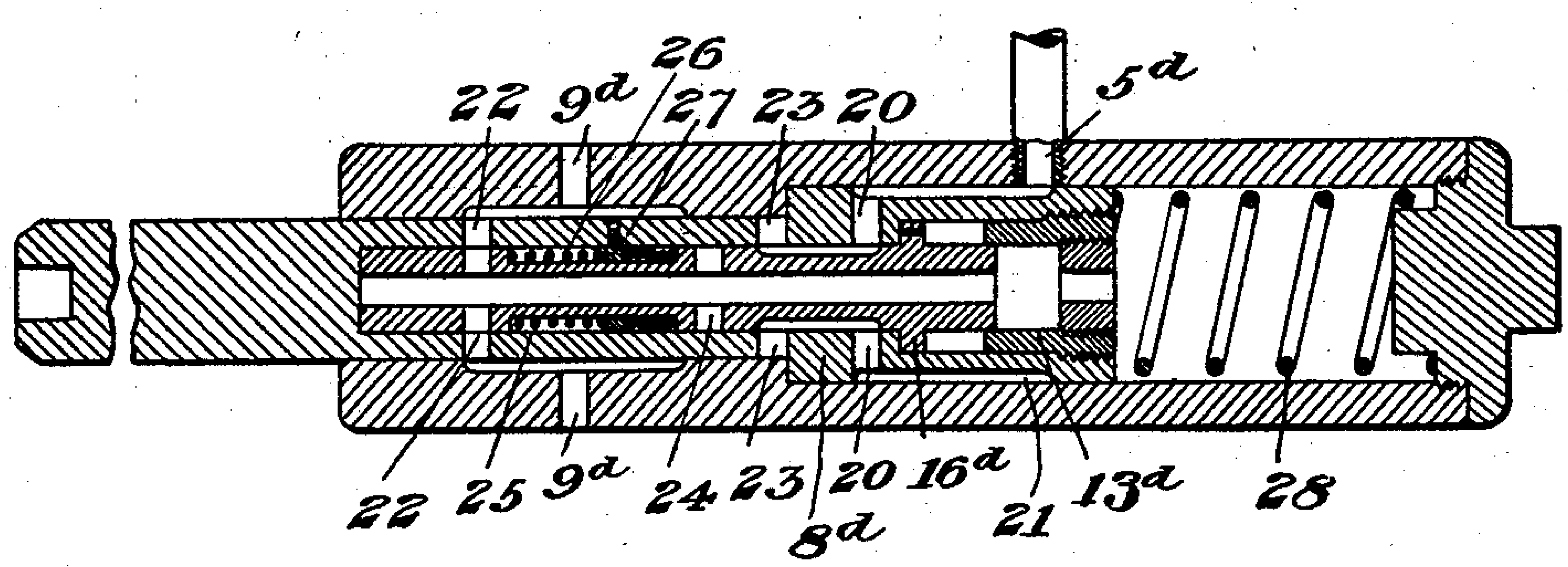


Fig. 8.



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UNITED STATES PATENT OFFICE.

CHESTER B. ALBREE, OF ALLEGHENY, PENNSYLVANIA.

MOTOR FOR TOOLS.

SPECIFICATION forming part of Letters Patent No. 695,664, dated March 18, 1902.

Application filed May 18, 1901. Serial No. 60,833. (No model.)

To all whom it may concern:

Be it known that I, CHESTER B. ALBREE, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Motor for Tools, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal section of a pneumatic tool embodying my invention. Fig. 2 is a similar view showing the parts in a different position, and Figs. 3 and 4 are longitudinal sections showing modified forms of the invention. Fig. 5 is a cross-section on line V V of Fig. 3. Fig. 6 is an end view of the piston, and Figs. 7 and 8 are longitudinal sections showing other modifications of the invention.

My invention relates to that class of fluid-pressure motors for tools wherein an inertia-valve is employed to control the movements of the piston; and its object is to prevent the rapid destruction of these valves. In a series of experiments upon these inertia-valves I have found that it is difficult to prevent deterioration of the valves owing to the shocks to which they are subjected. I have overcome this difficulty by the present invention, which consists in cushioning these inertia-valves at the forward end of the stroke, and preferably at both ends of the stroke, by means of a fluid cushion. This principle may be worked out in many different forms, and I show in the drawings several forms in which it is applied to tubular inertia-valves.

In the form of Figs. 1 and 2, 2 represents the usual handle and 3 the cylinder of the tool. The wall of this cylinder contains the inlet-passage 4, leading to the supply-port 5, and the piston inlet-port 6, of annular form. The piston is provided with a rear and larger portion 7 and a forwardly-extending portion 8, of smaller diameter, which fits within the reduced bore of the forward portion of the cylinder. This reduced bore has an annular enlarged portion 9, forming the exhaust-port, with which the piston exhaust-ports 10 register in a certain position of the piston. The ports 10 extend laterally from a passage 11, extending longitudinally through the piston and connecting with side branch ports 12 in a valve-bushing 13. These ports 12 are controlled by the enlarged rear end portion 14 of the hollow inertia-valve 15. The front portion of this valve fits neatly within a slightly-enlarged portion of the passage 11, and at an intermediate point this inertia-valve is provided with an annular projection 16, which fits within a further enlarged bore within the piston. The ring projection 16 is provided with one or more axially-extending holes, as shown in Fig. 2, and forming a by-pass.

In Fig. 1 I show the inertia-valve in its normal position just before the piston reaches the forward end of its stroke. In this position the air enters through ports 5 and 6 and flowing around the reduced portion of the valve passes back through the ports 12 to the rear of the plunger and forces the piston or plunger forward. When the piston reaches the forward end of its stroke, the inertia of the valve carries it forward into the relative position shown in Fig. 2. As it moves forward the live air which has passed in front of its ring portion 16 during the forward stroke of the piston will pass slowly back through the small hole or holes in this ring portion, and thus cushion the forward stroke of the valve by throttling the escape of the imprisoned air. When the valve is thus shifted, its rear enlarged end portion is moved to a position in front of the ports 12 and connection between the supply-port 6 and these ports 12 is cut off, and consequently the exhaust takes place through the central channel 11 and the piston exhaust-ports 10 until these ports 10 pass back beyond the enlarged cylinder-port 9. The remaining air forms a cushion for the back stroke of the piston, and at the end of this rear stroke as the inertia-valve is driven back to its former position its ring portion moves back and the air flows slowly forward through the by-pass to the forward side of the projection 16, thus again cushioning the valve.

Instead of arranging the inertia-valve so that the air-cushion will be formed by the initial fluid-pressure I may so arrange it that the cushion is formed by air under atmospheric pressure. Thus in Fig. 3 I show the valve-bushing 13^a as provided with the front extension 17, which fits around the inertia-valve 15^a, the annular abutment portion 16^a being in front of this extension. The other parts of the device are similar to those of the form of Figs. 1 and 2, and in this form movement of the valve in either direction is opposed by the imprisoned air between the valve and the end of the bushing or between the valve and the abutment within the piston, and during the movements of the valve this air will slowly pass through the small by-pass hole or holes in the valve from one side to the other, and thus cushion the valve and prevent its hammering. Again, the hole through the valve-ring may be done away with and a by-pass provided around it and extending through the piston-wall, as shown at 18 in Fig. 4. In this form 16^b is the projection on the valve, and 13^b the valve-bushing.

In Fig. 7 I show the invention as applied to the form of motor shown in my United States Patent No. 638,490, dated December 5, 1899. In this form 5^c is the inlet-port, 8^c the piston, and 16^c the enlarged portion of the valve, moving in an inclosed pocket between the front end of the valve-bushing 13^c and the front end of the enlarged bore of the piston. In this case the by-pass is shown as extending through the enlargement 16^c.

In the form of Fig. 8 I show the invention as applied to the compound motor shown in Fig. 1 of my United States Patent No. 638,489, dated December 5, 1899. In this case 5^d is the inlet-port, 8^d the piston, having two portions of different diameters, and 9^d the exhaust-port, communicating with an annular space around the piston in the smaller diameter of the cylinder. In this form a passage 19 is formed lengthwise through the piston, having ports 20 communicating with the annular port 21 around the larger diameter of the piston. The ports 22 at the front end of the piston communicate with the annular port around this portion arranged to be in communication with them at all points of the stroke. Ports 23 also lead from the longitudinal passage to the outer surface of the piston at or near the juncture between its two diameters. The longitudinal passage contains the inertia-valve, the annular port 21 of which is in communication with the ports 20 and 23 when the valve is at the outer end of the passage, as shown in the figure. A port 24 leads from the interior to the exterior of the valve and is arranged to register with the port 23 when the valve is at the inner end of the passage. The valve has also a cut-away portion forming an annular space 25, arranged so that it does not register with any two of the ports 22, 23, and 24 at any position of the valve. In this space are placed coiled springs 26, the adjacent ends of which bear against a ring 27, fixed to and projecting inwardly from the piston. These springs are so related as to relative strength that they normally hold the valve in the position shown in the figure, but are sufficiently flexible to allow the valve to be moved by inertia to the other end of its stroke. In this form the projection 16^d on the valve fits within an annular pocket between the inner end of the valve-bushing 13^d and a shoulder formed within the enlarged portion of the piston, the projection having a small perforation, as in the forms of Figs. 1, 2, 3, and 5. Between the cylinder-head and the piston is a spring 28, which is arranged to return the piston automatically at the outer end of the stroke to put the parts in position for starting when the cylinder is disconnected from the power-supply. In this form the projection on the valve acts in the same manner as in the previous forms and cushions the impact of the valve at both ends of its stroke.

The advantages of my invention result from the use of the fluid cushioning device for the inertia-valve, since the difficulties heretofore incident to the use of such valves are thereby done away with and the life of the valve correspondingly lengthened.

It will be understood that many other forms of the fluid-cushion for the inertia-valve may be readily devised and that the form and arrangement of the inertia-valve and the other parts of the motor may be varied widely without departing from my invention.

I claim—

1. A motor having a piston with differential areas, a valve carried by the piston, and arranged to be moved longitudinally of the piston by inertia when the motion of the piston is checked, a port affording communication between the spaces at the smaller and larger piston areas, said port being controlled by the inertia-valve, the cylinder having a separate exhaust-port also controlled by said valve, and a fluid cushion device arranged to cushion the valve at one end of its stroke; substantially as described.

2. A motor having a piston with differential areas, a valve carried by the piston, and arranged to be moved longitudinally of the piston by inertia when the motion of the piston is checked, a port affording communication between the spaces at the smaller and larger piston areas, said port being controlled by the inertia-valve, the cylinder having a separate exhaust-port also controlled by said valve, said inertia-valve having a by-pass port arranged to cushion the valve at the end of its stroke; substantially as described.

3. A motor having a piston with differential areas, a valve carried by the piston, and arranged to be moved longitudinally of the piston by inertia when the motion of the piston is checked, a port affording communication between the spaces at the smaller and larger piston areas, said port being controlled by the inertia-valve, the cylinder having a separate exhaust-port controlled by said valve, the inertia-valve having a projection arranged to reciprocate between two fixed surfaces, and a by-pass connecting the opposite sides of the projection and permitting the passage of air or other fluid; substantially as described.

4. A motor having a piston with differential areas, a valve carried by the piston and arranged to be moved longitudinally of the piston by inertia when the motion of the piston is checked, a port affording communication between the spaces at the smaller and larger piston areas, said port being controlled by the inertia-valve, the cylinder having a separate exhaust-port also controlled by said valve, said valve having an annular projection movable within the bore of the piston, and a by-pass from one side of the projection to its other side; substantially as described.

In testimony whereof I have hereunto set my hand.

CHESTER B. ALBREE.

Witnesses:
C. P. BYRNES,
GEO. B. BLEMING.