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E. GUNNELL.

PNEUMATIC HAMMER.

(Application filed Mar. 6, 1899.)

(No Model.)

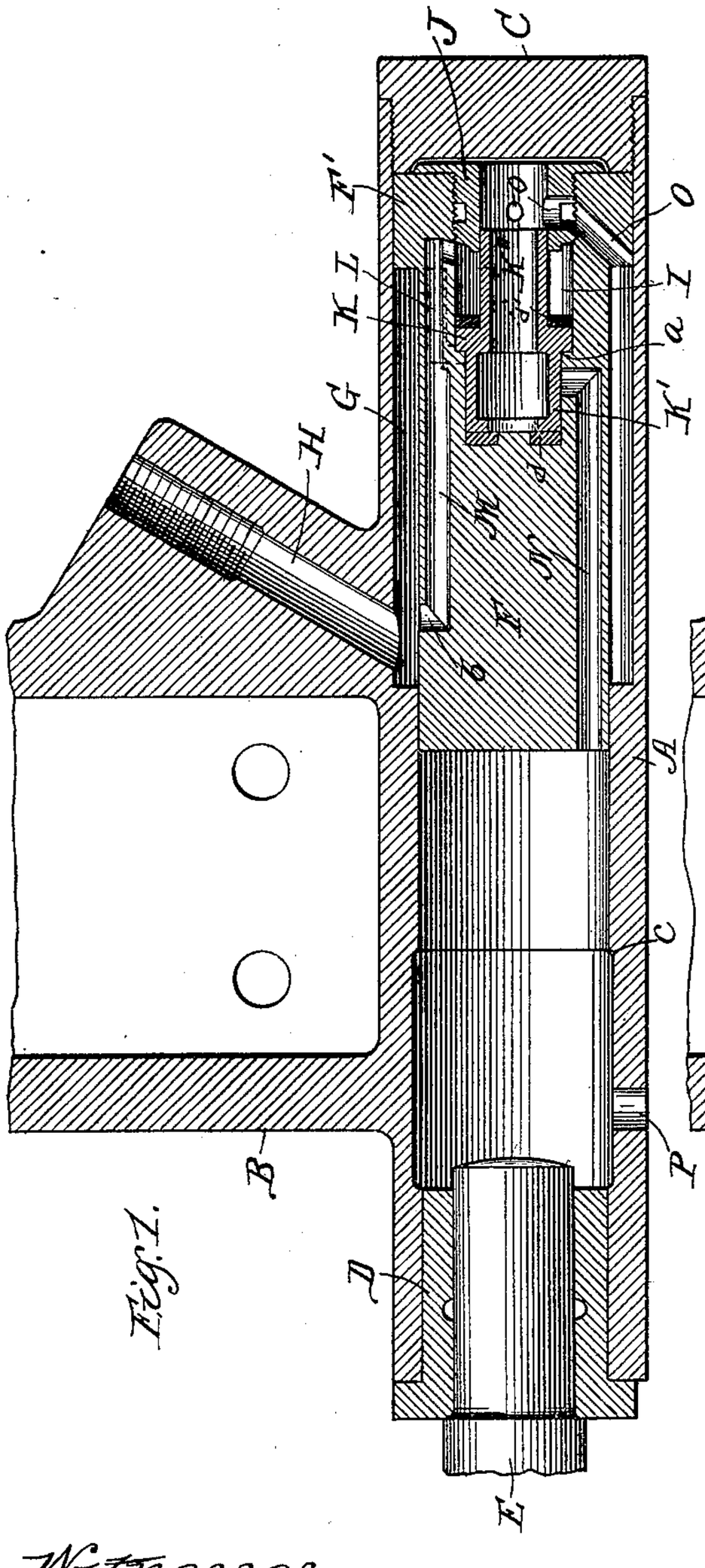

Fig. 1.

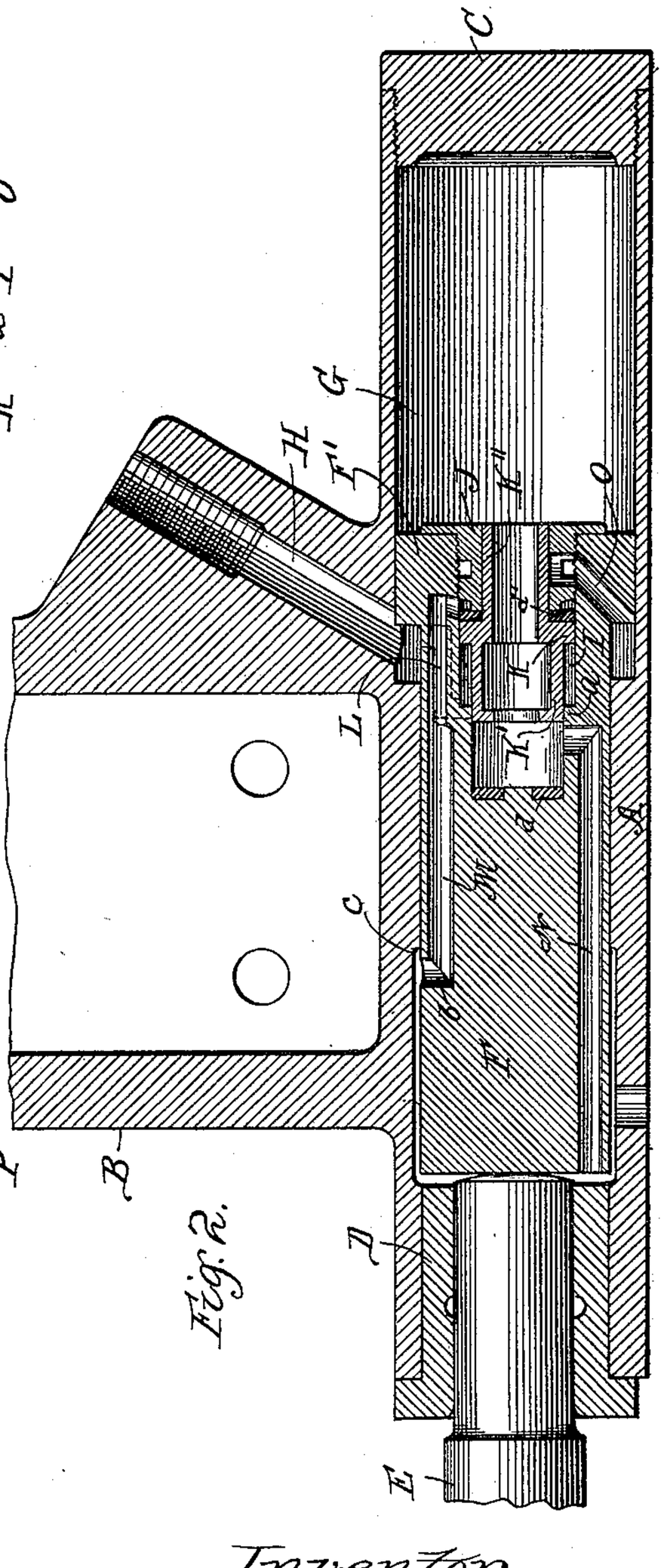

Fig. 2.

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UNITED STATES PATENT OFFICE.

ELIAS GUNNELL, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO W. IRVING BABCOCK, OF SAME PLACE.

PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 632,261, dated September 5, 1899.

Application filed March 6, 1899. Serial No. 708,028. (No model.)

To all whom it may concern:

Be it known that I, ELIAS GUNNELL, a citizen of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to the engine part of such hammers; and it consists in a certain novel construction, arrangement, and operation of the valve for controlling the inlet and exhaust of the motive fluid at the rear end of the piston-chamber.

In the drawings I have illustrated the hammer as adapted for use as a pneumatic riveter, the cylinder having cast upon its upper side a socket-piece by which it is adapted to be secured to a dependent arm of the riveter-frame; but the device is adapted to any of the uses of a pneumatic hammer and may be provided with a handle and used as a hand-tool or be supported in any suitable manner and by any suitable means.

Figure 1 is a longitudinal vertical section of the machine with the piston at the rear end of the piston-chamber, and Fig. 2 a corresponding view with the piston at the forward end of its stroke and ready to begin its backward stroke.

Same letters of reference are used to indicate identical parts in the two views.

A is the cylinder, which in the present instance, as above stated, has formed upon its upper side a socket-piece B for attachment to a riveter-frame, but which will be omitted if the hammer is to be used as a hand-tool or otherwise supported. The rear end of the cylinder A is closed by a screw-plug or cylinder-head C, and its front end has driven into it the usual sleeve or bushing D, adapted to receive the shank or stem E of the rivet-set or other working tool. The interior of this cylinder A is bored to form a piston-chamber proper of two diameters in which fits and travels the piston, composed of the body portion F, fitting the smaller bore of the piston-chamber, and the head F′, at the rear end of the body portion F and fitting the larger bore of the piston-chamber. The reduced diameter of the body portion F of the piston leaves the latter surrounded in the larger bore of the piston-chamber by an annular chamber G in front of the piston-head F′. The motive fluid is constantly admitted (when the main throttle-valve is open) to this chamber G through the main inlet-passage H and acts upon the annular front end of the piston-head F′ and tends to constantly press the piston rearward, the piston being reciprocated by the alternate admission and exhaust of the motive fluid to the larger rear end of the piston-head F′. The valve for controlling this admission and exhaust of the motive fluid at the rear end of the piston-chamber is located within the piston itself, to which end the latter is provided in its rear half with a central longitudinal bore or chamber I, whose extreme forward end has a reduced diameter, forming an annular shoulder in the chamber at *a*. The rear end of this central bore or chamber is interiorly threaded and has screwed into it a flanged plug J, having a central bore of considerably less diameter than the central bore or chamber I, formed in the piston, with the result that there is thus formed in the piston a longitudinal valve-chamber composed of a middle portion of maximum diameter, a forward portion of less diameter, and a rearward portion of still less diameter. Fitting in the chamber thus formed is the tubular valve, composed of a middle portion or head K, fitting the largest diameter of the valve-chamber, a forward portion K′, fitting the forward portion of the valve-chamber, and a rear portion K″, fitting the rear portion of the valve-chamber. The forward side of the middle head K of this valve thus presents an annular pressure area corresponding to the shoulder *a* in the wall of the chamber, and its rear side presents a larger annular pressure area, corresponding to the difference in the diameter between the middle portion of the valve-chamber and the reduced rear portion thereof.

The motive fluid is constantly admitted to the forward pressure area of the valve through a passage L, (shown in dotted lines,) extending through the shell of the piston around the valve-chamber and opening at its outer end into the pressure-chamber G, with the result

that a constant rearward pressure is exerted upon the valve, which pressure is intermittently overcome and the valve forced forward in its chamber by the admission of the motive fluid to the annular rear side of the middle head K of the valve through the medium of a longitudinal passage M, formed in the piston F and provided with an outwardly-opening port *b* at its forward end and at its rear end with an inwardly-opening port connecting it with the rear end of the large middle portion of the valve-chamber. A second longitudinal passage N, formed in the piston F at its opposite side, opens at its front end through the forward end of the piston and at its rear end communicates with the reduced forward portion of the valve-chamber. A series of diagonal ports or passages, O extending through the piston-head F and plug J, furnish communication between the pressure-chamber G and the central bore of the piston and the rear end of the piston-chamber. The interior of the cylinder A in front of the piston F is constantly open to the atmosphere through a port P, so that the longitudinal passage N in the piston F constitutes an exhaust-passage whose forward end is always open to the atmosphere and whose rear end is alternately opened and closed by the part K′ of the valve. The front end of the piston-chamber proper or of the portion which fits and guides the body F of the piston terminates at the shoulder *c*, forward of which the internal bore of the cylinder is slightly enlarged to form an exhaust-chamber around the body F of the piston when the latter is at the forward end of its stroke.

The operation of the machine under the above-described construction and arrangement of parts is as follows: In the position of the parts shown in Fig. 1 the valve will be held in its forward position, as there shown, by the pressure admitted to the rear side of its middle head K through the passage M, and in such forward position of the valve the rear end of the exhaust-passage N will be closed and the inner ends of the ports O will be uncovered and free communication established between the pressure-chamber G and the rear end of the piston-chamber, with the result that the motive fluid thus admitted behind the piston will drive the latter forward. As soon as the port B, at the front end of the passage M, passes from the larger bore to the smaller bore of the piston-chamber it will be closed and the admission of motive fluid to the rear side of the valve be thereby cut off, so that during the further forward movement of the piston the valve will be held in its forward position, Fig. 1, by the motive fluid confined in the middle portion of the valve-chamber behind it. As soon, however, as the port *b* passes beyond the forward end of the piston-chamber proper and clears the shoulder *c* the passage M and the middle portion of the valve-chamber will be opened to the exhaust, with the result that the constant pressure admitted to the forward side of the valve (through the passage L) will drive the valve rearward in its chamber in the piston, causing its rear portion K″ to cover the inner ends of the port O and cut off the motive fluid from the chamber behind the piston, while its forward portion K′ will uncover the rear end of the exhaust-passage N, and thus place the chamber behind the piston in communication (through the central bore in the piston and valve) with the exhaust, (see Fig. 2,) whereupon the pressure of the motive fluid in the chamber G, constantly exerted against the annular forward shoulder of the piston-head F′, will drive the piston rearward again. During this rearward movement of the piston as soon as the port *b* at the front end of the passage M passes into the larger bore G of the piston-chamber the motive fluid will be admitted through said passage to the rear side of the valve and there, acting against the larger pressure area of the valve, will drive the latter forward again against the constant pressure admitted through the passage L to its forward side. This forward movement of the valve in its chamber as the piston approaches the rear end of its stroke will close the rear end of the exhaust-passage N and open the rear ends of the inlet ports or passages O, thereby again admitting the motive fluid from the pressure-chamber G to the rear end of the piston-chamber, behind the piston, cushioning the latter at the end of its rearward stroke and then driving it forward again, as before.

I have shown leather rings *d* and *d′* at the front end of the valve chamber and between the rear side of the head R of the valve and the rear wall of the middle portion of the valve-chamber to cushion the valve at the opposite ends of its strokes and to form tighter joints; but they are not essential.

It will be understood from the foregoing description that I employ a differential piston to whose smaller pressure area the motive fluid is constantly admitted and to whose larger pressure area the motive fluid is alternately admitted and exhausted by the operation of a differential valve carried by the piston, and to whose smaller area the motive fluid is constantly admitted from the larger piston-chamber and to whose larger pressure area the motive fluid is alternately admitted and exhausted through a passage placed in communication with the motive-fluid supply at one end of the piston-stroke and with the exhaust at the opposite end of the piston-stroke. I am aware that differential pistons have before been employed in pneumatic hammers and that the admission and exhaust of the motive fluid behind the piston has been controlled by a valve carried by the piston and located in a longitudinal central bore therein; but so far as I am aware the construction and arrangement of my valve and piston and their mode of coöperation with each other are novel and an improvement

upon those heretofore employed. The construction of both valve and piston is exceedingly simple and of such character that the work may be readily done by the ordinary machinist without especial skill in the construction of this particular class of tools. None of the parts are of delicate construction or apt to break or get out of order, while access to the valve-chamber for inspection or removal of the valve, if occasion should require, may be readily had by removing the piston from the cylinder and unscrewing the plug J.

Having thus fully described my invention, I claim—

1. In a pneumatic hammer, the combination of a cylinder bored to form a piston-chamber of two diameters, a differential piston in said chamber, and a differential valve located in the chamber formed by a central longitudinal bore in the rear end of the piston, the motive fluid being constantly admitted to the smaller pressure area of said valve, and alternately admitted to and exhausted from its larger pressure area through a passage placed in communication with the motive-fluid supply at one end of the piston-stroke and with the exhaust at the opposite end of the piston-stroke, and the movements of said valve in its chamber serving to place the rear end of the piston-chamber alternately in communication with the motive-fluid supply and with the exhaust, substantially as described.

2. The combination of the cylinder bored to form a piston-chamber of two diameters, a differential piston therein, and a differential tubular valve located in a central longitudinal valve-chamber formed in the rear end of the piston and operating at its movement in one direction to admit the motive fluid to the rear side of the piston and at its movement in the opposite direction to place the rear end of the piston-chamber in communication, through the internal bore of the valve, with the exhaust, substantially as described.

3. The combination of the cylinder A, the differential piston F F′ therein, forming the pressure-chamber G around the body F of the piston, and the differential valve K K′ K″ located in the valve-chamber formed in the rear portion of the piston by the central longitudinal bore L and screw-plug J and controlling the exhaust-passage N and the inlet-passages O, said valve being operated by the motive fluid constantly admitted to its smaller pressure area through the passage L and alternately admitted to and exhausted from its larger pressure area through the passage M, substantially as described.

4. The combination of the cylinder A, the differential piston F F′ therein provided with the passages L, M, N, O, and central longitudinal bore I, the plug J screwed into the rear end of the bore I and itself having a central bore into which open the inner ends of the passages O, and the tubular valve K K′ K″ operating at its movement in one direction to uncover the inner ends of the passages O and cover the inner end of the passage N and at its movement in the opposite direction to uncover the inner end of the passage N and cover the inner ends of the passages O, and itself operated by motive fluid constantly admitted to its forward side through the passage L and alternately admitted to and exhausted from the rear side through the passage M, substantially as described.

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Witnesses:
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