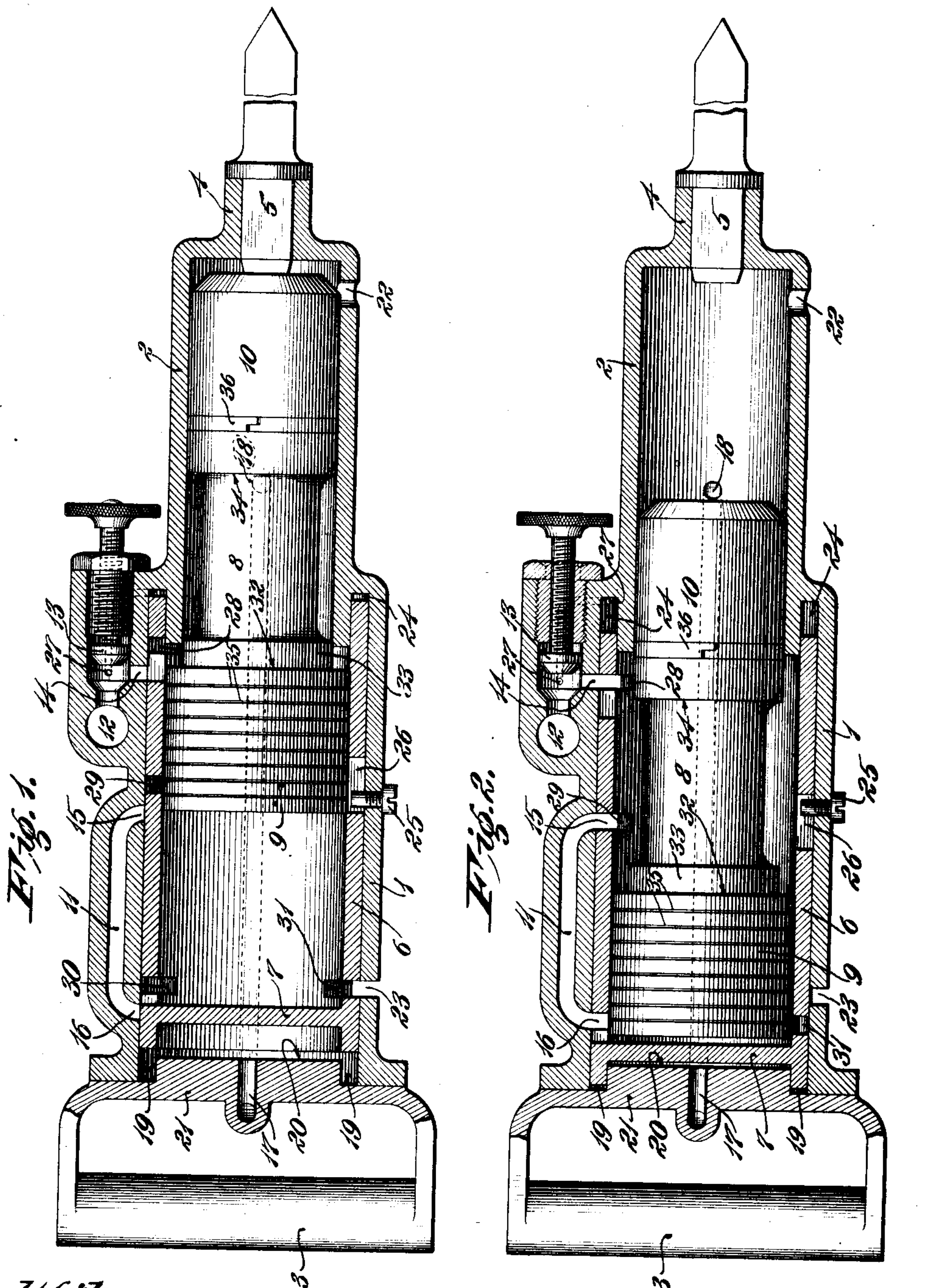
B. BRAZELLE.

SINGLE ACTING ENGINE.

APPLICATION FILED MAY 31, 1912.

1,065,339. Patented June 24, 1913.



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UNITED STATES PATENT OFFICE.

BENJAMIN BRAZELLE, OF ST. LOUIS, MISSOURI.

SINGLE-ACTING ENGINE.

1,065,339. Specification of Letters Patent. Patented June 24, 1913.

Application filed May 31, 1912. Serial No. 700,661.

To all whom it may concern:

Be it known that I, BENJAMIN BRAZELLE, a citizen of the United States, and a resident of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Single-Acting Steam or Pneumatic Engines, of which the following is a specification.

The object of my invention is to provide a simple, compact and durable fluid pressure engine of the piston-hammer type adapted for application to drilling and chipping rock, driving rivets, cutting metal, and analogous uses, to which end my improvements consist in certain novel constructions and combinations of parts as hereinafter described.

A further object of my invention is the elimination of small or frail working parts and springs and the reduction of the number of working parts to a minimum.

The details of my invention are more fully set forth in the appended claims.

I have illustrated my invention in the accompanying drawings embodied in a portable stone cutting tool.

In the drawings, in which like parts are designated by like characters wherever they occur, Figure 1 is a longitudinal section on the principal axis of the tool cylinder, showing the piston-hammer at the end of its outward stroke; and Fig. 2 is a similar view showing the piston-hammer near the end of its inward stroke.

Referring to the drawings, it will be seen that no springs and no very light and frail moving parts are contained in my improved device, and that the only moving parts, the piston-hammer, and the hollow cylindrical slide-valve, are large in size and substantial in form.

In my improved device the power cylinder is made in two parts, a barrel or casing 1 and a cylinder head 21, securely bolted together. The cylinder barrel is not uniform in diameter but for about half its length at the head end of the cylinder it is greater in diameter than at the other end of the cylinder. The enlarged portion of the cylinder barrel contains the slide valve and the piston head of the differential piston concentrically arranged therein; and the portion of less diameter serves as a casing and guide for the reduced outer or hammer portion of the piston which slides back and forth therein.

The outer end of the cylinder barrel or casing 1 is closed except for an axial cylindrical extension forming a tool socket 4 for the shank of a tool 5 which extends into the casing in position to be struck by the end of the piston-hammer. Upon the outside of the casing, at the end opposite the tool socket, is a handle 3. An air inlet duct 12 controlled by a stop valve 13 is provided on one side of the casing, to which inlet duct a supply pipe may be attached. This valve may be operated by a lever or trigger instead of by the thumb-screw shown.

The slide valve 6 is a hollow cylinder, fitting snugly within the part of the power cylinder of larger diameter and having its end toward the handle 3, or head end of the engine, closed by a diaphragm 7 positioned a short distance from the end of the valve. This valve 6 is slidable axially back and forth within the casing and controls the admission of air or other motive fluid to and from the power chamber. The piston-hammer 8, with its differential piston portion 9 sliding within the valve 6 and its hammer portion 10 sliding within the smaller portion 2 of the casing, reciprocates back and forth within the casing, at the outer end of its stroke hitting the shank of the tool successive blows. The side wall of the cylinder near the duct 12 is provided with an air inlet or supply port 14 in communication with the air duct when the stop valve is open. The cylinder wall is also provided with a longitudinal passage 11 at the ends of which are air cut off and air inlet ports 15, 16 communicating with the cylinder chamber near its mid portion and inner end, respectively. The cylinder head 21, which closes the inner or head end of the cylinder, is formed with a central cylindrical projection 20 of less diameter than the cylinder, and forming with the cylinder wall an annular air space 19 for cushioning the end of the valve 6. At the small end of the cylinder casing near the tool socket is a port 22 leading directly into the atmosphere. A small port 18 in the reduced portion of the cylinder casing communicates through connecting passages in the cylinder walls with a passage 17 in the inner end wall leading to the head end of said power cylinder chamber. A port 23 leads from the cylinder chamber near its head end directly into the atmosphere.

The open end of the slide valve 6 fits in an annular groove 24 cut in the casing near its middle point where it is reduced in diameter. This groove is in communication with the air inlet port 14 through a small passage 27 in the casing. The valve 6 is prevented from rotating in the cylinder by the screw 25, secured in the casing and projecting into the longitudinal slot 26 in the valve. The slide-valve 6 has ports 28, 29, 30 adapted to register with and uncover the air supply port 14 and the cut off and inlet ports 15 and 16, respectively, in the casing when the valve is at the head end of the cylinder, thus admitting air under pressure to the head end of the cylinder if the stop valve is open and the piston back. Narrow slits 37, 38 are cut through the walls of the valve lengthwise of the axis of the cylinder leading from the ports 28 and 30, respectively. The slit 37 extends but a short distance toward the head end of the cylinder, and the slit 38 extends to the head end of the cylinder. These slits are to permit air to pass slowly into the power cylinder in front of or behind the piston to start the latter in case it should become stalled at either end of its stroke. A port 31 in the slide-valve registers with the exhaust port 23 in the casing when the valve is at its extreme position away from the head end of the cylinder, thus opening a direct passage from the cylinder chamber to the atmosphere.

The operation of the device is as follows: In Fig. 2 valve 6 is shown at the extreme inner end of its stroke, and therefore, all of the air inlet ports are open full and air is entering the casing and passing around the piston into the head end of the cylinder and pressing upon the entire area of the piston head 9. The air pressure on the piston head drives the piston outward until its hammer portion strikes the shank of the cutting tool 5. As the piston moves outward it will cover the air cut off port 29 and cut off the further entrance of air into the passage 11 and head end of the cylinder. The point in the stroke at which this cutting off of the fluid pressure occurs may be varied by changing the location of the port 29, but I prefer to locate it at about one-quarter of the full stroke of the piston. The air in the cylinder behind the piston will expand and a large part of the expansive force of this air will be utilized in driving the piston forward, thus economizing in the use of air. In case the piston is not stopped in its outward travel by striking the shank of the tool, the shoulder 32 and cylindrical portion 33 of the piston adjacent thereto will confine the air in the annular space surrounding the latter and between the piston and inner end of the reduced portion of the casing and cushion the piston before it strikes the casing. When the piston has traveled far enough outward for the inner edge 34 of the hammer portion 10 to pass by and uncover the port 18 air will pass through the port 18 and communicating passages through the opening 17 into the space behind the end of the slide valve and force the slide valve away from the head of the cylinder, thus closing the inlet ports into the rear end of the cylinder chamber and opening the exhaust port 23, as shown in Fig. 1. As there is always air under full pressure acting against the shoulder 32 tending to return the piston to the head end of the cylinder, when the pressure on the upper side of the piston is relieved by opening the cylinder exhaust port the pressure on the shoulder 32 will overbalance the pressure behind the piston and it will be returned to the head end thereby. Shortly before the piston reaches the end of its inward stroke the outer end of the hammer portion 10 will uncover the port 18 and release the pressure on the head of the slide valve, allowing the valve to be returned to its inner position by the air pressure acting upon the annular area of its opposite end. The parts will then be in the positions shown in Fig. 2, and ready for the admission of air to the cylinder for another stroke. The sizes of the passages and ports, and relative areas of the slide-valve and piston faces, may be varied to obtain the desired speed of operation and force of blow.

Although I have shown th portion 9 of the piston provided with shallow grooves 35 for retaining oil and preventing leakage of air past the piston in either direction, I may provide this portion with packing rings arranged in grooves similar to the elastic expanding packing ring 36 on the hammer portion 10 of the piston.

I do not desire to be restricted to the precise size, shape and arrangement of parts shown and described, but

What I claim and desire to secure by Letters Patent is as follows:

1. In a fluid-pressure engine, the combination with a cylinder having an air supply port, an air cut-off port, and an air outlet port, of a sleeve valve controlling said ports, and a solid piston sliding within said valve, the movement of said piston operating to close said cut off port.

2. In a single-acting engine a hollow cylindrical valve having an air inlet port, an air cut-off port, and an air outlet port, said valve reciprocating within a casing to open and close said ports, and a piston arranged for reciprocation within said valve to open and close said cut off port.

3. In a single acting engine, the combination of a differential cylinder comprising two axially arranged communicating chambers of different diameters, the chamber of larger diameter being closed at one end and provided with an annular extension at its opposite end surrounding the chamber of smaller diameter, a hollow cylindrical valve having a closed end slidably arranged in said larger chamber with its open end arranged within said annular extension, a differential piston reciprocating within said valve and said smaller cylinder chamber, and means for admitting air alternately on each side of said closed end of said valve.

4. In a single acting engine having a differential cylinder comprising two axially arranged communicating chambers of different diameters, one end of the larger chamber being closed, said closed end containing an axial recess forming an extension of said larger chamber, a hollow cylindrical valve slidably arranged in said larger chamber with one end extending into said recess, a diaphragm in said valve, and means for admitting air alternately on each side of said diaphragm.

5. In a single-acting engine having a differential cylinder comprising two axially arranged communicating chambers of different diameters, one end of the larger chamber being closed, said closed end containing an axial recess forming an extension of said larger chamber, said cylinder containing an annular groove surrounding the smaller chamber thereof and forming an extension of said larger chamber, a hollow cylindrical valve slidably arranged in said larger chamber with one end extending into said recess and its opposite end extending into said groove, a diaphragm in said valve, and means for admitting air alternately on each side of said diaphragm.

6. In a reciprocating engine, a cylinder having an air supply duct, a hollow cylindrical valve having an air inlet port adapted to communicate with said supply duct, an air cut-off port, and an air outlet port, said valve reciprocating within said cylinder to open and close said inlet and outlet ports, and a piston within said valve adapted to cover said valve cut-off port at a predetermined point in its power stroke.

7. In a single-acting engine, a power cylinder terminating in a casing, a hollow cylindrical valve within said cylinder having an air inlet port, an air cut-off port, and an air outlet port, a diaphragm closing one end of said valve and means for alternately admitting air to each side of said diaphragm, said valve having its open end toward the outer end of the casing, and a piston arranged for reciprocation within said valve, said piston having a reduced portion projecting from said valve and sliding within said casing.

8. In a piston-hammer fluid pressure motor, a power cylinder, a sleeve valve movably arranged within said power cylinder, and a differential piston slidable within said valve, said piston being provided with an annular groove for permitting passage of air from the air supply to said valve during a portion of the power stroke.

9. In a piston-hammer fluid pressure motor, a power cylinder having an enlargement at its inner end and an outer end portion of less diameter, a sleeve valve movably arranged within said enlargement, and a piston slidable within said valve, said piston being provided with a shank sliding in the portion of the cylinder of less diameter, and an expanding packing ring for preventing leakage of air between said shank and said power cylinder.

10. In a fluid-pressure engine, the combination with a cylinder having an air supply port, and an air outlet port, of a cylindrical hollow valve controlling said ports, said valve containing an air cut off port, and a piston sliding within said valve, the movement of said piston operating to close said cut off port prior to the movement of said valve to open the outlet port.

Signed at St. Louis, Missouri, this 28th day of May, 1912.

BENJAMIN BRAZELLE.

Witnesses:

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