J. D. MacDONALD.

PNEUMATIC ENGINE OR TOOL.

APPLICATION FILED JAN. 13, 1912.

1,110,067. Patented Sept. 8, 1914.

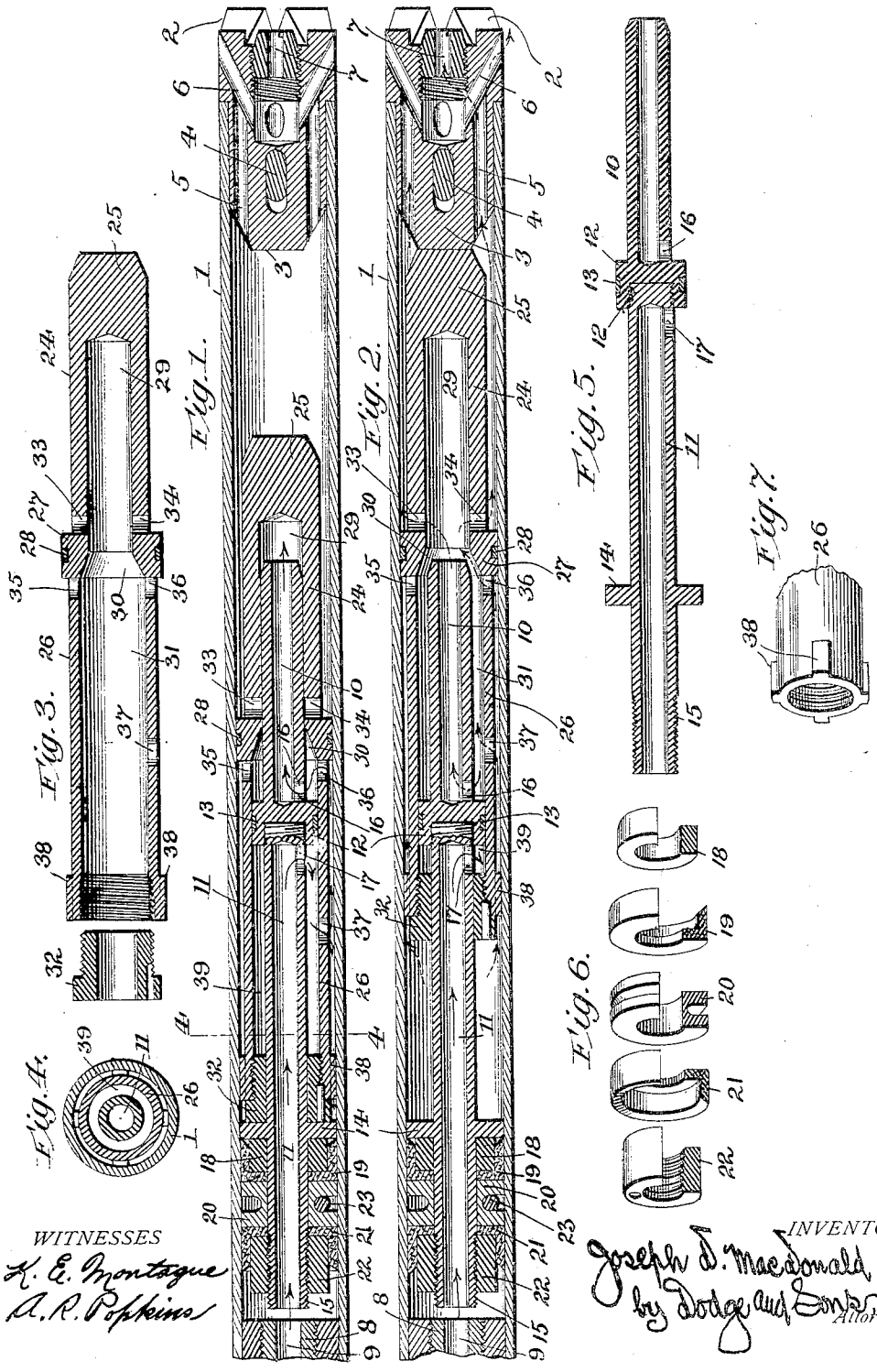


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

WITNESSES

K. E. Montague

A. R. Popkins

INVENTOR:

Joseph D. MacDonald

by Dodge and Dodge

Attorneys.

UNITED STATES PATENT OFFICE.

JOSEPH D. MacDONALD, OF BUTTE, MONTANA.

PNEUMATIC ENGINE OR TOOL.

1,110,067. Specification of Letters Patent. Patented Sept. 8, 1914.

Application filed January 13, 1912. Serial No. 671,049.

To all whom it may concern:

Be it known that I, JOSEPH D. MacDONALD, a citizen of the United States, residing at Butte, in the county of Silver Bow and State of Montana, have invented certain new and useful Improvements in Pneumatic Engines or Tools, of which the following is a specification.

My present invention pertains to an improved pneumatic engine or tool, the construction and advantages of which will be hereinafter set forth, reference being had to the annexed drawings, wherein:

Figure 1 is a longitudinal sectional view, showing the parts in that position in which the live air is in the act of forcing the hammer forwardly or to the right to deliver a blow, the course of the air being shown by the arrows in full lines; Fig. 2 a similar view, the hammer being shown as actually delivering a blow or coming into contact with the drill-head or anvil, the course of the exhaust air being indicated by arrows in dotted lines; Fig. 3 a longitudinal sectional view of the hammer proper; Fig. 4 a transverse sectional view of the structure taken upon the line 4—4 of Fig. 1; Fig. 5 a longitudinal sectional view of the combined piston-hammer support or guide and abutment member against which the compressed air works, said member likewise forming the conduit through which the compressed air or other motive fluid is introduced; Fig. 6 a sectional perspective view of the various elements employed to secure the combined guide and abutment member in place within the shell or casing; and Fig. 7 a perspective view of the rear end of the hammer proper.

The main object of the present invention is to produce a simple and highly efficient pneumatic tool which by reason of its construction is small in diameter and is free of valves except as the movable piston hammer itself performs the function of a valve, or a plurality of valves.

The tool or hammer is of the tandem type, and the compressed air is introduced centrally into the piston-hammer support and thence distributed through suitable ports so that it may act equally upon all of the abutments or fixed faces to cause a forward impulse or movement to be imparted to the hammer or movable piston. The ports are likewise so arranged that immediately the hammer has delivered its blow the air which caused the hammer to function will be freely exhausted and the incoming compressed air will act to return the piston-hammer to its initial position. The force by which the hammer is returned to its initial position preparatory to delivering a second blow is less than that which is employed in delivering the blow, and this by reason of the fact that the air acts upon a less number of faces or abutments in the return stroke than it does in the outward or hammer stroke. In the present instance two abutments or faces are exposed to the compressed air in making the outward stroke, while but one face is brought into use in making the return stroke. It is conceivable that a greater number of faces may be used, but in each instance the fixed abutments or faces employed in producing or effecting the hammer blow should be greater in number than those employed in causing the return of the hammer to a position where the live air is again delivered to the parts to effect the hammer blow.

Referring to the construction shown in Figs. 1 to 7 inclusive, 1 denotes the shell or casing of the engine or hammer, having secured to its outer or forward end a suitable cutting tool 2 provided with a stem or anvil portion 3, secured in the shell by a cross-bar or pin 4. Said stem and tool are provided with suitable exhaust ports 5, 6 and 7, through which the exhaust of the tool may discharge directly into the hole being cut. The cutting tool herein shown forms no part of the present invention, and any tool suitable for the work may be employed.

To the opposite end of the shell there is secured in any suitable manner the usual feed bar 8, having a port or opening 9, through which live or compressed air or other fluid medium under pressure is introduced. Located within the rear end of the shell and permanently positioned therein is the combined piston-hammer support and abutment member, shown in sectional elevation in Fig. 5. It comprises two tubular stems or portions 10 and 11, open at their distant ends, tube 11 being considerably longer than the tube 10. The limit of the two tubular members is defined by an intermediate abutment and piston-guiding member 12, said member having an external di-

ameter larger than the external diameter of the tubular members and provided with a packing-ring 13. Member 11 has formed integrally therewith a collar 14, and the outer end of the stem or tube is threaded, as at 15. The tubular member 10 is provided with a port 16, and member 11 with a port 17, said ports being formed adjacent to the abutment 12. To secure said combined abutment member and piston-hammer guide fixedly in place a ring 18, packing 19, externally-grooved ring 20, packing 21 and nut 22 are employed. Said parts are slipped over the threaded end 15, and the members passed into the shell (this, of course, before the engine is secured to the drill, or feed-bar 8 is secured in place, and after the hammer piston is mounted on the abutment guide), after which a cross-pin 23 is passed through the wall of the shell, said pin lying within the groove of the ring 20. Upon then screwing up the nut the packings are compressed and forced outwardly into close contact with the inner wall of the shell.

The combined piston and hammer is shown in detail in Figs. 3 and 7. It may be said to comprise a forward tubular portion 24, having a closed and relatively heavy hammer or head section 25, a rear tubular section 26, somewhat larger in external diameter than the forward portion, and an intermediate piston or piston-ring 27, provided with a packing 28. The bore 29 of the forward portion 24 is of a diameter to make a close fit with the stem 10, and said bore merges by the inclined face 30 into the somewhat larger bore 31 of section 26, the diameter of said bore being such as to make a close fit with the abutment member 12. The rear end of section 26 is internally threaded and a shouldered sleeve 32 is screwed into the same, the bore of the sleeve making a close working fit with the outer face of the tubular stem 11 when the parts are assembled.

Member 24 is provided with ports 33 and 34, adjacent to the piston member 27, and member 26 is likewise provided with ports 35 and 36 also adjacent to the piston. A port 37 is likewise formed in member 26 to the rear of the center thereof. Member 26 is likewise provided with external ribs 38, which make a close fit with the bore of the shell or casing 1, and acting in conjunction with piston 27, serve to guide and center the piston-hammer.

The operation of the structure is as follows, assuming, of course, that a constant supply of fluid under pressure is supplied through port 9: With the parts in the position shown in Fig. 1, the air passes through tube 11 which forms a support and guide for the collar or sleeve 32, out port 17, into the space or chamber designated by 39 between the portion 26 and tube 11, and between the abutment 12 and the inner end of sleeve 32; thence through port 37, into the space between the outer face of member 26 and the interior of the shell, passing rearwardly and forwardly; rearwardly past ribs 38, against the fixed collar 14, which may be termed a fixed abutment, and forwardly through ports 36 and 16 into the tubular stem and guide 10, which discharges into chamber 29 of the hammer. The compressed air acting between collar 14 and collar 32, and within the chamber or bore 29, between the forward face thereof and the forward face of abutment 12, tends to force the piston-hammer forwardly toward the right and brings the hammer-head 25 into contact with the anvil 3, the force of the blow imparted being dependent upon the air-pressure.

In Fig. 2 the parts are shown as just having functioned to deliver a blow and when in such position the exhaust ports are opened to relieve the pressure from between the collars and from within the bore or chamber 29, the air exhausting as shown in dotted arrows. At such time, however, and in order to retract the piston-hammer the compressed air still passes into chamber 39, which at such time is restricted in size and likewise closed, by reason of the fact that port 37 is carried forward beyond the solid abutment guide 12. The compressed air will, by reason of its expansion in the chamber, acting against the fixed abutment 12 and the collar 32, force the piston-hammer rearwardly or to the left, and such motion will continue until the parts resume the position shown in Fig. 1.

It is to be noted that under the construction as above set forth, the hammer is thrown forward by the air acting between what may be termed two pairs of abutments, one movable and one fixed in each pair. So too, upon the return stroke the pressure is applied between a single pair of abutments. It is likewise to be noted that the air is introduced through the drill-bar or rod into the center of the hammer, and that no valves, other than as the piston-hammer performs that function, are necessary. Furthermore, the air in its passage through the machine maintains the same general direction of travel, being introduced at one end and discharged at the other, preferably through the drill-head, and consequently there is in effect no reversal of the air currents, which is a matter of importance in a tool of the character described, in that it enables the drill to act with greater rapidity than where the air currents have to be reversed.

The term "air" in the foregoing specification and in the claims is to be understood as the equivalent of any suitable gaseous medium susceptible of being compressed and

giving off power due to expansion. So, too, the term "pneumatic" is used in a generic sense.

The introduction of the air in the manner set forth and the absence of valves enables me to produce a hammer of relatively small diameter and one which can be carried down into the opening being drilled by a mere extension of the drill or feed bar. The latter feature is of marked advantage, in that it brings the hammer and operating parts thereof into close relationship to the drill-head.

While the device has been described as intended for use in conjunction with a drill, it will be readily appreciated that it may be employed for other purposes, any suitable tool being substituted for the drill.

Having thus described my invention, what I claim is:

1. In a pneumatic hammer, the combination of a shell or casing; a tube in direct communication with a source of fluid supply under pressure; a collar carried by the tube; means for securing the tube in place within one end of the shell; a fixed abutment carried by the tube intermediate its length and dividing the bore of the tube into two parts; a hammer-piston mounted on the tube and abutment and movable thereon, said piston being formed with two chambers, a rear relatively large one to function with the abutment, and a smaller outer one adapted to coöperate with the forward portion of the tube; and a series of ports arranged in said tube and piston to permit the air to pass into and from the chambers and to and from the space between the rear of the piston and the collar, whereby the hammer-piston will be caused to reciprocate and deliver blows.

2. In a pneumatic hammer, the combination of a shell or casing; a tubular member secured in one end thereof; a fixed abutment carried by said member; a tubular extension projecting forwardly from said abutment, said member and said extension each having a port formed therein adjacent the abutment; a collar located adjacent the inner end of the tube and located between the tube and shell and forming a second abutment; a hammer-piston comprising a large and a small tubular section with a piston ring located at the junction of said sections, said ring being larger than the larger tubular section and making a close fit with the interior of the shell; a sleeve secured to the inner end of the piston and working over the tubular member aforesaid; and ports formed in the piston, adapted to coöperate with the ports aforesaid to cause the air to travel through the hammer to actuate the same.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH D. MacDONALD.

Witnesses:
C. F. Chapin,
C. C. Lantry.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."