

Dec. 29, 1925.

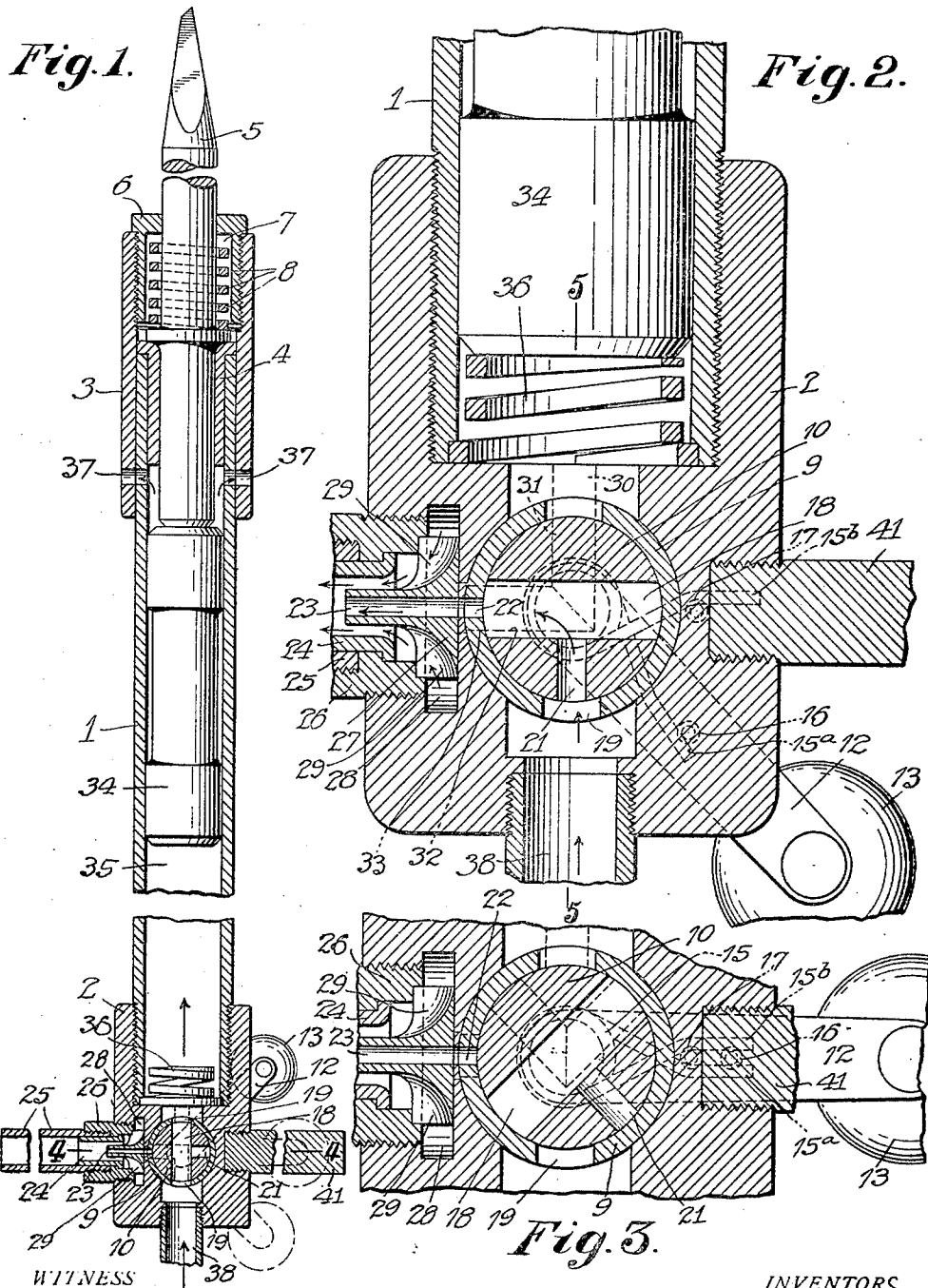
E. W. STEVENS ET AL

1,567,554

FLUID PRESSURE HAMMER

Filed August 25, 1920

2 Sheets-Sheet 1



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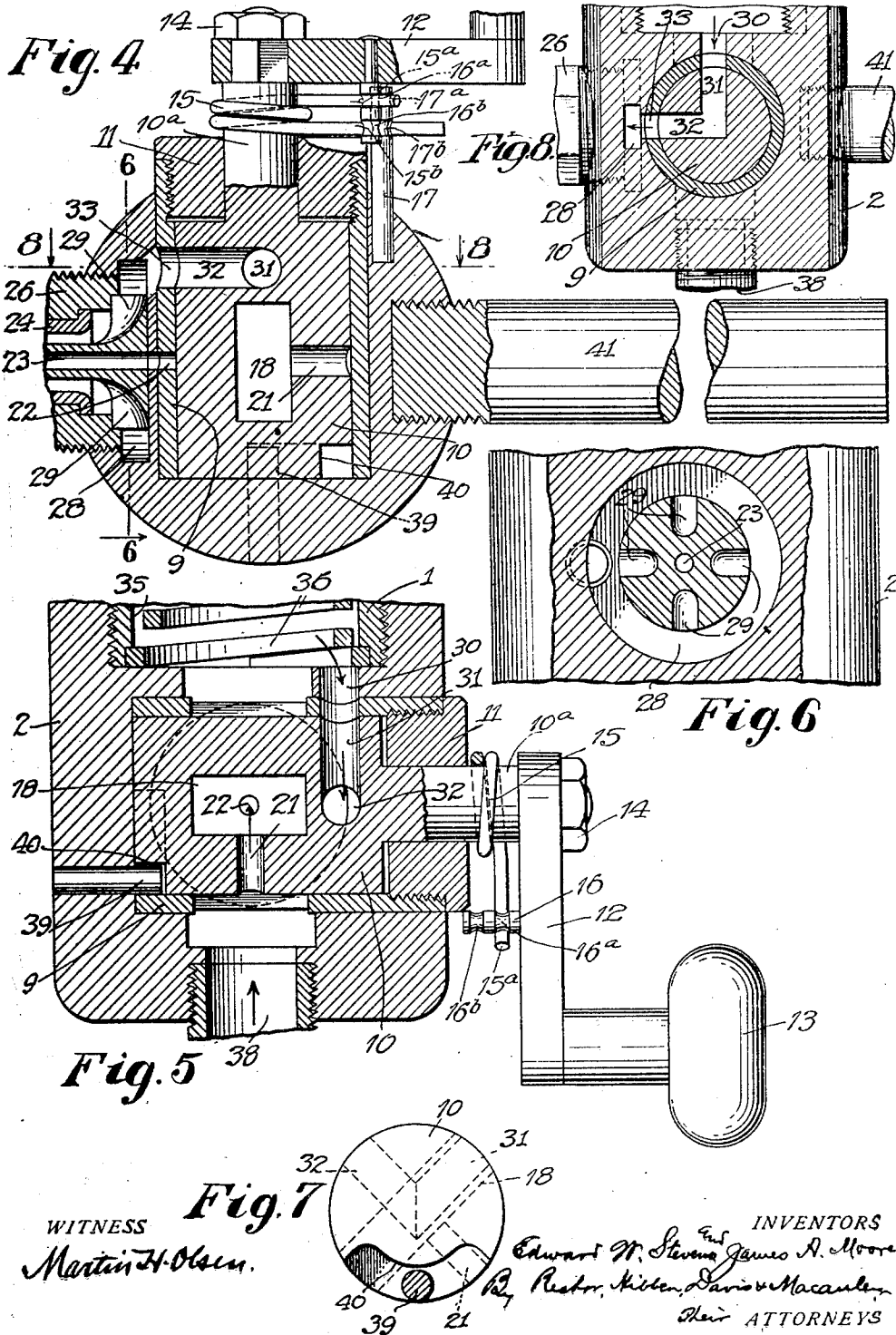
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UNITED STATES PATENT OFFICE.

EDWARD W. STEVENS AND JAMES A. MOORE, OF DETROIT, MICHIGAN, ASSIGNORS TO CHICAGO PNEUMATIC TOOL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

FLUID-PRESSURE HAMMER.

Application filed August 25, 1920. Serial No. 405,863.

To all whom it may concern:

Be it known that we, EDWARD W. STEVENS and JAMES A. MOORE, citizens of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Fluid-Pressure Hammers, of which the following is a specification.

Our invention relates to hammers operated by fluid pressure such as compressed air and pertains more particularly to that type of hammer used for the purpose of cutting rivets, stay bolts and the like, and sometimes referred to as rivet cutting guns or hammers. The object of our invention is to provide a hammer of this type which is simple in construction and operation and capable of striking a powerful blow and reducing the time and number of blows required to cut a rivet with an economic consumption of compressed air. These objects are accomplished by our hammer of novel construction and novel mode of operation characterized more particularly by the provision of means for creating a vacuum in the space behind the hammer piston to permit the latter to be returned under atmospheric pressure, instead of the fluid pressure which is liable to give too violent return of such piston. In that type of hammer in which the piston is returned by the fluid pressure it was necessary to regulate the size of the air passages which was not always successfully done. This required a restricted capacity of these passages which while sufficient to return the piston to its rearward position was insufficient to discharge the air in front of the piston when the same was moving forward to impart its blow, so that an air cushion or back pressure resulted which materially interfered with the maximum efficiency of the blow. According to our mode of operation these difficulties are overcome because there is never any pressure greater than atmospheric pressure at the front end of the piston and the exhaust openings which are provided at the forward end of the cylinder are of sufficient area to permit of full exhaust of all air ahead of the piston, thereby obtaining the maximum efficiency of the blow.

Another advantage resulting from our invention is the provision whereby the exhaust air from the front of the hammer is discharged without inconvenience to the

workman holding the tool thereby avoiding the objection of other hammers employing the auxiliary air tube for returning the hammer and exhausting in close proximity to the workman holding the gun at the forward end.

In the drawings Fig. 1 is a longitudinal section of a hammer embodying our invention, showing the piston at the moment of striking the working tool; Fig. 2 an enlarged section of the rear end of the hammer with the valve in a different position as compared with that of Fig. 1; Fig. 3 a view similar to a portion of Fig. 2 but showing the valve in neutral position; Fig. 4 a section on the line 4—4 of Fig. 1 but on a larger scale; Fig. 5 a section on the line 5—5 of Fig. 2; Fig. 6 a section on the line 6—6 of Fig. 4; Fig. 7 an elevation of one end of the valve with the stop pin in section; and Fig. 8 a cross-section of the valve showing the exhaust ports thereof.

The fluid pressure employed is usually compressed air and therefore for convenience compressed air will be referred to as the motive fluid.

Referring to the present embodiment of our invention as herein shown, the cylinder 1 is provided at its rearward end with a head or valve casing 2 secured thereto in suitable manner as by screw threading thereinto. The cylinder is provided at its outer end with a sleeve 3 permanently fastened thereto in suitable manner as by brazing. A flanged bushing 4 is seated on the inside of the forward end of the cylinder and is adapted to guide a suitable working tool as indicated at 5, which tool is held from displacement by a collar 6 which is secured to the sleeve 3 in suitable manner as by being threaded thereinto. This collar is provided with a socket 7 to receive a shock absorbing spring 8.

The valve casing 2 has a cylindrical transverse bore to receive a valve bushing 9 which in practice is tightly forced into such bore in order to prevent displacement. A valve 10 which is here cylindrical is received by and operates within this bushing being retained therein by the threaded nut 11 through which extends the reduced cylindrical valve stem 10^a of such valve. This stem has a crank arm 12 which has a handle 13 and which is held in position on the stem by a nut 14. A spring 15 encircles the valve

stem and its ends 15^a and 15^b form a pair of legs which normally act to position the crank arm 12 in the neutral position shown in Fig. 3. The crank arm 12 is provided with a stud 16 having a pair of annular grooves 16^a and 16^b. A similar stud 17 projects from the valve casing and is provided with a corresponding pair of annular grooves 17^a and 17^b. Both pairs of grooves are in alignment with the legs of the spring 15 and the studs are so positioned that the stud 16 will pass or clear stud 17 when moving to either one of its two extreme positions.

The valve 10 is provided with a rectangular opening 18, extending therethrough and preferably oblong in cross-section. When the valve is in the position shown in Fig. 1 this opening 18 registers with a similarly shaped opening 19 in the bushing 9 and thereby admits air to the cylinder. This valve is provided with an inlet port 21 extending radially from the opening or passage 19 and of lesser area. When the valve is turned to the position shown in Fig. 2 this port 21 communicates with the air supply inlet 38 and admits the live air to the passage or opening 19 and through a port 22 in the valve bushing to the syphon or ejector device which includes the passage, tube or ejector nozzle 23. This causes a syphoning effect in the space surrounding this tube as provided by the flanged sleeve 24 which is arranged within the inner end of the hollow handle 25 and also within the short sleeve 26 which screws into the valve casing and into which also screws the inner end of this handle 25. The syphon device is provided with a substantially cylindrical or disk shaped body 27 which is held seated in the chamber 28 formed in the valve casing in suitable manner as by means of the sleeve 26 which clamps this body or disk in position as clearly indicated in Figs. 2, 3 and 4 with the port 22 in register with the tube 23. This disk is provided with a plurality of ports or passages 29 which communicate between the chamber 28 and the space between the tube 23 and the sleeve 24 so that the air may be exhausted from the rear end of the cylinder as indicated by the arrows in Fig. 2, thereby creating a vacuum in the piston chamber.

An exhaust passage leads from the rear end of the piston chamber to the atmosphere through the syphon device and such passage is governed by the valve. As shown in Fig. 8 the rear end of the piston chamber is provided with the exhaust port 30 which in the exhaust position of the valve communicates with the two radial connecting ports 31 and 32 in such valve. The port 32 registers with the port 33 in the valve bushing 9 which in turn communicates with the chamber 28.

The hammer piston 34 is adapted to reciprocate within the piston chamber 35 formed in the cylinder 1, being forced forwardly by the live air to deliver its blow to the working tool whenever the valve is turned by the handle 13 to the position shown in Fig. 1, and to be returned to rearward position whenever such valve is turned by the handle to the position shown in Fig. 2; whereupon the compressed air is exhausted and a vacuum produced in the rear end of the piston chamber by means of the syphon or ejector device hereinbefore described. By preference a coiled spring 36 is provided at the rear end of the piston chamber in order to cushion the piston on its rearward stroke. As shown the last coil of the spring is held clamped between the end of the cylinder and the bottom of the socket of the valve casing.

Describing a cycle of operation, when the valve handle is turned to the position shown in Fig. 1 the live air is admitted to the rear end of the piston chamber whereupon the piston is driven in the direction of the working tool and caused to impart a blow thereto. As the piston moves in this direction, that is forwardly, a plurality of exhaust ports 37 extending through the cylinder 1 and sleeve 3 permit the air in front of the piston to escape freely to the atmosphere, thereby preventing any cushioning effect or retardation of the forward movement of the piston. As soon as the piston has delivered its blow, the handle and its valve are moved to the position shown in Fig. 2 whereupon the air from the source of supply or inlet 38 now passes through the ports 21 and 18 and through the syphon device, thereby creating a vacuum behind the hammer by drawing the air from the piston chamber through the ports 30, 31, 32 and 33 and chamber 28 which are all now connected in this position of the valve. At this time the air at atmospheric pressure entering the forward end of the cylinder through the exhaust ports 37 will drive the piston to its rearward position as shown in Fig. 2, ready to impart another blow to the working tool when the valve is again turned by the operator to the position shown in Fig. 1. It will be understood that with the working tool in position to perform its work such as cutting off a rivet head the impact of the piston against the tool has no effect on the spring 8 inasmuch as such spring is merely provided as a precautionary measure to avoid the danger of injury resulting from accidentally firing the piston when the point of the tool is not in position against the rivet. If this spring were not provided there would be danger of the tool being driven out far enough to cause injury to some one or with sufficient force to drive the cap 6 off the casing.

The valve 10 and its handle are normally positioned at the neutral position shown in Fig. 3 and are adapted to be moved to the position shown in Fig. 1 for driving the piston forwardly and to the position shown in Fig. 2 for exhausting the rear end of the piston chamber and creating a vacuum therein. When the valve and handle are in neutral position as shown in Fig. 3 the spring 15 will be in the position shown in dotted lines therein with its legs engaging one of the annular grooves of each of the studs 16 and 17. When the handle is moved to either the Fig. 1 or Fig. 2 position, the stud 16 will engage one or the other of the legs and cause a scissors action of the spring, thereby placing the same under tension. The other leg of the spring will then be held by the stud 17 in the valve casing. The tension of the spring will act to restore the handle to the neutral position of Fig. 3. In order to limit the movement of the valve in either of its two extreme positions there is provided a stud 39 projecting through the valve casing into a cut out portion 40 of the valve 10. In this way the valve is limited to a movement of 45 degrees on either side of its neutral position.

In the operation of this hammer the weight thereof requires handling by two men and for this purpose there is provided two handles, the handle 25 and another handle 41 extending radially from the valve casing and on opposite sides thereof.

We claim:

1. In a fluid pressure hammer, the combination of a cylinder having a piston chamber, a piston reciprocable therein, a valve casing at the rear end of the cylinder and having a passage direct from a source of fluid pressure to the rear end of the piston chamber, a valve mounted to oscillate in the casing and having a port to control said passage, a second port to control the exhaust from the rear end of the piston chamber,

and a third port communicating with the first port and an ejector device cooperating with said second port and with said third port for creating a vacuum in the rear end of the piston chamber.

2. In a fluid pressure hammer, the combination of a cylinder having a piston chamber, a piston reciprocable therein, a valve casing at the rear end of the cylinder and having a passage direct from a source of fluid pressure to the rear end of the piston chamber, a valve mounted to oscillate in the casing and having a port to control said passage, a second port to control the exhaust from the rear end of the piston chamber, and a third port communicating with the first port, and an ejector device cooperating with said second and third ports, said casing having handles, one of which is hollow and communicates with the ejector device.

3. In a fluid pressure hammer, the combination of a cylinder having a piston chamber, a piston reciprocable therein, a valve casing at the rear end of the cylinder and having a passage direct from a source of fluid pressure to the rear end of the piston chamber, a valve mounted to oscillate in the casing and having a port to control said passage, a second port to control the exhaust from the rear end of the piston chamber, and a third port communicating with the first port said valve casing having a chamber adapted to communicate with said first and second ports, an ejector device located in said chamber and comprising a body and a projecting tube which communicates with said first port in one position of the valve, and a sleeve surrounding said tube to form a space communicating with the atmosphere and with the valve casing chamber and the second valve port in said position of the valve.

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