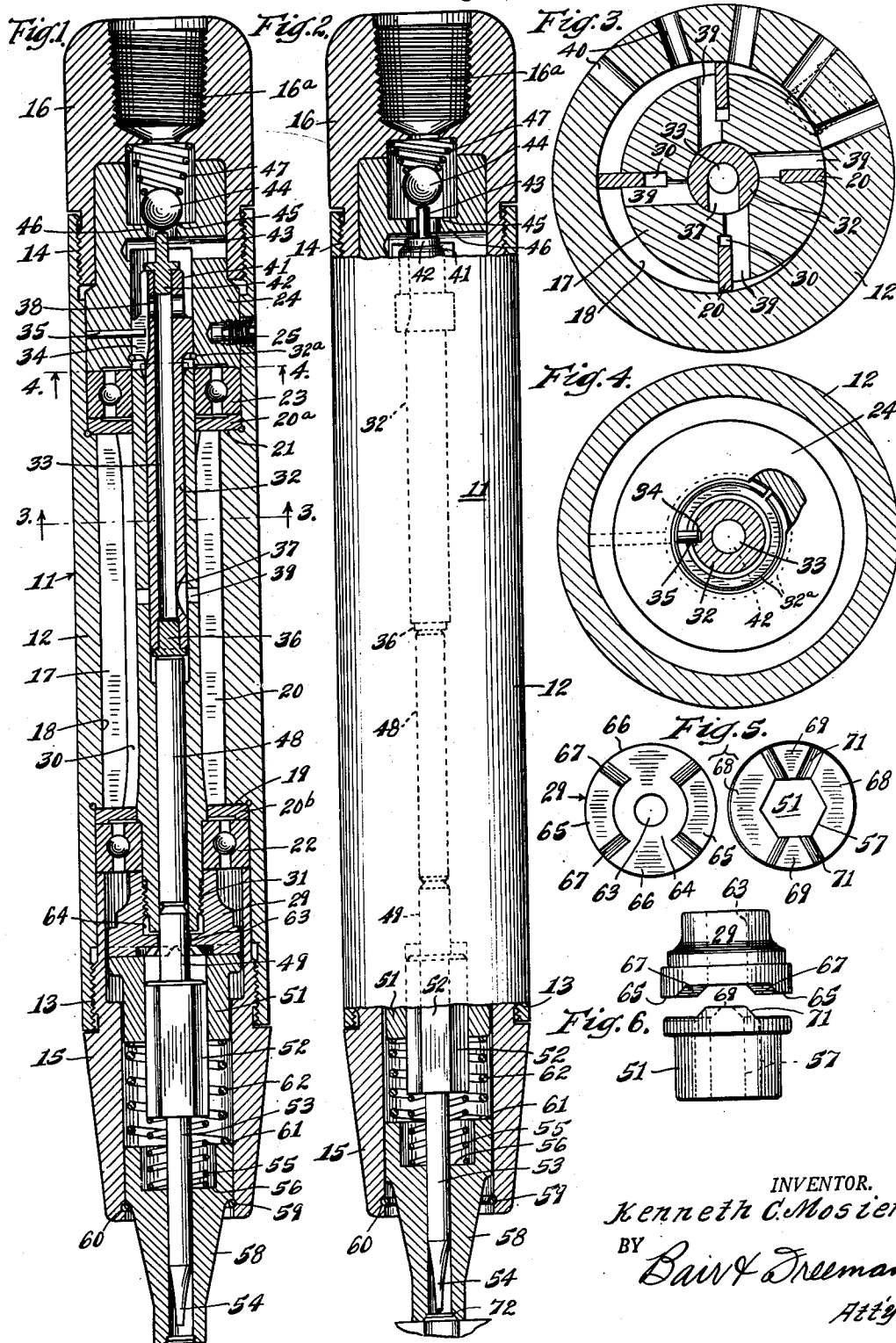


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PNEUMATIC SCREW DRIVER

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PNEUMATIC SCREW DRIVER

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1 Claim. (Cl. 144—32)

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This invention relates to a pneumatic screw driver, wherein the control of air to drive the screw driver is completely automatic and wherein impact means is built into the screw driver. This application is related to and discloses improvements not disclosed in my copending application Serial No. 623,630, filed October 22, 1945, and any common subject matter has been or is properly claimed in my said prior copending application.

It is an object of the invention to provide an improved pneumatic screw driver which is simple, compact, durable and formed of relatively few parts.

It is a further object of the invention to provide a pneumatic screw driver which automatically starts when the operator presses down with the bit engaging the screwhead, and automatically stops when the operator removes the bit from the screwhead.

It is another object of the invention to provide a pneumatic screw driver wherein the speed of rotation is automatically controlled by the amount of pressure the operator uses in pressing down on the screwhead.

It is still another object of the invention to provide impact mechanism of improved design in a pneumatic screw driver.

It is a further object of the invention to provide a unique finder for the screwhead on a pneumatic screw driver.

It is also an object of the invention to provide a novel control valve and operating means therefor in a pneumatic screw driver.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claim and illustrated in the accompanying drawing, wherein:

Figure 1 is a longitudinal sectional view through a pneumatic screw driver embodying the invention;

Figure 2 is a plan view of the pneumatic screw driver showing the parts dotted in the position for effecting operation thereof;

Figure 3 is a sectional view of the pneumatic screw driver taken on line 3—3 of Figure 1;

Figure 4 is a sectional view taken on line 4—4 of Figure 1;

Figure 5 is a view illustrating the cooperating faces of the impact members; and

Figure 6 is an exploded elevational view of the impact members.

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Referring specifically to the drawing for a detailed description of the invention, numeral 11 designates generally a small pneumatic screw driver, the size of which will be apparent when it is realized that Figure 1 is almost $2\frac{1}{2}$ times the size of the actual device, which is, in fact, sometimes referred to as a "pencil" type pneumatic screw driver. It is obvious, therefore, that the parts of the screw driver are very small and must be precision built of the finest of steels, hardened and ground to precision limits. Also, the screw-driver is very compact and light to handle.

The screw driver 11 comprises a main hollow cylindrical casing 12 having internally threaded ends 13 and 14 into which a tapered hollow head 15 and an inlet and valve retaining member 16, having an inlet connection 16a, are respectively secured. The casing 12 provides a cylinder in which a piston generally indicated at 17 rotates with radial blades or vanes 20. The cylinder or casing 12 is eccentrically formed intermediate its ends to provide a working chamber 18, as best shown in Figures 1 and 3.

Shoulders 19 and 21 are provided internally of the casing 12 toward the ends thereof, and bearing members 22 and 23 respectively are secured therein. The bearing members 22 and 23 are preferably of the ball bearing type and bearing member 22 is retained against a washer 20b, which is in turn held against shoulder 19 by the tapered head 15, while bearing member 23 is retained against another washer 20a, but is in turn retained against shoulder 21 by a valve seat block 24 retained within the casing 12 by valve-retaining member 16 and axially located or fixed by a lock screw 25.

The piston 17 is provided with a central bore 26 extending axially thereof, and is reduced at the valve end as shown at 27, which reduced end is journaled in ball bearing 23. The other or lower end of the piston 17 is reduced at 28, which reduced end is journaled in ball bearing 22. The lower reduced end 28 overhangs ball bearing 22 and is threaded to receive an impact and driving head, generally indicated at 29, which is screwed on said reduced end 28 as shown at 31. The radial blades or vanes 20 are slidably disposed in longitudinally extending slots 30 in the piston member 17.

A feed tube generally indicated at 32 extends through the bore 26 of piston 17 from the upper end thereof and is provided with an axially extending bore 33 and an axially extending slot 34, the slot being formed at the upper end of the

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feed tube 32. A pin 35 extending from valve seat block 24 extends into the slot 34 and prevents rotational movement of the tube 32 while affording axial movement thereof. A snap ring construction 32a limits the downward movement of the feed tube 32. The lower end of the bore 33 in the feed tube 32 is closed by a plug 36. The tube 32 is also provided with an outlet port 37 on its periphery adjacent the plug 36 and with an inlet port 38 adjacent the top thereof. A plurality of ports 39, four being shown by way of example, in the form of radial slots, are provided in the piston 17 and are aligned with outlet port 37 in tube 32, as best shown in Figures 1 and 3. The ports or radial slots 39 communicate with the longitudinally extending blade slots 30, as best shown in Figure 3. Exhaust ports 40 are provided in casing or cylinder 12, as shown in Figure 3, several being preferably provided.

The portion of tube 32 containing inlet port 38 extends into a recess 41 in the valve seat member 24 and upper end of the bore 33 is closed by a plug 42 having a pin 43 extending upwardly therefrom for contacting a ball valve 44, which is held on a valve seat 45 formed by an inwardly projecting flange 46 on the valve seat member by a relatively heavy coil spring 47. The coil spring 47 contacts the interior of the inlet member 16 and the ball valve 44 to retain the ball on its seat 45 until it is pushed off the seat by pin 43, in a manner hereinafter described.

An axially extending pin or bar 48 is slidably disposed in the lower end of bore 26 in piston 17 and contacts a pin 49 which extends through impact or driving member 29 and an anvil or driven member, generally indicated at 51. The pin 49 is formed integrally with a hexagonal portion 52 of a screw driver bit 53 having a screw-head engaging portion 54. The bit 53 is held in position, so that it does not drop down, by a coil spring 55 engaging the hexagonal portion 52 of the bit and a shoulder 56 formed interiorly of a finder 58. The hexagonal portion 52 is slidable axially in the driven member 51, but cannot rotate therein because the driven member is also formed in the shape of a hexagon at 57 interiorly thereof, as best shown in Figures 5 and 6.

The finder 58 surrounds the bit 53 and normally extends beyond the screw-head engaging portion 54, as shown in Figures 1 and 2. The finder is slidably retained in head 15 by a snap ring 59 retained in a groove 60 and is provided with a second shoulder 61 at its upper end. A coil spring 62 extends between the shoulder 61 and a shoulder on driven member 51, thus biasing the finder 58 toward the snap ring 59 at all times.

The screw driver is usually supplied with several sizes of bits 53 and several sizes of finders 58, for screw heads of various sizes. To change the bit or the finder, it is only necessary to unscrew the head 15 and the bit 53 will drop out. It is then also possible for finder 58 to drop out of the large end of the head 15. The new bit and finder are inserted and head 15 again screwed tightly to main casing 12.

As is obvious from Figure 1, it is also possible to replace spring 47 or ball 44 by merely unscrewing inlet member 16.

Referring particularly to Figures 5 and 6 for a detailed description of the impact mechanism, it will be noted that the driving or impact member 29 is hollow as shown at 63 and is provided with a threaded recess 64, into which the threaded end of the piston extends. The lower surface of impact member 29 is provided with two diametrically

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opposite high surfaces 65 and two diametrically opposite low surfaces 66 joined together by beveled surfaces 67.

Likewise, anvil or driven member 51 is provided with two diametrically opposite low surfaces 68 and two diametrically opposite high surfaces 69 joined together by beveled surfaces 71. The low surfaces of each of the members normally engage in driving relation with the high surfaces of the other member, and vice versa, as shown in Figure 1. Preferably, the upper border of beveled surface 71 is radial in order that said surfaces will engage throughout the entire common plane.

Operation

When compressed air from a source of supply (not shown) is connected to inlet 16a, the ball valve 44 is on its seat 45 and, obviously, the pneumatic screw driver does not operate. The operator then places the finder 58 around a screw-head and begins to press downwardly. First, the finder 58 is forced inwardly against the bias of coil spring 62, the coil spring 55 being incidentally compressed. However, spring 55 is a very light spring and does not appreciably affect the operation of the device, its main purpose, as stated hereinbefore, being to prevent the bit 53 from dropping downwardly.

As the operator presses the screw driver down farther, the portion 54 of the bit 53 engages the groove in the head of a screw 72, as shown in Figure 2. The bit 53, including hexagonal portion 52 and pin 49, pin 48 and feed tube 32 including pin 43, are all forced upwardly against the bias of valve spring 47, thus raising ball valve 44 from its seat 45 and permitting compressed air to enter inlet port 38 and bore 33 of feed tube 32. It is obvious that the operator may control the amount of compressed air admitted and, therefore, the speed of rotation of the screw driver, depending on how hard the operator pushes down on the screw-head, since this pressure controls the amount of lift of the ball 44 off the seat 45. The inlet port 37 in the feed tube 32 is sufficiently wide to afford unrestricted passage of compressed air therethrough regardless of the position of the feed tube.

When valve 44 is lifted from its seat, compressed air enters the recess 41, then enters the passage 33 in feed tube 32 through inlet port 38. Air passes through passage 33 through port 37 in feed tube 32 and through one of the ports 39 in piston 17, depending upon the position thereof, thus rotating the piston 17 and blades 20 in the work chamber 18. As the piston is rotated, compressed air is supplied to successive ports 39 in back of respective blades 20 to continue rotation of the piston and blades, the blades being forced outwardly by centrifugal force and also by the compressed air which enters the slots 30. Air is exhausted from the work chamber 18 after it has performed useful work through exhaust ports 40 in casing 12.

The rotation of piston 17 rotates the driving or impact member 29 and during the initial running down of the screw 72, during which time the resistance to turning torque is relatively low, the driving member 29 engages with the driven member 51 because of the bias of spring 62, and rotates it smoothly, operating as a continuously engaging clutch. As soon as the screw is practically driven home, and the resistance to turning torque increases, the driving member 29 disengages from the driven member 51 and rotates part of a revolution until the beveled surfaces 67

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on the driving member strike an impact blow against the beveled surfaces 71 on the driven member. This continues as long as the ball valve 44 is held open and ensures that the screw is driven tightly home.

From the foregoing, it will be apparent that I have provided a very compact, precision made pneumatic screw driver, which utilizes features of the highly efficient pneumatic motor which is disclosed and claimed in my application Serial 10 No. 623,630, the speed of which is automatically controlled by the pressure applied by the operator to the work.

Some changes may be made in the construction and arrangement of the parts of my pneumatic screw driver without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claim any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope without sacrificing any of the advantages thereof.

I claim as my invention:

A pneumatic screw driver including a casing and comprising a cylinder forming the major 25 portion of said casing, a work chamber in said cylinder, a piston rotatable in said work chamber, bearings for said piston, a central passageway through said piston, a non-rotatable member extending into said passageway and being provided 30 with a central bore therein, communicating ports between said central bore and said work chamber, an axially movable and rotatable screw driver head extending from the interior of said casing through one end thereof, means affording axial 35 movement of said screw driver head, means af-

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fording axial movement of said non-rotatable member, means for imparting axial movement of said screw driver head to said non-rotatable member when said screw driver head is forced axially against a screw, an operative connection between said piston and said screw driver head for imparting rotational movement of said piston to said screw driver head, a compressed air inlet to said casing and communicable with said central bore in the non-rotatable member, and a valve for controlling the flow of compressed air from said inlet to said bore to thereby rotate said piston and screw driver head, said valve being controlled by axial movement of said non-rotatable member, which is in turn controlled by said axial movement of said screw driver head, the amount of opening of said valve and therefore the speed of rotation of said screw driver head depending upon the pressure exerted by the screw driver head on the screw.

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