

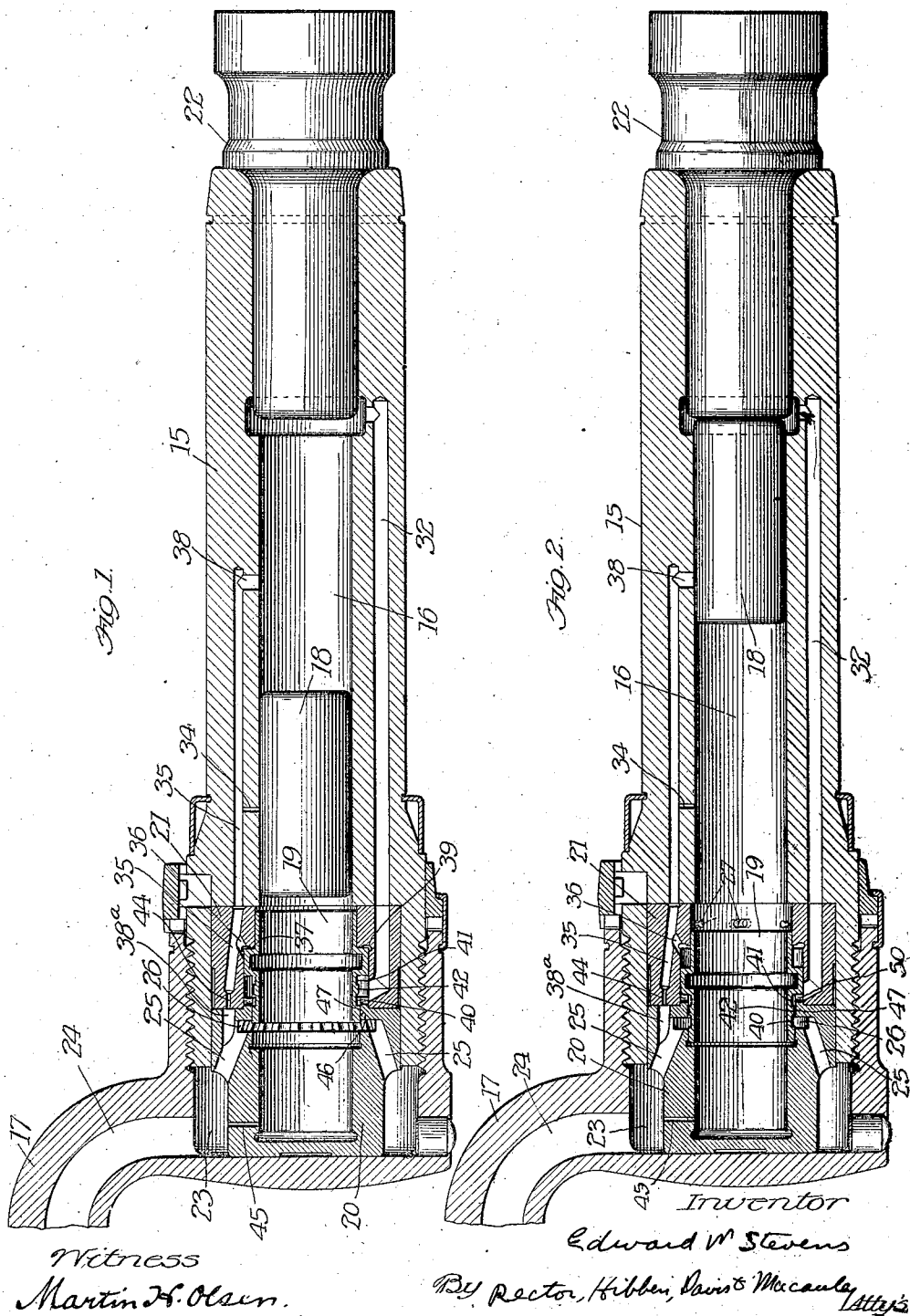
Feb. 15, 1927.

1,617,969

E. W. STEVENS
FLUID PRESSURE HAMMER

Filed May 1, 1922

3 Sheets-Sheet 1



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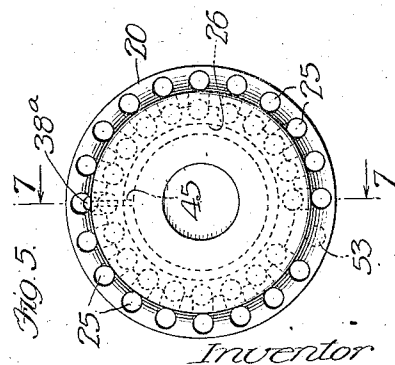
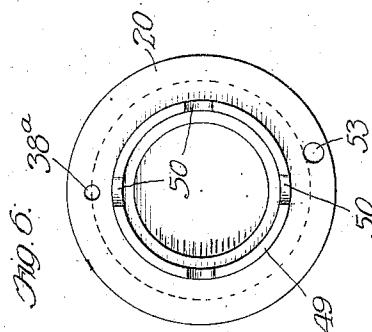
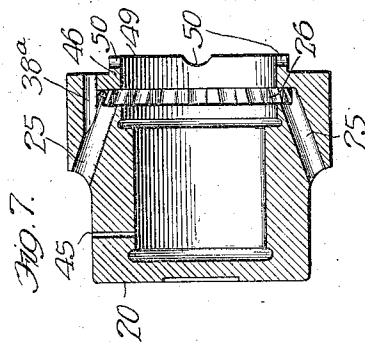
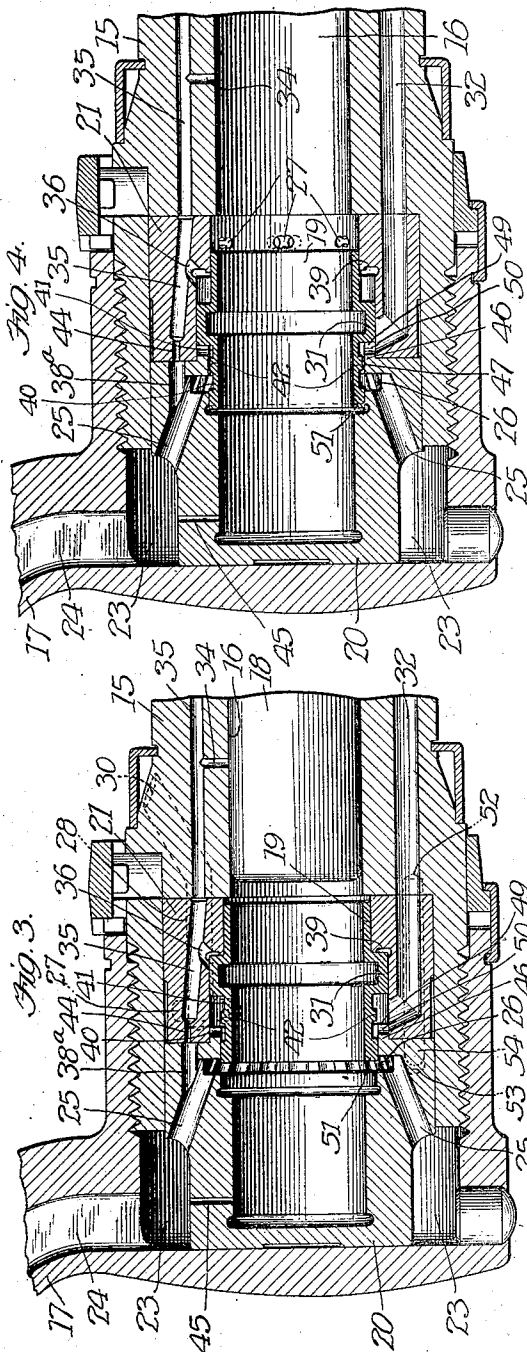
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FLUID PRESSURE HAMMER

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3 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE HAMMER.

Application filed May 1, 1922. Serial No. 557,550.

My invention relates to a fluid pressure hammer, such as a pneumatic hammer, more particularly but not necessarily, of the long-stroke or riveting type. My invention concerns more particularly the valve mechanism and the associated parts, including the valve case, and the object thereof is to improve the construction thereof and provide a hammer of increased efficiency and durability.

With the above and incidental objects in view, the invention consists in certain novel features of construction and combination of parts, the essential elements whereof are recited in the appended claims and a preferred form of embodiment of which is described in detail hereinafter and illustrated in full in the accompanying drawings, which form part of this specification.

Of said drawings, Fig. 1 is a sectional elevation of a hammer, embodying my invention and showing the piston in an intermediate position during its forward stroke to deliver the blow upon the rivet set; Fig. 2 is a similar view but showing the piston and valve in changed position at the time of the delivery of the piston blow; Figs. 3 and 4 are enlarged sectional views, similar to Figs. 1 and 2, respectively, with the forward end of the cylinder broken away; Fig. 5 is an elevation of the rear end of the valve case; Fig. 6 is an elevation of the forward end of the valve case with the lid removed; Fig. 7 is a sectional elevation through the body of the valve case; Fig. 8 is an elevation of the rear end of the lid of the valve case; Fig. 9 is a section on the line 9—9 of Fig. 8; Fig. 10 is an elevation of the forward end of the lid of the valve case; Figs. 11 and 12 are sections on the correspondingly indicated section lines of Fig. 9; Fig. 13 is an elevation of the rear end of the cylinder in which the piston reciprocates, and Fig. 14 is a side elevation of the tubular valve.

Referring to the particular embodiment of my invention, as shown herein, the same is a pneumatic riveting hammer and I will proceed to describe it in connection with such particular type of hammer without being limited specifically thereto.

In general, the hammer comprises the cylinder 15, having the longitudinal piston chamber 16, a grasping handle 17, (shown broken away in the drawings) secured to the rear end of the cylinder in a well-known

manner; a piston 18 reciprocable in the piston cylinder; valve mechanism, including a valve 19 and a case or block 20 with a lid or cover 21, and a rivet set 22 inserted in the forward end of the cylinder. The air under pressure admitted through the grasping handle is controlled by the main valve 19 which governs the admission and exhaust of air to and from opposite ends of the piston chamber as required for the reciprocations of the piston.

The valve case, which is substantially a cylindrical block provided with the necessary ports and passages, is contained within an enlarged counterbore in the rearward end of the cylinder. This case comprises the case proper or body 20 and the lid or cover 21. The case has a central bore within which the piston reciprocates. The bore of the lid 21 is slightly larger than the bore in the body 20 so as to receive the valve 19 which is tubular in general formation and coincident with the regular bore of the valve case and piston cylinder, so that the piston also reciprocates through the valve. The valve case and its lid have a series of ports and passages governed by the valve 19, by reason of the annular grooves and ribs or enlargements of different diameters formed thereon. These ports and passages and the particular formation of the valve will be described, as I now proceed to trace the course of the air under pressure through the hammer during a cycle of operation of the piston.

In Figs. 1 and 3, the piston is being driven down on its forward stroke and is shown in an intermediate position. The air passing through the passage 24 in the grasping handle 17 enters the annular chamber 23, formed by the reduced rear end of the valve case, and passes through inclined ports 25 in the valve case and thence through the annular groove 26 in the valve case into the piston chamber. The rear end of the piston, in these views, has cleared and uncovered the groove 26, so that the live air is admitted directly into the piston cylinder behind the piston after the latter has received an initial forward movement, as will be explained later. With the valve in the position shown in these views, exhaust ports 27, which are here in the lid 21 of the valve case, are closed or covered by the for-

ward end portion of the valve. Each of the exhaust ports 27 is formed by two overlapping and converging transverse bores, as best shown in Figs. 9, 10 and 11, and these

5 ports communicate with longitudinal passages 28 at the forward end of which are transverse exhaust ports 29. The forward ends of the passages 28 are in registry or coincidence with the exhaust passages 30 (Fig. 13) in the cylinder which lead to the atmosphere in the usual way. The ports 27 are the exhaust ports for the rear end of the cylinder and the ports 29 are the exhaust ports for the front end of the cylinder and these ports communicate with the interior of the valve case. With the valve 19 in the position shown in Figs. 1 and 3, the air in front of the piston on its downward stroke is driven forwardly and allowed to escape freely through passages 32 in the cylinder wall and the valve case into the annular groove or chamber, formed between the lid 21 and valve 19 rearwardly of an annular enlargement 31 of the valve 19, and thence through the ports 29 and passages 28 and 30 to the atmosphere. When the valve is in this position the ports 29 and the forward ends of the passages 32 are uncovered by the annular enlargement 31 of the valve 19.

30 The piston on its forward or downward stroke uncovers a restricted port 34 which communicates with the piston chamber with the result that the air behind the piston enters said port and passes rearwardly through a passage 35 in the cylinder and lid 21, augmenting the pressure therein against the large pressure area 37 constituting the forward face or side of the annular enlargement 31 of the valve, an inclined port or passage 36 being in communication with the passage 35 and a shallow groove 39 formed in the corner of the counterbore in the lid 21. The forward end of the passage 35 in the lid 21 has a restricted portion 44 in co-incidence with a port 38^a branching from one of the ports 25. An unrestricted or enlarged port 38 (Fig. 1) at the forward end of the passage 35 communicates with the piston chamber. Before the piston uncovers the port 34 and covers the port 38 live air passes through the branch 38^a, the passage 35 and port 38 into the forward end of the piston chamber, but the portion 44 of the passage 35 is so restricted that the volume of air passing through it and into the forward end of the piston cylinder is not sufficient to retard or interfere with the movement of the piston. As soon as the port 38 is closed some of the live air behind the piston passes through the port 34 and into the passage 35 and this air together with the air passing through the port 44 builds up sufficient pressure against the pressure area 37 on the enlargement 31 of the valve 19, to move the valve to the position shown

in Figs. 2 and 4, in opposition to the pressure on the rear end or edge of the valve, thereby causing the valve to cover the groove 26 and cut off the supply of live air to the rear end of the piston chamber. The constant admission of air through the port 44 to the passage 35 materially quickens the shift of the valve, with consequent increase in the speed of operation of the hammer.

70 With the valve in the position shown in Figs. 2 and 4, the live air is admitted to the lower or forward end of the cylinder through the grooves 40 and 41 in the valve and also through the passages 32 in the cylinder wall leading to the forward end of the piston chamber. The circumferential extensions or enlargements of the valve are such as to control the passage of air to these grooves and the enlargement 42 is of a predetermined size so as to provide between it and an annular rib 46, formed on the valve case, an annular passage 47 (Fig. 4) of a predetermined capacity, with the result that a limited amount of live air will be admitted to the forward end of the piston chamber, sufficient to move the piston rearwardly but not with any unnecessary force, or such force as might possibly cause it to strike the rear end of the piston chamber, notwithstanding the cushioning provision thereof, to be explained later, it being understood that the piston should be returned with a lighter pressure than that required for its forward stroke.

100 It will be observed, by referring to Figs. 3, 4, 6 and 7, that the forward end of the valve case body 20 has a forwardly extending annular flange 49 provided with recesses 50 which are adapted to register with the rear ends of the passages 32, there being one recess for each passage. When the valve is in its rearward position, shown in Fig. 4, the enlargement 31 of the valve engages the forward edge of the flange 49 and partially covers the ends of the passages 32 but the recesses or openings 50 form ports permitting the live air to pass into and through the passages 32 to the forward end of the piston to return the same. It will be understood that at the same time the periphery of the enlargement 31 of the valve covers and closes the ports 29 but that the valve has uncovered the exhaust ports 27 to permit escape of the air from the rear end of the piston chamber until the ports 27 are covered by the rear end of the piston entering the forward end of the valve on its return stroke. The valve is held in its rearward position by the live air admitted through the port 44 and passage 35 and to which the pressure area 37 of the valve is exposed. As the flow of live air passing through the annular passage 47 between the valve extensions 42 and 46 is light and is free to pass through the ports 32 to return

the piston, it does not cause much pressure against the top or rear face of the enlargement 31 and the air pressure on the opposite side of the enlargement is sufficient to maintain the valve in its rearward position until the pressure of air compressed by the piston, as will now be described, shifts the valve forwardly again to the position shown in Figs. 1 and 3.

The piston continues upwardly or rearwardly unrestricted until it covers the exhaust ports 27 whereupon it begins to compress the air trapped by it, the valve case thus constituting a cushion chamber. As soon as the rear end of the piston enters the valve it begins to compress the air in the rear end of the piston chamber and by the time the rear end of the piston has reached the rear end of the valve the pressure exerted by the compressed air against the rear end 51 of the valve is sufficient to overcome the pressure exerted against the pressure area 37 on the enlargement 31 of the valve, whereupon the valve is shifted from the position shown in Figs. 2 and 4 to the position shown in Figs. 1 and 3. It is obvious that the rear end of the piston chamber acts as a cushion for the piston. A passage 45 communicates with the forward end of the cushion chamber and the annular chamber 23, live air being admitted through this passage to give the piston its initial forward movement until its rear end has passed the rear end of the valve on its forward stroke, at which time the live air is admitted through the passages 25 and groove 26 to the rear of the piston, as above described. This completes the cycle of operation.

It will be observed that the only communicating passage extending through and from the valve body 20 to the lid 21 is that formed by the passages 38^a and 35. This is highly desirable and important as it lends simplicity to the construction and minimizes the chance of leakage between these parts.

An aligning pin 54 extends through an opening in the lid 21 and the forward end of the pin projects into a recess 52 in the cylinder, while the rear end projects into a recess 53 in the body 20, for the purpose of properly aligning the valve case in the cylinder.

I claim:

1. In a pneumatic hammer, the combination of a cylinder, having a piston chamber, a valve case, admission and exhaust ports and passages in said cylinder and case, a piston reciprocable in said piston chamber, a valve controlling said ports and passages, means subjecting a pressure area of the valve continuously to fluid pressure, means for permitting said pressure to build up during at least a part of the movement of said piston in one direction, and means operating substantially concomitantly with

said last named means for augmenting said pressure.

2. In a pneumatic hammer, the combination of a cylinder, having a piston chamber, a valve case, admission and exhaust ports and passages in said cylinder and case, a piston reciprocable in said piston chamber, a valve controlling said ports and passages, means subjecting a pressure area of the valve continuously to fluid pressure, means for permitting said pressure to build up during at least a part of the movement of said piston in one direction, and means operating substantially concomitantly with said last named means for augmenting said pressure, the two last named means being controlled by said piston.

3. In a pneumatic hammer, a valve, a valve case comprising a body and a lid with abutting ends, each part of said case having a plurality of passages terminating therewithin and controlled by said valve, a single live air passage extending through the abutting faces of said valve case parts, said last named passage being uncontrolled by said valve and having a port opening against a pressure area of said valve, and piston controlled means for controlling the escape of pressure fluid from said live air passage and for admitting additional pressure fluid thereto to control the actuation of said valve.

4. In a pneumatic hammer, the combination of a cylinder having a piston chamber therein, a valve, a valve case at one end comprising a body and a lid having but one continuous air passage extending through them, the passage communicating directly with the motive fluid supply and being uncontrolled by the valve, and admission and exhaust ports and passages in said case and cylinder controlled by said valve.

5. In a pneumatic hammer, the combination of a cylinder, a piston therein, a valve case at one end of the cylinder and having a lid provided with ports, such case and lid having a central bore through which the piston reciprocates, recesses in the case registering with said ports, and a tubular valve in such case adapted to open said ports when the valve is in one position and to close said ports except for said recesses when in another position.

6. In a pneumatic hammer, the combination of a cylinder, a piston therein, a valve case at one end of the cylinder and having a lid provided with ports, such case and lid having a central bore through which the piston reciprocates and the lid also having a counterbore therein, a flange on the case extending into said counterbore and provided with recesses in registry with said ports, and a tubular valve having an enlargement in said counterbore and adapted to uncover the ports when in one position

and to engage said flange and close the ports except for said recesses when in another position.

7. In a pneumatic hammer, in combination, a cylinder having a piston chamber, a piston reciprocable in said chamber, a valve case having a lid disposed at one end of said cylinder and defining a portion of the piston chamber, admission and exhaust ports and passages in said cylinder and said case, an imperforate sleeve valve within said case controlling said ports and passages, said valve being arranged to be shifted in one direction by air compressed by the piston on its non-working stroke, means shifting said valve in the opposite direction by built-up pressure augmented at the proper instant by pressure fluid from the piston chamber

comprising a passage communicating with a pressure area of the valve and having pressure fluid continuously admitted thereto in limited amount and spaced piston controlled ports controlling the exhausting of the passage to the piston chamber and the admission of pressure fluid to the passage from the piston chamber, said valve case and lid having cooperating interfitting parts, recesses in the innermost of said parts controlled by said valve registering with passages in said outermost parts for directing motive fluid to drive the piston on its non-working stroke, said valve being arranged to utilize the central bore of said valve case for admitting motive fluid to said registering recesses and passages.

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