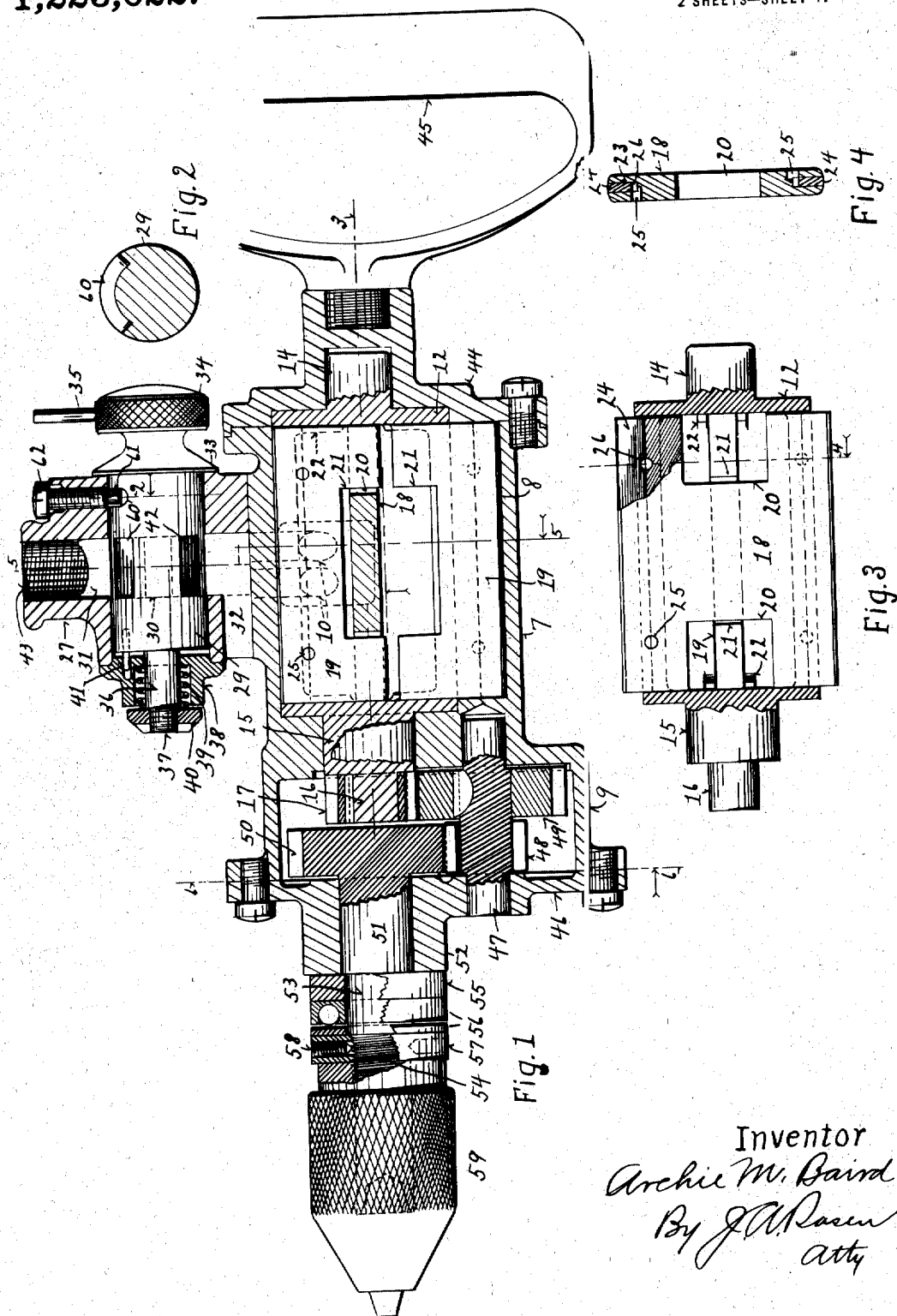


1,223,022.



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PNEUMATIC DRILL.
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2 SHEETS—SHEET 2.

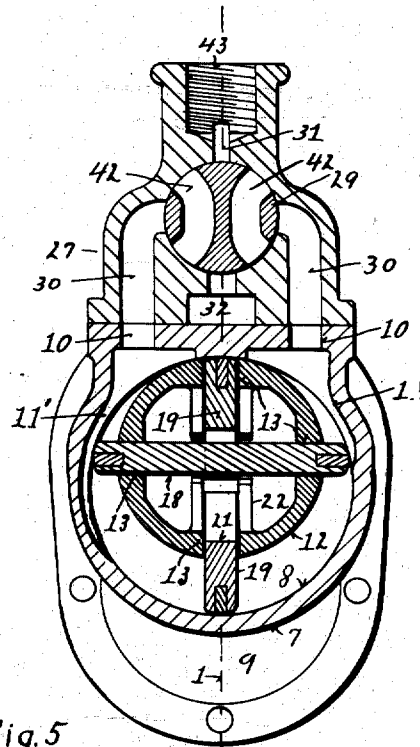


Fig. 5

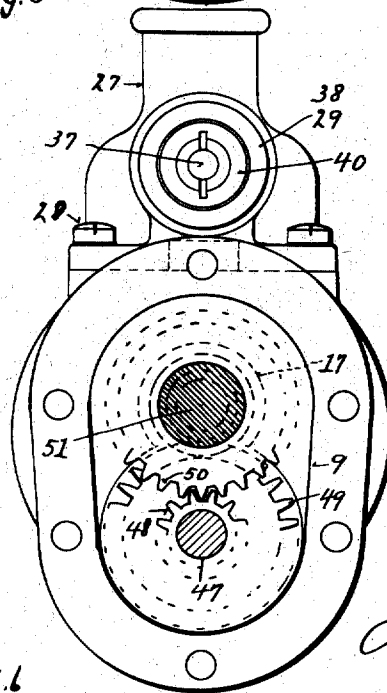


Fig. 6

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PNEUMATIC DRILL.

1,223,022.

Specification of Letters Patent.

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Application filed November 27, 1916. Serial No. 133,542.

To all whom it may concern:

Be it known that I, ARCHIE M. BAIRD, a citizen of the United States, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Pneumatic Drills, of which the following is a specification.

This invention is a portable drill having a pneumatic rotary motor of the reversible type.

The object of the invention is to produce a drill of this character that is of extreme lightness considering its power, that has fewer parts than prior tools of similar general character, and whose wearing parts are of such extreme simplicity of design that they may be easily repaired or replaced in any ordinary shop having use for the tool. The extreme simplicity is very important in that it enables shops to make their own repairs and replacements immediately without suffering from loss of use of the tool and without the necessity of carrying in stock many and expensive parts for repairs and replacements. A further object is to provide equally simple reversing means.

The invention consists of certain combinations relating to the piston blades, relating to the relation of the blades and rotary piston to the cylinder and to the reversing valve, and relating to the compounding of the gearing; also to the means for taking up the end thrust of the working tool; also it comprises the parts, improvements and combinations hereinafter set forth and claimed.

In the drawings accompanying and forming part of this specification and in the description of the drawings, I have shown my invention in its preferred form and what I deem to be the best mode of applying the principles thereof; but it is to be understood that, within the scope of the appended claim, I contemplate changes in form, proportions, and materials, the transposition of parts, and the substitution of equivalent members, without departing from the spirit of my invention.

Figure 1 is a central longitudinal sectional elevation of a pneumatic drill made in accordance with my invention, some of the parts being shown in elevation, the plane of the section being indicated substantially by the line 1 in Fig. 5. Fig. 2 is a cross section of the reversing valve plug on a plane indicated by the line 2 in Fig. 1. Fig. 3 is a sectional plan view of the rotary piston and

the blades taken approximately on the plane indicated by the line 3 in Fig. 1. Fig. 4 is a sectional view of the single piston blade on a plane indicated by the line 4 in Fig. 3. Fig. 5 is a vertical cross sectional elevation on a plane indicated approximately by the line 5 in Fig. 1. Fig. 6 is a view of the left-hand end (as seen in Fig. 1), the cover plate being removed and the two spindles being shown in section on a plane indicated by the line 6 in Fig. 1, and the gears being shown partly by dotted outlines.

Similar reference characters indicate similar parts throughout the several views.

The cylinder casing 7, which is formed with a cylinder bore 8 and closed at one end, is formed at its closed end with a gear housing 9. It is also formed with inlet and exhaust ports 10, 10, opening into adjacent quarters of the cylinder, the cylinder bore being formed with countersinks 11, 11' extending over the respective quarters.

The rotary piston 12 is eccentrically mounted within the cylinder bore and bears against the side of the cylinder wall between the two ports so as to seal them from each other. The piston is formed with two pairs of oppositely located slots 13, 13, 13, 13, the slots of each pair being diametrically opposite each other, and the two pairs being at right angles to each other, so that the four blades within the slots will extend radially from the four quarters of the piston, as shown in Fig. 5. The piston is formed at one end with a spindle 14 which has its bearing in the removable cylinder head 44, and at the other end with a spindle 15 which has bearing in the integral head of the casing and which has a reduced extension 16 projecting into the gear housing and to which is keyed the pinion 17.

One pair of the piston blades is in construction a single blade 18 of special form, its middle or web portion being of less length than its outer or exposed portions by reason of the cut-away portions 20, 20. The other two blades are separate but similar to each other, as shown at 19, 19, each being formed at each end with inward extensions 21, 21 which are of a size freely passing through the respective cut-away portions 20, 20 of the single blade. The slots form sufficient bearings for the single blade. To provide a sufficiently long bearing for each end of the two-part blades, however, the ribs 22, 22 are formed in the piston to serve as

guides and bearings for keeping the two-part blades in true radial alignment notwithstanding the air pressure and their reciprocating movement radially of the piston.

5 The cut-away portions 20, 20 and the extensions 21, 21 are wholly within the interior of the piston in all positions of the pistons and blades. In the edge of each blade which contacts with the cylinder wall is formed a longitudinal groove 23 in which is fitted a
10 radially movable packing strip 24. Two holes 25, 25 are drilled into the bottom of the groove from that side of the blade receiving the motive fluid when the tool is turning to the right, and the packing strip is notched
15 above each hole, as shown at 26, to admit the air under it even when the strip is in extreme depressed position.

The valve casing 27 secured to the top of the cylinder casing by means of screws
20 28, is formed with a cylindrically bored opening for receiving the valve plug 29, with ports 30, 30 leading from opposite sides of said opening to the respective ports 10, 10, with an exhaust port 32 through its base between the ports 30, 30, and with an intake
25 port 31 opposite the exhaust port and communicating with the inlet pipe to be screwed into the threaded portion 43. The valve plug is formed with a flange 33 bearing
30 against one end of the valve casing around said opening and with a knob or handle 34 on the same end, a pin 35 projecting from said knob for convenient operation of the
35 valve. The handle is located adjacent to the handle 45 of the drill. The other end of the plug is formed with a reduced stem 36 whose terminal is further reduced and threaded for the reception of a nut 40. The stem 36
40 extends through a cap 38 which is counter-bored for the reception of the compression spring 39 which bears between said cap and said nut for the purpose of compressing the flange 33 and the cap 38 against opposite
45 ends of the valve casing, taking up the wear, and sealing the opening; the cap rotating with the plug by reason of the engagement of the pin 41. The plug is formed with two passages 42, 42 for directing the inlet and
50 exhaust of the motive fluid. The openings of each passage are approximately ninety degrees from each other, center to center, and the adjacent openings of the two passages are similarly spaced apart. In the
55 central position of the plug, as shown in the drawings (see especially Fig. 5), both the inlet port 31 and the exhaust 32 are closed. Turning the plug to the left forty-five degrees, the inlet port 31 is brought into com-
60 munication with the right-hand port 30, and the left-hand port 30 is opened to the exhaust, thereby driving the motor to the right. By turning the plug to the right ninety degrees, the communications are re-
65 versed so as to drive the motor to the left.

The plug is formed with a groove 60 extending forty-five degrees on each side of its upper middle line when in central position, and into the groove extends the end 61 of a screw 62 for the purpose of limiting the
70 oscillation of the valve to exactly bring the ports into proper register, as just explained. With the handle of the plug close to the supporting handle of the machine, it becomes very convenient for the operator to
75 reverse the motor, as in withdrawing a tool.

An end plate or head 46 is fitted to the housing which contains the gears. A spindle 47, which bears in the integral cylinder head and in the cap 46 is formed integrally
80 with a small gear 48, and keyed to the spindle is a larger gear 49 which meshes with the small pinion 17 on the piston spindle. The gear 48 meshes with a large gear 50 which is integrally formed with a spindle
85 51 bearing in and projecting out of the boss 52 formed on the cap 46. The projecting portion 53 is reduced, and the spindle is terminally screw-threaded, as shown at 59. Loosely mounted on the reduced portion 53
90 is a washer or collar 55 which bears against the end of the boss, and adjacent to this collar are the two members of the ball bearing 56. A thrust collar 57 is screwed onto the screw-threaded terminal of the spindle, and held
95 securely in place by set-screws 58 against the ball bearing member; whereby the end thrust of the working tool is borne by the casing through the boss, the collar, and the ball bearing, without being trans-
100 mitted to the gearing or the rotary parts of the motor.

Assuming the valve to be turned to the proper position for driving the motor to the right, it will be noted that the piston blade
105 passing the lower edge of the countersink 11 will be impelled by the motive fluid under full pressure during the next quarter turn, at the end of which the succeeding blade will close the inlet to the first-named blade and itself take the full pressure. During the
110 next part of the turn, the first-named blade will present a greater area to the compressed air between the two blades than the area presented by the second-named blade, and by reason thereof will be propelled by the ex-
115 panding air until it reaches the lower edge of the exhaust port 11', when the cylinder chamber back of the first-named blade becomes open to the exhaust. In similar man-
120 ner, each blade in turn is propelled by the air under initial pressure and then by the expanding air, thus compounding the motor. It will be noted, too, that the coun-
125 tersink 11' for the exhaust extends circumferentially of the cylinder up substantially to the place of contact of the rotor with the cylinder wall. This relieves the blade entirely of back pressure during its last quar-
130 ter or three-eighths turn.

Upon reversing the motor, the parts are driven in the opposite direction, and in the same manner, except that there is no compounding of the pressure; indeed, there is a slight compression; but this will not be material in view of the fact that the motor will usually be driven in the reverse only momentarily as in withdrawing a tool bit. For a similar reason and in view of the same fact, I provide the ports 25 only on the back sides of the blades when the blades are driven to the right. By the use of the packing strips, I avoid the necessity, and the use, of springs, depending not only on the centrifugal force for throwing the blades and packings against the wall of the cylinder, but also on the air pressure under the packing strips immediately upon passing over the lower edge of the inlet port. The packing strips are thus forced to make perfect seals immediately upon passing the inlet

port, notwithstanding the action of the blades under centrifugal force may be somewhat sluggish.

Having thus described my invention, 25 what I claim is:

The combination of a casing formed with a cylinder bore and with inlet and exhaust ports, a hollow rotary piston eccentrically mounted in the cylinder bore and bearing 30 against one side thereof, a single one-piece pair of piston blades diametrically mounted in the piston, and a pair of separate piston blades radially mounted in said piston at right angles to the one-piece blade, said piston being formed with slots for the reception 35 of said blades and with ribs for guiding the separate blades.

In testimony whereof I have affixed my signature.

ARCHIE M. BAIRD.