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C. H. JOHNSON.

FLUID PRESSURE OPERATED TOOL.

APPLICATION FILED JULY 24, 1902.

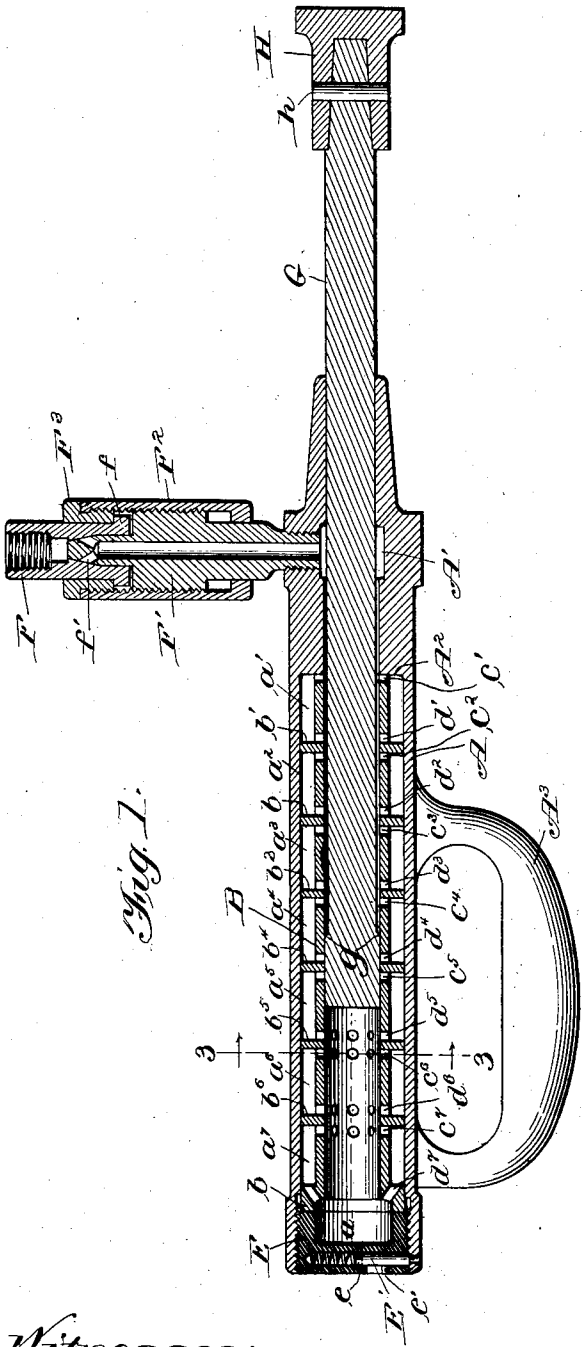


Fig. 1.

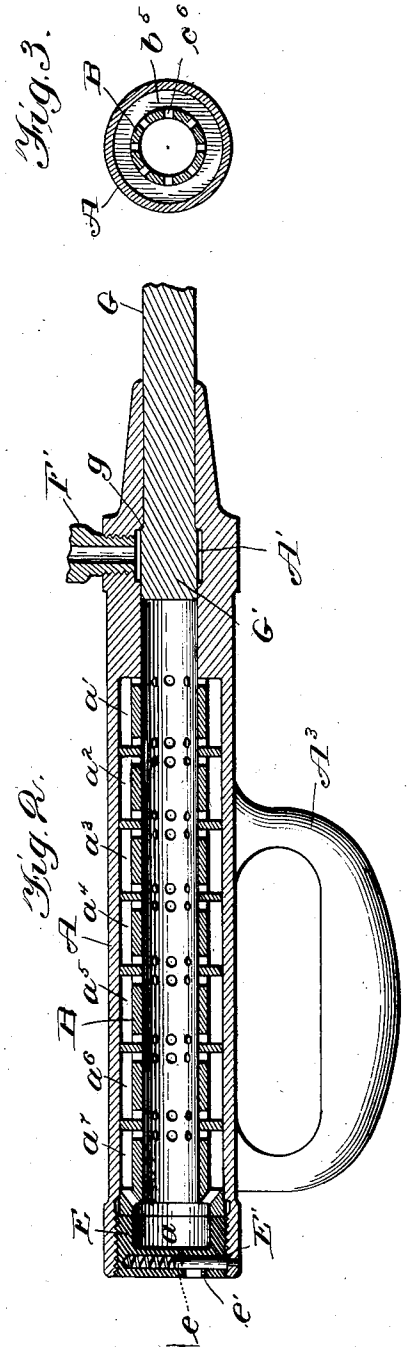


Fig. 2.

Fig. 3.

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FLUID-PRESSURE-OPERATED TOOL.

No. 826,106. Specification of Letters Patent. Patented July 17, 1906.

Application filed July 24, 1902. Serial No. 116,835.

To all whom it may concern:

Be it known that I, CHARLES H. JOHNSON, a citizen of the United States, residing at Chicago Heights, 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 tools of the valveless type.

It is desirable in various uses for which fluid-pressure-operated tools are adapted to have the stroke of the piston variable in order that the object worked upon may be engaged by the tool at every stroke of the piston, even though the distance between the object and the tool does not remain constant. In ramming sand for metal founding, for instance, it is advantageous that the stroke of the rammer should be greater or less according to the compactness of the sand engaged by the rammer at each blow. In working upon uneven surfaces it is necessary that the stroke of the tool should be variable in order that each reciprocation of the piston may effect the engagement of the tool with the objective surface.

Another use for fluid-pressure-operated tools in which a variable stroke is of advantage is in undercutting in mining, where the distance between the tool and the objective surface cannot be accurately gaged.

The primary object of my invention is to provide a fluid-pressure-operated tool in which the stroke of the piston automatically varies according to the distance between the tool and the surface worked upon.

A further object of my invention is to provide a fluid-pressure-operated tool in which the piston reverses immediately upon engaging the object without continuing to the limit of its throw.

A still further object of my invention is to provide a fluid-pressure-operated tool of the character described which will be simple in construction, comparatively inexpensive in manufacture, and efficient in operation.

The embodiment of my invention herein disclosed comprises, generally described, a cylinder having a constantly-open restricted exhaust-port leading from the back end thereof and a plurality of chambers or reservoirs which are successively charged during the back stroke of the piston and which successively discharge into the back end of the cylinder during the forward stroke of the piston toward the objective surface.

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

Figure 1 is a longitudinal section through my invention; Fig. 2, a view similar to Fig. 1, showing the piston in its forward position; and Fig. 3, a cross-sectional view on line 3 3, Fig. 1.

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

Reference character A designates a cylinder within an enlarged bore of which is located a bushing B, centrally spaced by means of a series of annular partitions b', b^2, b^3, b^4, b^5, and b^6, which are preferably formed integrally with the exterior surface of the bushing. One end of the bushing B engages an annular shoulder A^2, formed within the cylinder A between the bores of different diameters therein. The other end of the bushing is provided with a collar b of an exterior diameter substantially the same as the interior diameter of the larger bore of the cylinder which is engaged and reatined in proper position within the cylinder by a cylinder-head E.

The cylinder-head E is secured within the end of the cylinder A by any suitable means—as, for instance, a screw-threaded engagement. The cylinder-head is prevented from rotating relatively to the cylinder by any suitable means—such, for instance, as the spring-bolt E′, which is provided with an actuating-pin e', extending through a slot in the end wall of the cylinder-head. The cylinder-head is provided with a restricted exhaust-port e, which places the interior of the back end of the cylinder in constant communication with the atmosphere.

The annular partitions b', &c., divide the space between the outer surface of the bushing and the inner surface of the cylinder A

into a series of chambers or reservoirs a', a^2, a^3, a^4, a^5, a^6, and a^7. The reservoirs a', &c., are provided with admission-ports c', c^2, c^3, c^4, c^5, c^6, and c^7, respectively, and also with discharge-ports d', d^2, d^3, d^4, d^5, d^6, and d^7. These admission and discharge ports extend through the bushing B, the former being located at the ends of the respective reservoirs toward the forward end of the tool, while the latter are located at the opposite ends of the respective reservoirs—namely, toward the back of the tool.

An annular chamber A′ is formed in the cylinder A at the point adjacent to the front end of the tool, into which is discharged motive fluid from a source thereof. F indicates a screw-threaded section of pipe with which is connected a conduit leading from the source of motive-fluid supply. The pipe F′ is screwed into an opening extending through the wall of the cylinder into the chamber A′. A coupling F^2 unites the two sections of pipe F and F′. The coupling F^2 is preferably in screw-threaded engagement with a portion of the pipe-section F′ and is provided with a cap F^3, which surrounds the pipe-section F and retains the collar f on the latter between the pipe-section F and the inner end of the cap. The two pipe-sections F and F′ are preferably provided with means for regulating the flow therethrough of the motive fluid, such means being shown as consisting in a projection f' on the end of the pipe-section F′, having ports therethrough, and in a recess formed within the pipe-section F′, which serves as a seat against which the projection f' may engage. The projection f' and the coöperating seat are preferably tapered, as shown in Fig. 1.

Located within the cylinder is a piston G, comprising a head G′ of a diameter substantially the same as the interior diameter of the bushing B and of a length substantially equal to the distance between the adjacent partitions b' b^2, &c. The bore of the cylinder A between the shoulder A^2 and the chamber A′ conforms to the interior diameter of the bushing B, while the bore of the cylinder between the chamber A′ and the front end thereof is of a smaller diameter conforming to the diameter of the piston G between the end thereof and the shoulder g, formed by the enlarged head G′.

The piston G may be arranged to deliver a blow upon a tool in any well-known manner, or the same may be secured to a head H by means of a pin h when the tool is designed for ramming purposes.

Any suitable means may be provided for holding the tool when in operation—such, for instance, as a handle A^3, preferably formed integrally with the cylinder A.

The operation of my invention is as follows: When the piston is at the forward end of its stroke, as shown in Fig. 2, fluid-pressure passes to the chamber A′ and is exerted upon the shoulder g, thereby moving the piston toward the left, such movement being permitted by reason of the cylinder being at atmospheric pressure owing to the exhaust-port e. The pressure exerted upon the shoulder g moves the piston to the left, thereby uncovering the admission-port c', leading to the reservoir a', which is consequently charged with pressure. The continued movement of the piston toward the left successively uncovers the admission-ports c^2, c^3, c^4, c^5, and c^6, successively charging the reservoirs a^2, a^3, a^4, a^5, a^6, and a^7.

When the admission-ports c^7 have been uncovered by the piston-head G′, the fluid-pressure flows from the reservoir a^7 through the discharge-ports d^7, formed through the collar b on the bushing B into the back end of the cylinder, which is shown as consisting in a chamber a, formed within the cylinder-head E. The discharge-ports d^7 being relatively larger than the exhaust-port e, the flow of pressure to the back end of the cylinder is exerted upon the end of the piston-head G′, which forces the piston to the right, overcoming the pressure exerted upon the relatively small area of the shoulder g. When the piston in moving toward the right uncovers the discharge-ports d^6, the reservoir a^6 is placed in communication with the back end of the cylinder and adds impetus to the movement of the piston. The discharge-ports d^5, d^4, d^3, d^2, and d' are successively uncovered during the stroke of the piston toward the object being worked upon and the reservoirs a^5, a^4, a^3, a^2, and a' successively placed in communication with the back end of the cylinder.

Should the rammer H or other tool actuated by the piston G engage the objective surface before the piston has completed its forward stroke—that is, before it has reached the position indicated in Fig. 2—the movement of the piston will be stopped and the pressure in the back end of the cylinder exhausted through the port e, thereby immediately effecting the movement of the piston to the left, owing to the pressure constantly exerted upon the shoulder g. Should the rammer H engage an object when in the position indicated in Fig. 1, only the pressure admitted to the back end of the cylinder from the reservoirs a^5, a^6, and a^7 would exhaust through the port e, while the pressure would continue stored in the reservoirs a^4, a^3, a^2, and a'. As the length of the piston-head G′ is greater than the distance between the several partitions b' b^2, &c., the pressure which is admitted to each reservoir in succession as the piston moves toward the left is prevented from flowing to the back end of the cylinder until the end of the piston-head passes the discharge-ports d' d^2, &c., during its forward stroke.

The flow of fluid-pressure to the chamber

A′ may be regulated by relatively adjusting the two pipe-sections F and F′. By turning the coupling F^2 so that it moves away from the cylinder the flange f on the pipe-section may move away from the pipe-section F^2, thereby separating the projection f' from the seat formed in the pipe-section F, so as to afford increased passage-way for pressure between the projection f' and the seat formed in the pipe-section F. When the two sections F and F′ are separated, so as to afford a maximum passage-way for the fluid-pressure, such passage-way may be restricted by turning the coupling F^2 so that it will approach the cylinder.

From the foregoing description it will be observed that I have invented a fluid-pressure-operated tool in which the stroke of the piston varies automatically according to the distance between the tool and the objective surface, and as soon as contact is made with the objective surface the piston immediately reverses without continuing its forward stroke.

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 of the valveless type, the combination with a cylinder, of a reciprocating piston therein, said cylinder having motive-fluid supply and exhaust ports and passages for automatically terminating the stroke of the piston relatively to the cylinder upon the piston engaging an object.

2. In a fluid-pressure-operated tool of the valveless type, the combination with a cylinder, of a reciprocating piston therein, said cylinder having motive-fluid supply and exhaust ports and passages for automatically reversing the movement of the piston upon its movement in one direction being arrested before it reaches the limit of its stroke.

3. In a fluid-pressure-operated tool, the combination with a cylinder, of a reciprocating piston therein, an extension on said piston projecting through the cylinder, said cylinder having motive-fluid supply and exhaust ports and passages for automatically terminating the stroke of the piston when the end of the extension on the piston engages an object.

4. In a fluid-pressure-operated tool, the combination with a cylinder, of a reciprocating piston therein, an extension on said piston projecting through the cylinder, said cylinder having motive-fluid supply and exhaust ports and passages for automatically reversing the movement of the piston upon the end of the extension thereof engaging an object.

5. In a fluid-pressure-operated tool, the combination with a cylinder having a restricted constant exhaust from the back end thereof, of a reciprocating piston therein, a plurality of reservoirs, and means for successively discharging said reservoirs into the back end of the cylinder.

6. In a fluid-pressure-operated tool, the combination with a cylinder having a restricted constant exhaust from the back end thereof, of a reciprocating piston therein, a plurality of reservoirs, means for successively charging said reservoirs during the throw of a piston away from the work and successively discharging said reservoirs into the back end of the cylinder during the stroke of the piston toward the work.

7. In a fluid-pressure-operated tool, the combination with a cylinder having a restricted constant exhaust from the back end thereof, of a reciprocating piston therein, a plurality of reservoirs, means for successively charging said reservoirs during the throw of the piston away from the work prior to the admission of pressure to the back end of the cylinder and successively discharging said reservoirs into the back end of the cylinder after the motive-fluid supply has been cut off therefrom.

8. In a fluid-pressure-operated tool, the combination with a cylinder having a restricted constant exhaust from the back end thereof, of a reciprocating piston therein, a plurality of reservoirs connected with the fluid-pressure supply by the piston during its throw away from the work and successively connected with the back end of the cylinder by the piston during its stroke toward the work.

9. In a fluid-pressure-operated tool, the combination with a cylinder having a restricted constant exhaust from the back end thereof, a bushing concentrically located within the cylinder, a series of annular partitions between the cylinder and the exterior of the bushing forming a series of reservoirs, a reciprocating piston successively connecting said reservoirs with the source of fluid-pressure during its stroke away from the work and successively connecting said reservoirs with the back end of the cylinder during its stroke toward the work.

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

CHARLES H. JOHNSON.

Witnesses:
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C. C. CUNNINGHAM.