No. 657,716. Patented Sept. 11, 1900.

D. S. WAUGH.

AUTOMATIC HAMMER.

(Application filed Nov. 9, 1899.)

(No Model.)

Fig. 1.

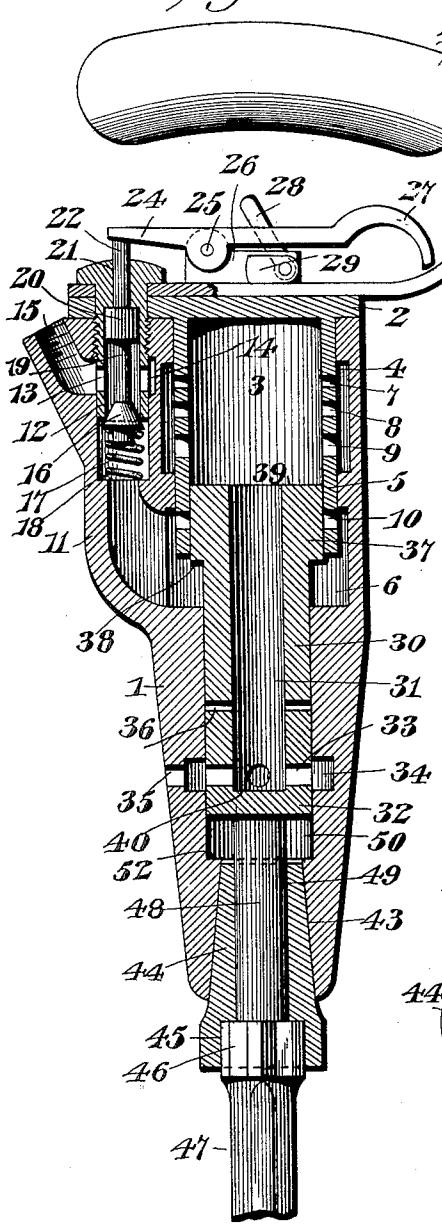


Fig. 2.

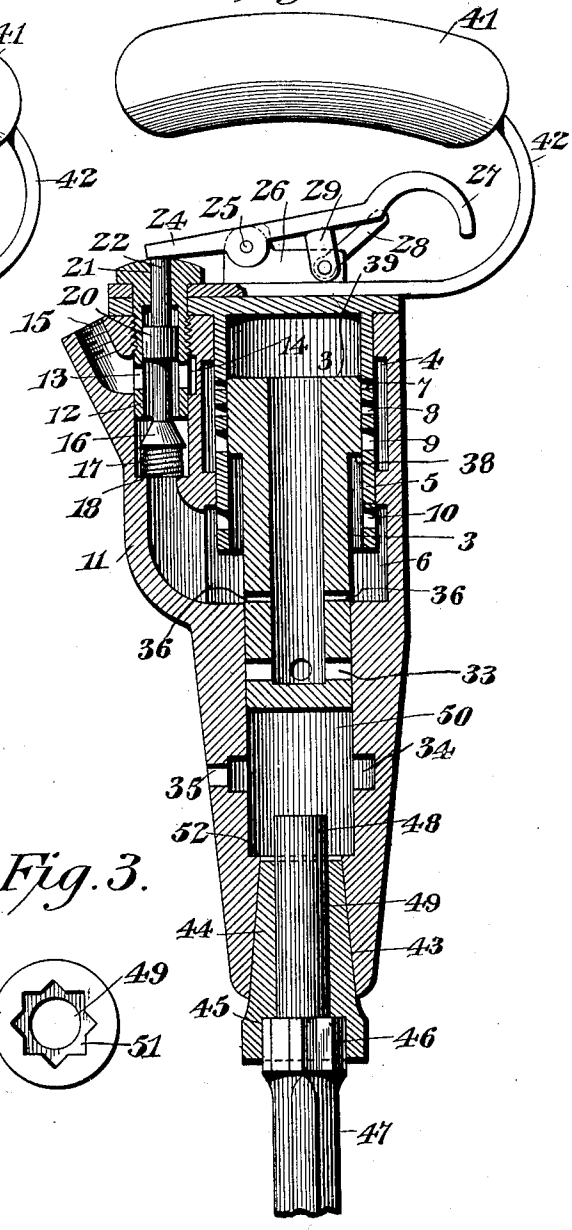


Fig. 3.

Witnesses
Jas. K. McCathran
L. T. Holcombe

Daniel S. Waugh, Inventor
By E. G. Siggers Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

DANIEL SHAW WAUGH, OF MARION, OHIO.

AUTOMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 657,716, dated September 11, 1900.

Application filed November 9, 1899. Serial No. 736,335. (No model.)

To all whom it may concern:

Be it known that I, DANIEL SHAW WAUGH, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented a new and useful Automatic Hammer, of which the following is a specification.

This invention relates to automatic hammers; and the object in view is to provide a simple, economical, and effective hammer which is capable of being driven by compressed air, gas, steam, &c.

One of the principal objects of the invention is to do away with the automatic valves ordinarily employed in this type of hammer, thereby reducing the liability of the device as a whole to get out of order and become inoperative.

It is also an object of this invention to reduce or to a great extent absorb the vibration imparted to the casing or shell of the instrument, which is injurious and objectionable to the workmen; also, to provide means for locking the supply-controlling valve in its open position. The operative parts of the device and the several ports are so disposed that a light pressure is given at the commencement of the downstroke of the hammer or piston and the pressure is gradually and progressively increased as the hammer approaches the limit of its downward movement, thereby enabling a sharp and heavy blow to be struck without any jar or vibration of the shell or casing.

Other objects and advantages of the invention will appear in the course of the ensuing description.

The invention consists in an automatic hammer embodying certain novel features and details of construction and arrangement of parts, as hereinafter fully described, illustrated in the drawings, and incorporated in the claims.

In the accompanying drawings, Figure 1 is a longitudinal section through a hammer constructed in accordance with the present invention, showing the piston at or near the outward or downward limit of its movement. Fig. 2 is a similar view showing the piston at or near the upper or inner limit of its movement. Fig. 3 is an end view of the bit socket or holder.

Similar numerals of reference designate corresponding parts in all figures of the drawings.

The hammer contemplated in this invention will be described for convenience as a pneumatic hammer; but it is to be understood that compressed air, gas, steam, or any fluid or liquid under compression may be used for driving the piston or that part which strikes the blow upon the tool or bit.

In carrying out the present invention I employ a tubular shell or casing 1, having its upper end closed by a head 2 and comprising a main compression-chamber 3 and an auxiliary compression-chamber 4, the chambers 3 and 4 being separated by a cylindrical wall 5, terminating in the primary or initial air-chamber 6. The chambers 3 and 4 are placed in communication by graduated ports 7, 8, and 9, the said ports being arranged in annular series. The ports 7 nearest the inner end of the chamber 3 are smaller in area than the adjacent row of ports 8, and the ports 9 have a still greater area than the ports 8, so that the ports 7, 8, and 9 are of successively-increasing area from the inner toward the outer or lower end of the main compression-chamber 3, and all of said ports communicate with the auxiliary compression-chamber 4. The cylindrical wall 5 is preferably formed as an integral part of the cap 2, which is inserted into the upper end of the shell 1 and secured in any convenient manner. The wall 5 is also provided with other ports 10, leading from the chamber 3 into the initial air-chamber 6, the purpose of which will hereinafter appear. The casing is also provided with a lateral extension 11, which is hollowed out to receive a valve-casing 12. This valve-casing is preferably screwed into the lateral extension of the shell and is provided with ports 13, communicating with an annular space or groove 14, by means of which the air admitted through the supply-port 15 is conveyed to the interior of the valve-chamber. The valve 16 is shown as cone-shaped and held closed by means of a coiled valve-seating spring 17, which bears at one end against the valve 16 and rests at its opposite end against an annular shoulder 18 within the extension 11. The valve 16 has a stem 19, the extremity of which is enlarged, as shown at 20, so as to fit

snugly within the valve-casing and properly guide the valve in its movement. The outer end of the valve-casing is reduced to leave a bore 21, in which is slidingly fitted an auxiliary stem 22, against the outer end of which one arm 24 of a valve-operating lever bears. The valve-operating lever is fulcrumed at 25 at a point intermediate its ends on a suitable bracket 26 at the head of the casing, and the opposite arm of said lever is provided with a finger-grip 27, by means of which it may be readily vibrated. The valve-operating lever is adapted to be locked by means of a cam-lever 28, journaled on the head of the casing and provided with a cam 29, which when turned is adapted to bear against the inner surface of the lever and hold the arm 24 inward, the valve 16 being thus held open or unseated for allowing the compressed air to pass continuously into the initial air-chamber 6.

The hammer proper is in the form of a hollow piston 30. The piston 30 has a hollow longitudinal bore 31, which is open at its upper or inner end and closed at its opposite end to form the striking end or surface 32, adjacent to which it is provided with laterally-extending eduction-ports 33, which communicate with an annular exhaust-chamber 34, having an exhaust-port 35 opening out through the side of the shell or casing. The piston is also provided with smaller induction-ports 36 and has its inner or upper ends slightly enlarged to form what may be termed a "head" 37, providing an annular shoulder 38, forming the surface against which the compressed air acts in retracting the piston or hammer. The inner or upper surface 39 of the head 37 forms one of the surfaces against which the compressed air acts for driving the piston downward or outward, and the extremity 40 of the bore 31 forms an additional surface for the same purpose. It will thus be seen that a much larger area is provided for receiving the downward or outward pressure of the air than the surface which is acted upon by the air for retracting the piston.

The handle 41 may consist of wood or other suitable material and is fixedly attached to one end of a U-shaped spring 42, the opposite end of which is securely fastened to the head or cap of the shell 1. This spring serves to absorb the vibration imparted to the shell or casing 1 and prevent it from being communicated to the handle 41, which greatly relieves the operator.

The outer end of the shell 1 is provided with a tapered opening 43, in which is received a correspondingly-tapered bit socket or holder 44, having its outer end enlarged and provided with a recess 45 to receive the enlarged or shoulder portion 46 of the bit or tool 47, said bit having its shank 48 extended through a longitudinal opening 49 in the bit-socket 44 and projecting into the longitudinal cavity 50 of the shell 1, so as to receive the impact of the piston or hammer. The portion 46 of the bit is ordinarily squared, and the recess 45 is provided with twice that number of angles 51 to receive the corners or angles of the bit in order to prevent the latter from turning and also to enable it to be adjusted from one set of angles 51 to another set for the purpose of presenting the active end of the bit at different angles, as may be desired.

In operation the compressed air passes in through the supply-port 15 and is admitted by the valve 16 to the initial air-chamber 6, where it acts against the annular shoulder 38 to lift or retract the piston 30. As the shoulder 38 is of a comparatively-smaller area, the inward movement of the piston is comparatively slow. When the piston has moved inward or upward sufficiently to bring the induction-ports 36 into communication with the air-chamber 6, the air passes through the ports 36, and the inward movement of the piston is arrested and the direction of movement of the piston reversed as the air passes into the bore 31 and fills the chamber 3. When the piston on its inward or upward movement reaches a position for the ports 36 therein to communicate with the chamber 6, the upper end of the piston does not cover the upper port 7, and the air under pressure rushes through the passage 31 and flows through the ports 7 into the compression-chamber 4 before the piston is lifted sufficiently to cover the series of ports 7 8 9. The piston 30 in moving inward also compresses the air which is behind it in the chamber 3 and forces said air into the auxiliary compression-chamber 4, the inward movement of the piston being arrested at or about the position shown by Fig. 2, so that the parts of the chamber 4 will be covered by the imperforate part of the plunger, whereby the air is retained in the chamber 4 until the plunger begins its downward movement. After the ports 36 have been placed in communication with the air-chamber 6 the pressure of the air against the surfaces 39 and 40 is greatly in excess of the pressure against the comparatively-small surface 38, and the result of this is that the piston begins to move downward or outward. As the induction-ports 36 pass out of communication with the air-chamber 6 the head 39 uncovers the ports 7 and the compressed air stored in the auxiliary chamber 4 compensates in a measure for the expansion of air in the working or plunger chamber, and thereby gives a fresh impetus to the hammer or piston. The ports 8 and 9 of successively-increasing area are successively uncovered, thus gradually and progressively compensating still further for the expansion of the fluid behind the plunger, and thereby increasing the impetus or speed of the piston. The hammer or piston finally strikes against the shank of the bit and imparts thereto the requisite blow. At the same time the eduction-ports 33 register with the exhaust-chamber 34, and the compressed air is discharged through the

exhaust-port 35. Immediately thereafter the air entering the chamber 6 again acts on the shoulder 38 and retracts the plunger in the manner heretofore described. Should the piston or hammer move outward until it rests against the annular shoulder 52 near the outer end of the shell or casing 1, air will pass through the ports 10 and hold the piston at the outer limit of its movement. This will enable the controlling or supply valve to be dispensed with, and the machine may be started by using the bit 47 as a means for pressing the piston inward until it is in position for the compressed air to act thereon in the manner hereinabove described. In order to close the valve 16, the cam-lever 28 is moved to the position illustrated in Fig. 1, thereby allowing the spring 17 to seat the valve, thus shutting off the supply of compressed air.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. A fluid-pressure hammer comprising a shell or casing having the reciprocating piston and also carrying means for controlling the admission of motive fluid thereto, a doubled spring having one arm secured to the casing, and a handle attached to the other arm of said spring, whereby the entire hammer may be held and manipulated in the hand and the spring is adapted to absorb the vibration due to reciprocation of the piston, substantially as described.

2. In an automatic hammer, a casing provided with graduated ports communicating with the main compression-chamber, a piston or hammer mounted to slide past said openings and successively uncover the same and means for supplying motive fluid under pressure to said ports, whereby a progressively-increasing impetus is imparted to the piston or hammer, substantially as described.

3. In an automatic hammer, a casing having ports of progressively-increasing areas communicating with the main compression-chamber, in combination with a piston mounted to slide within said chamber and to successively uncover said ports beginning with those of the least area, said piston also serving as means for controlling the supply of motive fluid to the ports for the main compression-chamber, substantially as and for the purpose specified.

4. In a fluid-pressure hammer, the combination with a shell or casing, of a reciprocatory plunger fitted in said casing and serving as an automatic valve for controlling the admission and exhaust of motive fluid to or from the working chamber of said shell or casing, a supply-valve communicating with said working chamber, an operating device for said supply-valve, and means for locking said operating device to hold the supply-valve in an open position, substantially as described.

5. In a fluid-pressure hammer, the combination with a shell or casing having a working chamber, of a reciprocatory plunger fitted in said casing and serving as an automatic valve for controlling the admission and exhaust of motive fluid to and from the working chamber thereof, a supply-valve communicating with said working chamber, an operating-lever mounted on the casing and connected with said supply-valve, and means for locking said lever in place to hold the supply-valve normally in an open position, substantially as described.

6. In an automatic hammer, the combination of a shell or casing having a valve-chamber and a valve-seat, a supply-valve provided with the spaced head and piston and arranged within the chamber for said head and piston to be exposed to the pressure of the motive fluid, a valve-lever mounted on the shell or casing, and a cam-lever fulcrumed independently of the valve-lever and having a crank adapted in one position to engage with said valve-lever and hold the valve open, substantially as described.

7. In an automatic hammer, a shell or casing and means for supplying the motive agent thereto, of a main compression-chamber, an auxiliary compression-chamber having graduated ports leading to the main compression-chamber, and a reciprocating piston or hammer having a central bore closed at one end and open at the other and provided with lateral induction and eduction ports, substantially as described.

8. In an automatic hammer, a shell or casing comprising a main compression-chamber, an auxiliary compression-chamber surrounding the same and communicating therewith by means of graduated ports, in combination with a hollow piston or hammer slidingly mounted in said main compression-chamber and provided with induction and eduction ports, substantially as described.

9. In a fluid-hammer, a casing provided in addition to its working chamber with an auxiliary compression-chamber and with a series of ports between the two chambers, combined with a hollow plunger having ports for the supply and exhaust of the motive fluid, said plunger controlling the admission of motive fluid to the reservoir-chamber and slidably arranged to cover and expose the ports, substantially as described.

10. In a fluid-pressure hammer, a casing provided in addition to the working chamber with an annular supply-chamber and with an auxiliary compression-chamber, and a cap

having a shell fitted within said casing across said annular chambers therein and provided with the ports, 7, 8, 9 and 10, combined with a hollow shouldered plunger having the contiguous supply and exhaust ports and slidably fitted in the casing for the shoulder thereof to traverse the ports, 10, and for the supply-ports to communicate with the supply-chamber, substantially as described.

11. In a fluid-pressure hammer, a casing provided, in addition to the working chamber with the annular supply-chamber and the auxiliary compression-chamber, and also having a series of ports which establish communication between the reservoir and working chambers, combined with a hollow shouldered plunger having the supply and exhaust ports and said plunger slidably fitted in the casing for one end portion thereof to traverse the series of ports from the reservoir-chamber, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

DANIEL SHAW WAUGH.

Witnesses:

D. R. CRISSINGER,

F. M. ILER.