No. 726,305. PATENTED APR. 28, 1903.

C. H. JOHNSON.

FLUID PRESSURE OPERATED TOOL.

APPLICATION FILED JAN. 25, 1902.

NO MODEL.

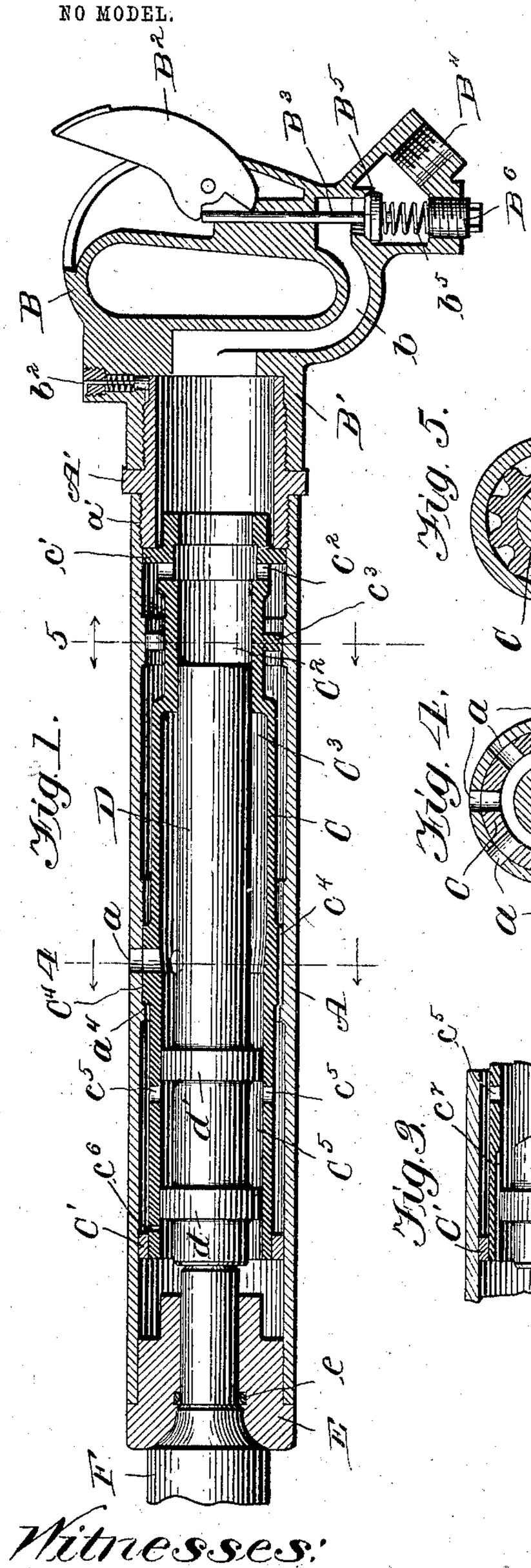

Fig. 1.

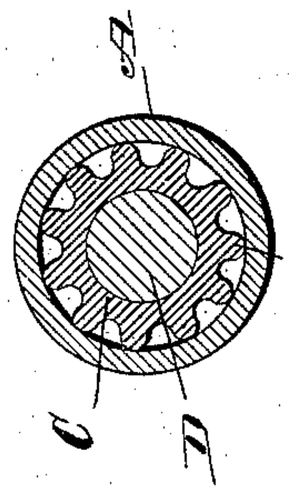

Fig. 5.

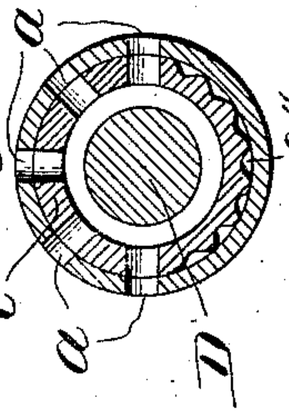

Fig. 4.

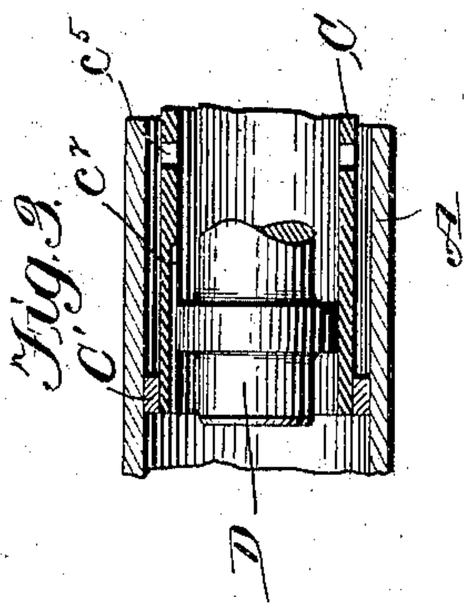

Fig. 3.

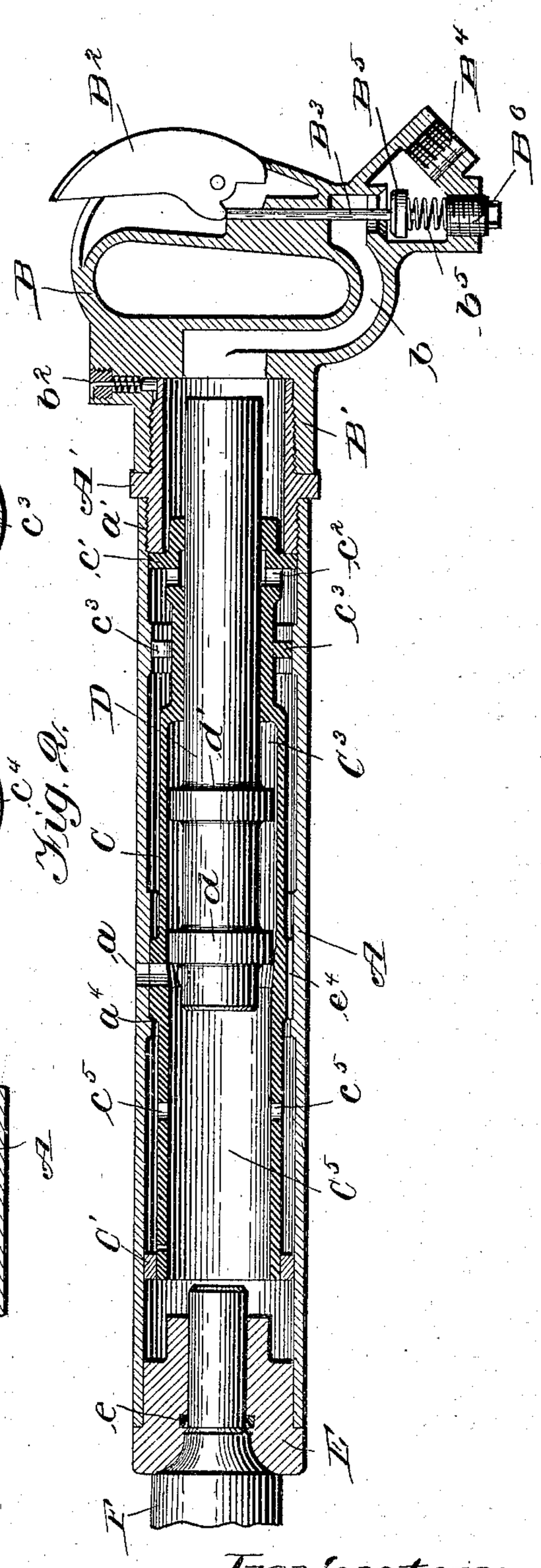

Fig. 2.

Witnesses:
H. S. Gaither
Geo. L. Wilkinson

Inventor:
Charles H. Johnson
by Miles H. Lamberton
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES H. JOHNSON, OF CHICAGO, ILLINOIS.

FLUID-PRESSURE-OPERATED TOOL.

SPECIFICATION forming part of Letters Patent No. 726,305, dated April 28, 1903.

Application filed January 25, 1902. Serial No. 91,203. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. JOHNSON, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Fluid-Pressure-Operated Tools; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates in general to fluid-pressure-operated tools, and more particularly to the type of such tools commonly known as "pneumatic hammers."

In pneumatic tools in which a constant pressure is maintained upon the piston in the direction of the tool the throw of the piston away from the tool has heretofore been effected by first exposing the larger end of the piston to pressure from the motive-fluid supply and then cutting off the supply and allowing the expansion of the pressure admitted to the cylinder to complete the throw of the piston. It is obvious that in a tool so constructed the pressure to which the piston is exposed during the latter part of its throw away from the tool is reduced by the expansion of the fluid within the cylinder.

The object of my invention is to provide a fluid-pressure-operated tool of the type referred to in which the speed of the piston during its movement away from the tool is not diminished after the motive-fluid supply is cut off, but is accelerated by exposing the piston to fluid-pressure admitted from a reservoir.

A further object of my invention is to provide a fluid-pressure-operated tool which will be simple in construction and efficient in operation.

My invention, generally stated, consists in a fluid-pressure-operated tool comprising a cylinder, a piston exposed to a constant pressure in the direction of the tool, and a reservoir which is charged with pressure from the motive-fluid supply and which discharges to accelerate the latter part of the movement of the piston away from the tool.

My invention will be more fully described hereinafter, with reference to the accompanying drawings, in which the same is illustrated as embodied in a convenient and practical form, and in which—

Figure 1 is a longitudinal section through a tool embodying my invention, showing the piston delivering a blow upon the tool; Fig. 2, a view similar to Fig. 1, showing the piston at the beginning of its stroke toward the tool; Fig. 3, a fragmentary view showing a modification of my invention, and Figs. 4 and 5 sectional views on lines 4 4 and 5 5, Fig. 1.

Similar reference characters are used to designate similar parts in the several figures of the drawings.

Reference-letter A designates a cylinder one end of which is interiorly screw-threaded to be engaged by the screw-threaded extension a' of the coupling A'. A handle B is provided with an interiorly-screw-threaded tubular portion B', which engages the screw-threaded portion of the coupling A' opposite to that engaged by the end of the cylinder A. Any suitable means may be provided for preventing the rotation of the handle with respect to the coupling A', such means being shown as consisting in a spring-actuated bolt b^2, which engages with ratchet-teeth formed on the exterior surface of the end of the coupling A'.

A ferrule E is fitted within the end of the cylinder opposite to the end engaged by the coupling A'. A snap or die or the shank of the tool F extends through the ferrule E and is frictionally engaged therein by any suitable means—such, for instance, as a spring-ring e, seated within a groove in the ferrule E.

A bushing C is located within the cylinder A and is retained therein against longitudinal displacement by means of a radially-projecting flange c', which is engaged by the end a' of the coupling A'. An exterior shoulder is formed by an enlarged portion C^4 of the bushing, which engages a shoulder a^4, formed on the interior surface of the cylinder A. The end of the bushing adjacent to the ferrule E is spaced within the cylinder A by means of an interposed ring C'. The end C^2 of the bushing C adjacent to the annular flange c' has a reduced bore, which is retained concen-

trically within the cylinder by means of an annular flange, through which are formed ports c^3. The annular projecting portion C^4 of the bushing C is provided with a series of longitudinal passages c^4 and a series of ports in register with a series of exhaust-ports a, formed through the cylinder A. The bore of the bushing between the projecting portion C^4 and the reduced portion c^2 is enlarged to form the chamber C^3, which tapers slightly at the point where the exhaust-ports are located and continues to the spacing-ring C′ with a uniform diameter, forming the chamber C^5. A series of ports c^5 extend through the bushing C, connecting the chamber C^5 with a space between the exterior of the bushing and the interior of the cylinder A. A small port c^6 also extends through the bushing C at a point adjacent to the spacing-ring C′. Within the bushing C is located a piston D, comprising an extended portion of a diameter to correspond with the diameter of the chamber C^2 of the bushing and two annular shoulders d and d', closely fitting within the chamber C^5 of the bushing, but of a slightly less diameter than the diameter of the chamber C^3 of the bushing.

Any desired form of throttle-valve may be employed for controlling the admission of pressure through the handle to the cylinder. Such throttle-valve for convenience is shown as consisting in a pop-valve B^5, located within a chamber in the handle B′ and normally seated by means of a spring b^5.

B^4 indicates a coupling, to which a pipe leading from the motive-fluid supply is secured.

B^3 indicates the valve-stem, which is secured at one end to the throttle-valve B^5 and at its other end is engaged by a hand-operated lever B^2, pivotally mounted in the handle B.

b indicates a passage in the handle B, leading from a chamber above the throttle-valve to the interior of the coupling A′.

In Fig. 3 I have illustrated a modification in the means for permitting the fluid-pressure to flow into the end of the cylinder adjacent to the shank of the tool. Instead of providing a restricted port c^6, as in Figs. 1 and 2, I have provided a longitudinal groove c^7 upon the inner surface of the chamber C^5 of the bushing, through which fluid-pressure may pass from the chamber C^5 to the end of the cylinder to be exerted upon the combined areas of the end of the piston and the vertical surface of the annular projection d.

The operation of my improved fluid-pressure-operated tool is as follows: A hand-lever B^2 is depressed, as indicated in Fig. 2, which through the interposed spindle B^3 unseats the throttle-valve B^5. Motive fluid then flows from the source thereof through the coupling B^4, thence through the throttle-valve, and through the passage b to the interior of the coupling A′. When the piston is in the position indicated in Fig. 1, the fluid-pressure passes through the series of ports c^2, through the bushing, thence through ports c^3, formed in the annular flange between the bushing and the cylinder A, thence through the space between the chamber C^3 of the bushing and the interior surface of the cylinder, through the longitudinal passages c^4, formed through the annular projecting portion C^4 of the bushing, thence into the space between the chamber C^5 of the bushing and the interior surface of the cylinder, thence through the restricted ports c^6 to the end of the cylinder. The end of the piston adjacent to the tool as well as the vertical face of the annular shoulder d are then exposed to pressure from the source thereof, and consequently the piston is moved toward the handle of the tool, overcoming the pressure exerted upon the opposite end of the piston, owing to the latter being of less area than the combined areas of the end and vertical face of the shoulder d of the piston. When the end of the piston adjacent to the handle covers the ports c^2, through the bushing, and thereby cuts off further flow of pressure from the source thereof to the space between the exterior surface of the bushing and the interior surface of the cylinder, the annular projection d on the piston has passed the series of ports c^5, so that the fluid-pressure which has been stored in the space constituting a reservoir between the bushing and cylinder expands against the end of the piston and the vertical face of the shoulder d, thereby accelerating the movement of the piston during the portion of its stroke away from the tool after the source of fluid-supply has been cut off. The piston continues its stroke away from the tool until the annular projection d thereon has passed the series of exhaust-ports a, whereupon the fluid-pressure which has propelled the piston away from the tool escapes to the atmosphere and permits the lesser area of the opposite end of the piston, which is exposed to a constant pressure from the source of motive fluid, to move the piston toward the tool, the shank of which receives the impact of the piston. The interior diameter of the portion C^3 of the bushing C is slightly greater than the combined diameter of the piston and the annular projections d or d'. Consequently when the annular projections pass the exhaust-ports a during the stroke of the piston toward the handle of the valve communication between the chamber C^3 and exhaust-ports a around the piston is permitted, thereby avoiding the compression of fluid between the annular projections and the shoulder formed between the portions C^3 and C^2 of the bushing.

The operation of the modification shown in Fig. 3 is similar to the operation of the embodiment shown in Figs. 1 and 2 except that a groove c^7 is provided upon the interior surface of the end of the bushing adjacent to the shank of the tool through which fluid-pres-

sure passes to the end of the cylinder to impart the initial movement of the piston away from the tool. The groove c^7 takes the place of the restricted port c^6 in the specific form shown in Figs. 1 and 2.

From the foregoing description it will be observed that I have invented an improved fluid-pressure-operated tool of the type in which the piston is exposed to a constant pressure in the direction of the tool, the stroke of the piston of which away from the tool is accelerated after the supply thereto of pressure from the motive-fluid source has been cut off by exposing the larger area of the piston to pressure which has been stored in a reservoir.

While I have described more or less precisely the details of construction, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form, the proportion of parts, and the substitution of equivalents, as circumstances may suggest or render expedient, without departing from the spirit of my invention.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a fluid-pressure-operated tool, the combination with a cylinder, of a reciprocating piston therein exposed to a constant pressure toward the tool, means for admitting fluid-pressure from the motive-fluid source to impart an initial movement to the piston away from the tool, and means for subsequently increasing the pressure to which the piston is exposed.

2. In a fluid-pressure-operated tool, the combination with a cylinder, of a differential piston therein the smaller area of which is exposed to a constant pressure toward the tool, means for exposing the larger area of the piston to pressure flowing from the motive-fluid source to impart an initial movement to the piston away from the tool, and means for accelerating said movement of the piston after the motive-fluid source has been cut off.

3. In a fluid-pressure-operated tool, the combination with a cylinder, of a differential piston therein controlling the admission of fluid-pressure from the motive-fluid source to impart an initial movement to the piston away from the tool, and a reservoir the communication of which with the cylinder is controlled by the piston to accelerate the movement of the piston away from the tool.

4. In a fluid-pressure-operated tool, the combination with a cylinder, of a reciprocating piston in said cylinder, a reservoir adapted to be charged with fluid-pressure, means for admitting pressure from the motive-fluid source to impart an initial movement to the piston away from the tool, means for cutting off communication with the motive-fluid source, and means for subsequently admitting pressure from said reservoir to accelerate the movement of the piston.

5. In a fluid-pressure-operated tool, the combination with a cylinder, of a differential piston exposed to a constant pressure toward the tool, said cylinder having a reservoir formed therein having ports controlled by the piston whereby pressure is first admitted from the motive-fluid source to impart an initial movement to the piston away from the tool and subsequently admitted from said reservoir to accelerate the movement of the piston.

6. In a fluid-pressure-operated tool, the combination with a cylinder, of a bushing therein said cylinder and bushing being spaced apart to form a reservoir, a differential piston within said bushing exposed to a constant pressure toward the tool and controlling the admission of pressure to said reservoir from the motive-fluid source and also controlling the discharge of said reservoir into said cylinder to accelerate the movement of the piston away from the tool.

7. In a fluid-pressure-operated tool, the combination with a cylinder, of a bushing located within said cylinder so as to form a reservoir between the interior surface of the cylinder and the exterior surface of the bushing, a reciprocating differential piston within said bushing controlling ports therein through which pressure is admitted to said reservoir and also controlling ports in said bushing through which pressure in said reservoir is discharged into the cylinder to accelerate the movement of the piston away from the tool.

8. In a fluid-pressure-operated tool, the combination with a cylinder, of a bushing located within said cylinder so as to form a reservoir between the interior surface of the cylinder and the exterior surface of the bushing, the diameter of the bore of said bushing being less near the end thereof adjacent to the handle of the tool, said bushing having a port through the restricted portion thereof and also a port through the larger portion thereof, a differential piston subjected to a constant pressure toward the tool controlling said ports through the bushing whereby pressure is admitted to said reservoir during the initial movement of the piston away from the tool and discharged from said reservoir into the cylinder after such initial movement of the piston.

9. In a fluid-pressure-operated tool, the combination with a cylinder, of a bushing located within said cylinder so as to form a reservoir between the interior surface of the cylinder and the exterior surface of the bushing, the diameter of the bore of said bushing being less near the end thereof adjacent to the handle of the tool, said bushing having a port through the restricted portion thereof, a restricted port through the opposite end thereof, and a relatively larger port therethrough at a predetermined distance from

said restricted port, a differential piston within said bushing subjected to a constant pressure toward the tool controlling said ports through the bushing whereby said reservoir is connected to the source of motive-fluid supply while pressure is admitted through said restricted port to impart an initial movement to the piston away from the tool and whereby subsequently the reservoir is disconnected from the motive-fluid source and connected with the cylinder to accelerate the movement of the piston.

In testimony whereof I sign this specification in the presence of two witnesses.

CHARLES H. JOHNSON.

Witnesses:

H. H. VAUGHAN,

ROY SMITH.