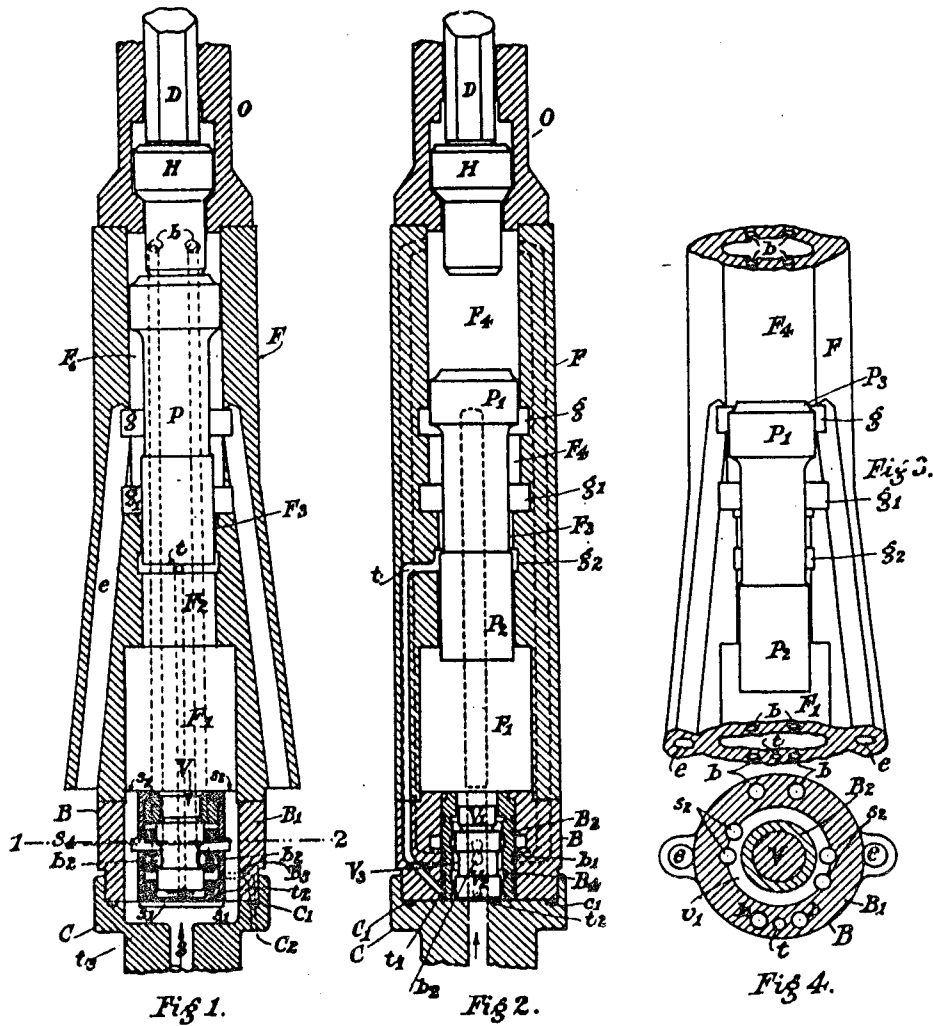


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HAMMER OPERATED BY COMPRESSED FLUID.
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1,061,203.

Patented May 6, 1913.



WITNESSES:

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HAMMER OPERATED BY COMPRESSED FLUID.

1,061,203.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES H. SHAW, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Hammers Operated by Compressed Fluid; and I do hereby 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 appertains to make and use the same.

This invention relates to improvements in hammers and especially that class of hammers ordinarily operated by compressed air and ordinarily called "air hammers" or "pneumatic hammers".

An object of my invention is to provide, in a mechanism of the class described, for economy in the quantity of air or other compressed fluid used, and to make the piston strike a maximum blow with the expenditure of a minimum quantity of the compressed fluid.

Another object of my invention is to provide a mechanism of the class described with a minimum number of movable parts.

Another object of my invention is to provide a hammer of the class described in which the compressed fluid which operates the piston shall remain at substantially the same pressure against the rear of the piston constantly during both the forward and backward movements of the piston, so long as compressed fluid is being supplied to the machine.

Another object of my invention is to provide, in a hammer of the class described, improved means for returning and forcing back the piston against a constant pressure upon the rear end thereof.

Another object of my invention is to provide, in a hammer of the class described, an arrangement of passages, valves and ports whereby, from a single supply of compressed fluid to the mechanism, the said compressed fluid will exert a constant and substantially equal pressure upon the rear end of the piston at all times, during both forward and backward strokes, but whereby, also, the said compressed fluid will be supplied automatically and intermittently to the front of the piston and against the same so that the piston will be alternately forced back against the constant pressure against its rear end and then released so that the said constant

pressure will force it forward to strike the blow.

With these and other objects in view my invention comprises certain novel constructions, combinations and arrangements of parts as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1. represents a longitudinal view of my hammer showing the casing and other stationary parts in section and the piston and other moving parts in elevation and showing some of the ports and passages and showing the piston at the forward end of the stroke. Fig. 2 represents another longitudinal view of my hammer showing the casing and other stationary parts in section and showing the piston and other moving parts in elevation and showing other ports and passages and showing the piston approximately midway on the back stroke. Fig. 3 represents the central portion of my hammer showing the piston and associated grooves and exhaust passages in elevation as if the casing were transparent and showing the position of all passages in the broken ends of the casing and showing the piston on the back stroke after exhaustion of the air in front of the piston and while the back stroke is being completed by momentum of the piston. Fig. 4 represents a cross-section of the valve block of my hammer on line 1—2 of Fig. 1.

Like characters of reference represent corresponding parts throughout the several views.

The end of the hammer having the valve block will be referred to as the rear end and the movement of the piston toward the valve block will be referred to as the back stroke.

In the construction of my hammer I provide a casing F with a chuck O at its forward end in which chuck I provide a tappet block H, the chuck being so constructed as to admit the end of a drill D or other tool. It is preferable to construct the chuck and tappet block as shown but this is no part of my present invention as any suitable means for closing the forward end of the chamber F while at the same time communicating the blow from the piston within the chamber to the tool to be operated, may be used.

The rear end of the casing F is provided with a valve block B to which is attached a cap C. The connections of the casing with the chuck O and valve block B and of the

valve block B with the cap C are all air tight except where ports or passages are indicated.

The casing F is constructed with a central chamber, having rear portion F^1 which is, in diameter, the largest portion. The portion of the chamber next adjoining F^1 is designated as F^2 and F^3 and has the smallest diameter and from this point forward the chamber is widened into F^4 . The casing F is also provided with annular grooves g , g^1 and g^2 and with a plurality of exhaust passages, e , communicating at their inner ends with the annular grooves g and g^1 and at their outer ends with the atmosphere. The casing F is also provided with a plurality of passages b communicating at their forward ends with chamber F^4 and at their rear ends with annular grooves b^1 in the valve block. The casing F is also provided with passage t communicating at its forward end with annular groove g^2 and at its rear end with annular groove t^1 in the valve block.

The passages t and b have been mentioned as being formed in the casing F but corresponding passages designated by the same letters are formed in the valve block B, connected with the passages in the casing F and thus form continuous passages connected with the chambers and grooves as above described.

The piston P has its forward end enlarged as at P^1 and its rear end is smaller in diameter as at P^2 . The central portion of the piston is cut away as clearly shown at P in Fig. 1 so that, when the piston is in the position shown in Fig. 2, a connection is formed between the annular grooves g^1 and g^2 and when the piston is at or near the end of the back stroke as in Fig. 3, the annular grooves g^1 and g^2 are still connected. The extreme forward end of the piston may be beveled as at P^3 in order to permit connection between chamber F^4 and annular groove g and the exhaust of the compressed fluid from chamber F^4 through groove g and exhausts e , at an earlier stage of the back stroke than would be possible were the forward end of the piston not so beveled.

The valve block B is constructed with an outer casing B^1 and an inner casing B^2 . There is an annular groove S^4 in the outer casing which groove connects with the supply passages S^2 . This casing is also provided with a passage B^3 as shown in Fig. 1 which connects with the atmosphere through annular groove C^1 and passage C^2 leading therefrom.

The valve V is slidingly mounted within the inner casing B^2 and is constructed with the forward end thereof, designated as V^1 , smaller than the rear end thereof, designated as V^2 . A portion, V^3 , of the valve is cut away so as to form connection between

the annular groove S^4 and the ports b^2 when the valve is in the forward position as shown in Fig. 1 and so as to form connection between the ports b^2 and the annular groove and port B^4 when the valve is in the position shown in Fig. 2.

In order to describe the operation of the hammer I commence when the piston is at or near the extreme back stroke as in Fig. 3 at which time the valve V is also at the extreme back stroke as in Fig. 2. Through the passage S I allow fluid under pressure to pass into the mechanism through passages S^1 and S^2 thus filling the chamber F^1 with the fluid under full pressure. This drives the piston forward until the rear of the piston passes into annular groove g^2 as clearly shown in Fig. 1, thus opening passage t for the passage of the compressed fluid from chamber F^1 through F^2 , into annular groove g^2 and thence through passage t into annular groove t^1 , thence through port t^2 into the chamber t^3 at the rear of the valve. The rear of the valve being larger than the forward end and having a larger surface exposed to the pressure and the pressure at both ends of the valve being the same per unit area, the valve will be moved forward to the position shown in Fig. 1.

When the valve moves into the position in Fig. 1, communication is opened between annular groove S^4 and ports b^2 so that the compressed fluid passes from passages S^2 into annular grooves S^4 , thence into ports b^2 , through the passages b and thence into the chamber F^4 in front of the head of the piston thus establishing pressure at the head of the piston equal per unit area to the pressure at the rear of the piston.

While it is true that the pressure is established in chamber F^4 almost instantaneously upon the opening of annular groove g^2 , as above described, still it is not established quickly enough to prevent the momentum of the piston aided by the constant pressure at its rear, from carrying the piston to the completion of the stroke with full force. At the end of the stroke the piston very slightly rebounds from the tappet block, by the force of the blow, thus leaving the entire surface of the forward end of the piston exposed to the pressure of the fluid in chamber F^4 and this pressure being equal per unit area to the pressure at the rear of the piston and the surface of the forward end being larger than the surface of the rear of the piston, the piston is forced back by the pressure in chamber F^4 , against the pressure of the fluid in chamber F^1 . When the piston has thus been forced back to the position shown in Fig. 2, communication is established between chamber t^3 and the atmosphere through the passage t annular groove g^2 , cut away portion P of the piston, the an-

nular grooves g and g^1 and thence through exhausts e . Through this channel the compressed fluid at the rear of the valve is exhausted and the pressure in chamber F^1 immediately forces the valve back to the position shown in Fig. 2 thus cutting off the communication from passages S^2 , through annular groove S^4 and ports b^2 and passages b , with chamber F^4 . The supply of compressed fluid is therefore cut off from chamber F^4 when the piston reaches the position shown in Fig. 2. It will be noted that from this point the piston will be carried back by the pressure already established in chamber F^4 as well as by its own momentum until it reaches the position shown in Fig. 3, when the pressure in chamber F^4 will exhaust through groove g and exhausts e . It is clear that the piston will then continue on the back stroke only so long as its momentum exceeds the pressure in chamber F^1 . The momentum is overcome by this pressure when the enlarged portion P^1 reaches a point in front of F^2 of the chamber, where the diameter of the chamber decreases, which point is determined by the relation between the weight of the piston, the relative sizes of its forward and rear ends and the pressure under which the fluid is used. The piston then stops and is instantaneously again forced forward as first above described.

In order to eliminate the back pressure which would result, in chamber F^4 , from the forward movement of the piston after it has passed annular groove g , annular groove B^4 , is provided in the inner casing B^2 of the valve block and communicating with the atmosphere through passage B^3 annular groove C^1 and passage C^2 . When the valve is in the position shown in Fig. 2 communication is established between chamber F^4 and the atmosphere through passages b , ports b^2 , cut-away portion V^2 of the valve, annular groove B^4 , passage B^3 and groove and passage C^1 and C^2 . Therefore, while the piston is passing forward, the fluid in chamber F^4 is forced out through the communication established, as above described, to the atmosphere and back pressure is avoided.

It is preferable to have chamber F^1 considerably larger than the portion of the piston which projects into it on the back stroke. The reason for this is that the larger the bulk of compressed fluid in chamber F^1

as compared to the bulk of that portion of the piston, the less will the pressure be increased or diminished by the piston being injected into or withdrawn from the chamber and the nearer constant and equal will the pressure remain in the chamber.

I claim—

1. In a device of the class described, a cylinder, a piston hammer mounted to reciprocate freely in the cylinder and being of larger area at its forward than its rearward end, the said cylinder being provided with an inlet port and conduits leading from the inlet port to the front end of the cylinder and to an annular groove intermediate the ends of the cylinder, means to subject both ends of the piston to fluid pressure, and a valve mounted in the inlet port adapted at times to relieve the fluid pressure at the forward end of the piston.

2. In a device of the class described, a cylinder, a piston hammer mounted to reciprocate freely in the cylinder and provided with its forward end having a greater area than its rearward end, said cylinder being provided with an inlet port and conduits leading from the inlet port to the forward end of the cylinder and to an annular groove intermediate the ends of the cylinder, means to introduce fluid under pressure through the inlet port and through the passages to subject both ends of the piston to fluid pressure, a valve introduced into the inlet port adapted to control the conduits and adapted at times to cut off communication between the conduits and the inlet port and to open communication between the conduits and an exhaust.

3. In a device of the class described, a piston having its front end of larger transverse area than its rear end, a chamber at the rear thereof, means for supplying compressed fluid to said chamber, a chamber at the front of said piston, passages to said front chamber, an automatically operated valve, having its front end of a smaller transverse area than its rear end, for permitting compressed fluid to pass intermittently from said means of supply, through said passages and into said front chamber.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES H. SHAW.

Witnesses:

CARLE WHITEHEAD,
A. FRANK JAMES.