April 6, 1954 J. L. TAYLOR 2,674,098

PORTABLE POWER-DRIVEN TOOL FOR DRILLING AND LIKE OPERATIONS

Filed March 12, 1949 2 Sheets-Sheet 1

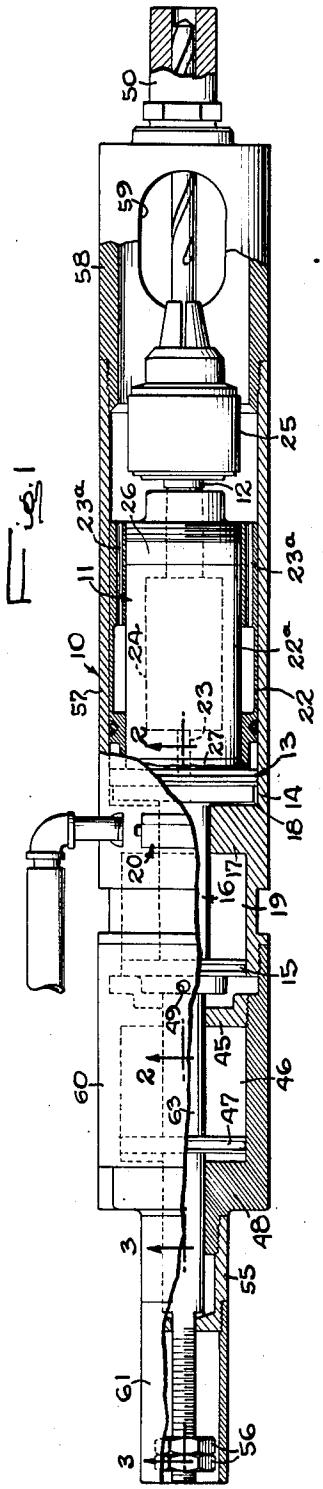


Fig. 1

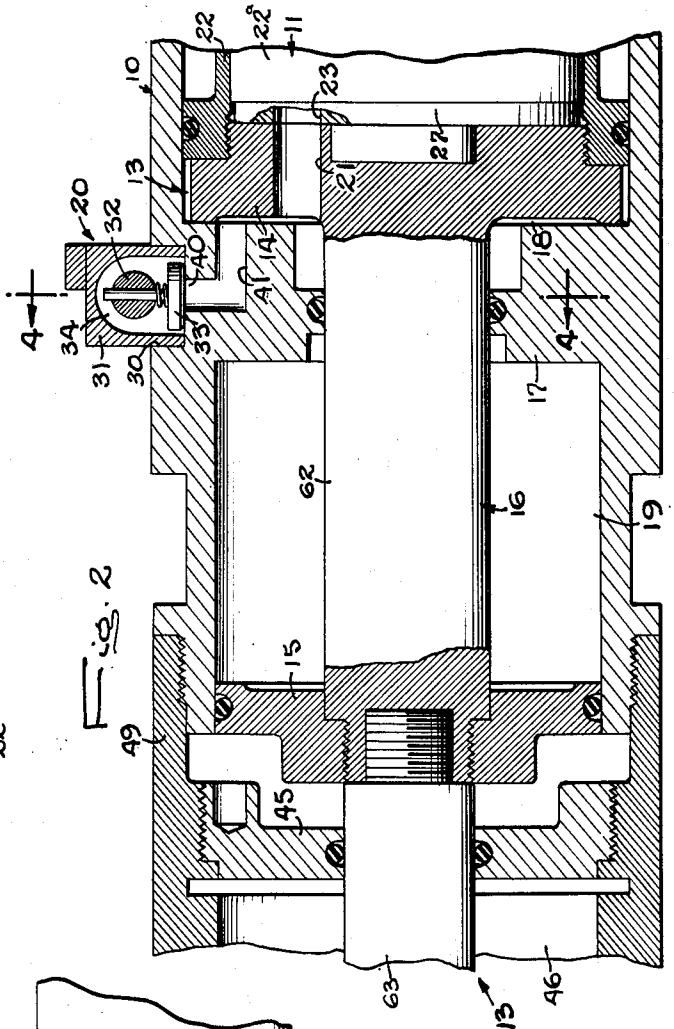


Fig. 2

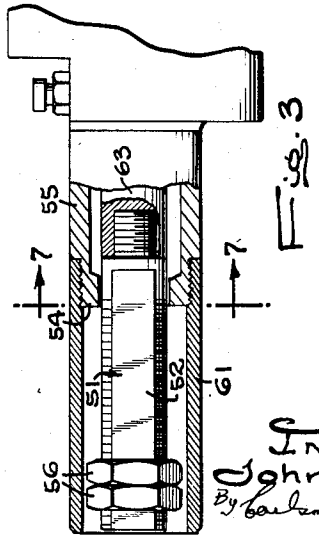


Fig. 3

INVENTOR
John L. Taylor
By Carlson, Pitzer, Hubbard & Wolfe
ATTORNEYS

April 6, 1954 J. L. TAYLOR 2,674,098

PORTABLE POWER-DRIVEN TOOL FOR DRILLING AND LIKE OPERATIONS

Filed March 12, 1949 2 Sheets-Sheet 2

Fig. 4

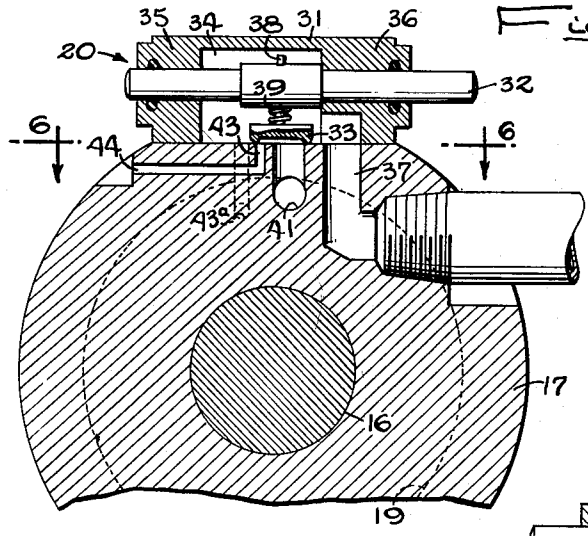
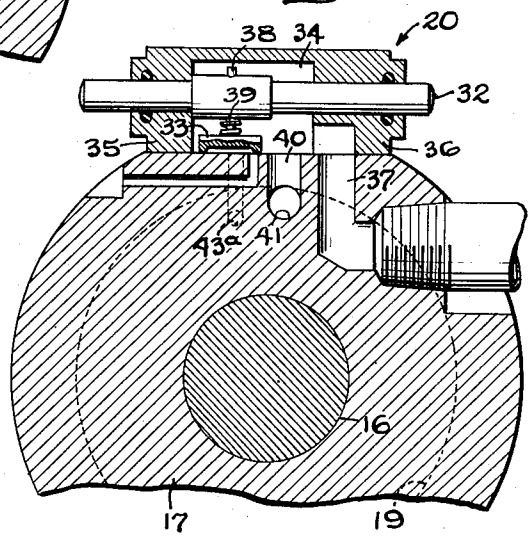


Fig. 5



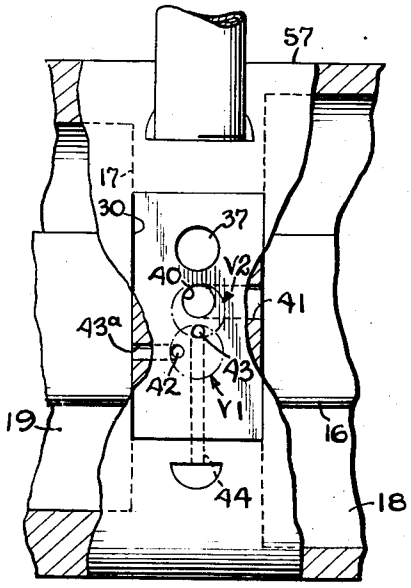


Fig. 6

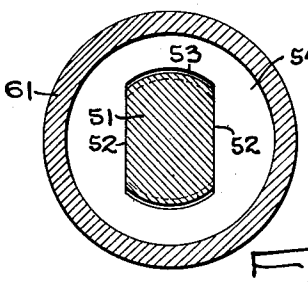


Fig. 7

INVENTOR
John L. Taylor
By Carlson, Peterson, Hubbard & Wolfe.
ATTORNEYS

Patented Apr. 6, 1954

2,674,098

UNITED STATES PATENT OFFICE

2,674,098

PORTABLE POWER-DRIVEN TOOL FOR DRILLING AND LIKE OPERATIONS

John L. Taylor, La Habra Heights, Calif., assignor to Keller Tool Company, Grand Haven, Mich., a corporation of Michigan

Application March 12, 1949, Serial No. 81,050

8 Claims. (Cl. 60—97)

1

The invention pertains to a pressure fluid operated tool of the type in which a rotary spindle is reciprocated toward and from the work to perform drilling, tapping or allied machining operations, and has more special reference to small compact tools of the type adapted for detachable connection with a jig plate or the like associated with the work, and also is capable of use in an arrangement wherein a plurality of tools are stationarily supported in closely spaced relation for the performance of drilling, tapping or like operations on a single workpiece.

More specifically stated, the invention pertains to a tool of the type embodying a power-driven spindle, a motor for driving the same and means for feeding the spindle toward the work and retracting it therefrom; and the primary object is to provide a tool of this character in which the driving motor for the spindle is advantageously arranged with respect to a reciprocating actuator so as to reduce the transverse dimensions of the tool and at the same time permit of easy and convenient control of both the motor and the actuator by a simple valve device.

A further object is to provide a tool of the character set forth which is operated by air under pressure both for driving and reciprocating the tool spindle.

Another object is to provide a simple valve means for controlling both the motor and the feed mechanism.

The objects of the invention thus generally stated, together with other objects and ancillary advantages, are attained by the construction and arrangement set forth by way of illustration in the accompanying drawings, wherein:

Figure 1 is a fragmentary elevational view of the tool with parts broken away and shown in section.

Fig. 2 is a fragmentary sectional view on a somewhat enlarged scale taken transversely in the plane of line 2—2 of Fig. 1.

Fig. 3 is a fragmentary longitudinal sectional view taken in the plane of line 3—3 of Fig. 1.

Fig. 4 is a transverse sectional view taken in the plane of line 4—4 of Fig. 2 and showing the control valve.

Fig. 5 is a similar view but showing the control valve in a different position.

Fig. 6 is a fragmentary horizontal section taken transversely in the plane of line 6—6 of Fig. 4, but showing schematically the valving arrangement for controlling the supply of pressure fluid to the drive motor and feed mechanism.

Fig. 7 is a transverse sectional view taken in

2

the plane of line 7—7 of Fig. 3 but on a larger scale.

In general, the improved tool comprises an elongated body herein in the form of a cylinder 10 having a rotary air motor 11 guided for reciprocation in the forward open end of the cylinder and having its motor connected to a tool spindle 12. Within the cylinder immediately behind the motor and rigidly secured thereto is a pneumatic actuator comprising reciprocating plunger 13 having axially spaced pistons 14 and 15 on a piston rod 16. In the present embodiment the pistons are disposed on opposite sides of a stationary abutment 17 in the form of a partition in the cylinder centrally apertured for the passage of the piston rod and coacting with the cylinder and pistons to define advancing and retracting (herein front and rear) piston chambers 18 and 19. To control the supply and exhaust of air to and from the front and rear piston chambers and also to the motor, a simple two position valve 20 is employed (Fig. 4). As shown the valve is mounted on the cylinder 10 substantially in the transverse plane of the abutment 17, the motor being supplied with pressure fluid during the forward or advancing stroke of the actuator through the provision of one or more passages 21 in the front piston establishing communication between the forward piston chamber and the motor.

Air under pressure is advantageously utilized both for actuating the motor 11 and the reciprocating plunger 13. Preferably, I employ a motor of the rotary vane type comprising in the instant embodiment a cylindrical casing or housing 22 enclosing a rotor cylinder 22a with an inlet port 23 registering with the passage 21 in the piston. Within the cylinder 22a is a rotor 24 suitably connected with the tool spindle 12, the latter being equipped as shown with a chuck 25 for supporting a drill or the like.

The rotor cylinder 22a has front and rear end plates 26 and 27, the latter having the inlet port 23 therein. Exhaust air from the rotor cylinder escapes from the housing 22 through passages 23a. To secure the motor rigidly to the actuator plunger, the piston 14 has a portion screw threaded into the housing as shown in Fig. 2.

The abutment 17 is herein shown as formed integral with the cylinder, and the cylinder 10 is milled transversely thereof to provide an external groove 30 for the reception of the valve device 20. The latter comprises a valve block 31 (herein of rectangular cross section) detachably secured to the cylinder and having mounted

therein a push rod 32 to which is connected a slide valve 33. The valve block is seated in the groove 30 and has a flat inner fact mating with the bottom of the groove 30, the block being made hollow so as to coact with the valve seat to form a valve chamber 34 with opposed end walls 35 and 36 apertured for the passage of the rod 32 so that the opposite ends of the rod project from the casing for convenient manipulation.

Air under pressure is supplied to the valve chamber 34 through a supply passage 37, so that when the tool is in operation the chamber is constantly under pressure. Air is delivered alternately to the front and rear piston chambers 18 and 19 according to the position of the valve member 33, the latter being shiftable manually by the push rod into either of two positions shown in broken lines in Fig. 6 and respectively designated V1 and V2.

As shown, the valve member is in the form of a recessed disk connected with the push rod by a cross pin 38 and yieldably urged by a spring 39 against the valve seat. In the "advance" position V1 of the valve, it uncovers a forward delivery port 40 connected by a passage 41 to the forward piston chamber. At the same time it connects a rear delivery port 42 to an exhaust port 43, the former leading to the rear piston chamber through a passage 43*a*, and the latter to the atmosphere through a passage 44. In its "retract" position V2, on the other hand, the valve member uncovers the rear delivery port 42 and connects the forward delivery port 40 with the exhaust port 43. Thus, depending upon the position of the valve member, air under pressure is delivered from the valve chamber either to the front or rear piston chamber, while air in the other piston chamber is permitted to exhaust to the atmosphere.

It will be seen that by the construction and arrangement set forth, the supply and exhaust of air from the respective piston chambers is accomplished through the use of ports and passages of short length, with no external connections save that required for supplying air to the valve chamber. At the same time, delivery of air to the motor is accomplished in a very simple manner through passages in the front piston receiving a supply of air from the front piston chamber and therefore only during the advancing movement of the plunger.

Rearwardly of the piston 15, the cylinder is provided with a transverse partition 45 forming the forward wall of an oil chamber 46 having a piston 47 therein so as to form a dashpot for controlling the advancing or feeding movement of the plunger 13 in the manner disclosed in my copending application Serial No. 749,567 (now Patent No. 2,488,992) and forming per se no part of the present invention. The rear wall of the chamber 46 is formed by another partition 48 in the cylinder, both partitions 45 and 48 being centrally apertured for the passage of the piston rod 16 which carries the piston 47. The space between the partition 45 and the rear piston 15 communicates with the atmosphere through a port 49.

The forward open end of the cylinder 10 surrounds the drill chuck 25, and its extreme forward end carries a bushing 50. The latter constitutes a drill guide and serves in some instances as a part of a detachable connection (not shown) between the tool and a suitable jig plate, serving to support the tool firmly at right angles to the work.

In view of the arrangement of the spindle drive motor and actuator in axial alinement, with the motor casing rigidly secured to the actuator plunger and the tool cylinder stationarily supported, means is provided for holding the motor casing against rotation relative to the cylinder. In the present embodiment the plunger 13 projects axially rearward from the dashpot chamber 46 and has rigidly secured thereto a rod 51 shaped for sliding but nonrotative engagement with the cylinder through the medium of a rearward extension thereof. In the present instance, the rod 51 is formed with flat sides 52 for passage through a slot 53 in an abutment 54, the latter being formed on an annular member 55 rigidly secured to the cylinder.

The rod 51 and abutment 54 are additionally utilized in limiting the forward feeding movement of the actuator plunger. For this purpose, the rod is screwthreaded and equipped with a pair of nuts 56, the foremost one of which engages with the abutment 54 to limit the extent of travel of the plunger.

The specific construction of the cylinder 10 may be varied as desired. As shown, the cylinder comprises a main section 57 having the partition member 17 integral therewith. The section 57 carries at its forward end a nose piece 58 which, in turn, carries the bushing 50, the sides of the nose piece 58 being suitably apertured as at 59 to permit of access to the drill chuck 25. Rearwardly of the main section 57 is an intermediate section 60 carrying the partitions 45 and 48 of the dashpot piston chamber 46; and mounted on the rear end of this intermediate section is the annular member 55 for coaction with the torque rod 51. Finally, the member 55 has mounted thereon a tubular tail piece 61 open at its rear end but serving to enclose the torque rod and its stop nuts.

Similarly, the plunger 13 may for convenience be of sectional construction. Thus it comprises, in the present instance, a forward portion 62 having the forward piston 14 integral therewith and the rear piston 15 screw threaded thereon; an intermediate section 63 screw threaded into the forward section and carrying the piston 47; and the rod 51 screw threaded into the section 63.

It will be seen that the construction and arrangement set forth provides a portable tool which may be mounted in fixed relation to the work and which is especially adapted to be supported by a rigid nose portion in detachable relation to a jig plate or other support. The provision of a rotary spindle driving air motor guided for movement in the tool body by means of an axially alined pneumatic actuator minimizes the transverse dimensions of the tool so that a plurality of tools may be mounted side by side in closely spaced relation. Use of air under pressure both for driving the tool spindle and for feeding purposes is especially advantageous in that adequate power from a remote source is rendered available notwithstanding the small size of the motor. By reason of the axial alinement of the motor and actuator the feeding thrust is applied most effectually to the cutting tool.

Of especial importance is the fact that while the tool is essentially of the portable type, when mounted in fixed relation to the work it provides its own support and guide for the tool spindle, the latter being carried by the motor which, in turn, is guided by the stationary body of the tool. Thus the reaction forces incident to the opera-

tion of the tool are borne by the jig plate or other support for the tool, thereby relieving the operator from the fatigue which accompanies the use of conventional portable tools, while insuring proper positioning of the tool relative to the work. Finally, the construction provides for control of the operation by means of a simple two position valve, as well as for the easy and convenient adjustment of means for limiting the length of stroke.

This application is a continuation in part of my prior application, Serial No. 602,592 filed June 30, 1945, now Patent No. 2,541,306, and of my prior application Serial No. 749,567, filed May 21, 1949, now Patent No. 2,488,992.

I claim as my invention:

1. An air-operated tool comprising in combination an elongated cylinder open at its forward end, a rotary air motor having a cylindrical casing slidable axially of the cylinder and a rotor in said casing with a tool spindle projecting forwardly into said open end of the cylinder, said casing having an air inlet opening in its rear end, a plunger in said cylinder comprising a piston rod having two axially spaced pistons, the forward one of said pistons being secured to the motor casing, a partition member in said cylinder centrally apertured for the passage of said rod and defining with the two pistons forward and rear piston chambers, the forward one of said pistons being apertured for the passage of air from the forward piston chamber to the motor through its said air inlet opening, and means including a valve device mounted on the cylinder substantially in the plane of said partition and controlling the admission and exhaust of air under pressure to and from said piston chambers alternately, said cylinder having a rearward extension and said plunger having a part projecting rearwardly into said extension of the cylinder and having a slidable but non-rotatable connection therewith so as to hold the plunger and thereby the motor casing against rotation during the reciprocation thereof.

2. An air-operated tool comprising in combination an elongated cylinder open at its forward end, a rotary air motor having a cylindrical casing slidable axially of the cylinder and a rotor in said casing with a tool spindle projecting forwardly into said open end of the cylinder, said casing having an air inlet opening in its rear end, a plunger in said cylinder comprising a piston rod having two axially spaced pistons, the forward one of said pistons being rigid with the motor casing, a partition member in said cylinder centrally apertured for the passage of said rod and defining with the two pistons forward and rear piston chambers, the forward one of said pistons being apertured for the passage of air from the forward piston chamber to the motor through its said air inlet opening, and valve means controlling the admission and exhaust of air under pressure to and from said piston chambers alternately, the cylinder and plunger having a non-rotatable sliding connection therebetween to hold the plunger against rotation, and further having interengaging stop means for limiting the forward movement of the plunger.

3. A portable power driven tool comprising an elongated body adapted to be mounted in fixed relation to a workpiece, an air motor, a tool spindle driven by the motor and adapted for connection with a cutting tool, said body having a chamber in its forward portion in which the motor is guided axially relative to the body for movement toward and from the work, a pneumatic actuator for reciprocating the motor including a plunger with piston means thereon connected with the motor, said body having advancing and retracting piston chambers disposed rearwardly of the motor chamber in axial alinement therewith, means controlling the supply of air under pressure to said piston chambers selectively and to said motor including a two position valve effective in each position to control the admission of air to one piston chamber and the exhaust of air from the other piston chamber, and adjustable stop means for limiting the extent of advancing movement of the motor by said actuator.

4. A portable power driven tool comprising a body in the form of an elongated cylinder having a coaxially disposed chamber adjacent the forward end thereof, an air motor comprising a casing guided for axial reciprocation in said chamber, a tool spindle connected with said motor and projecting forwardly for connection with a cutting tool, a pneumatic actuator for reciprocating the motor including a plunger with piston means thereon, said body having advancing and retracting piston chambers in axial alinement with the motor chamber, and said motor casing having a supply port in constant communication with the advancing piston chamber, means for controlling the supply of air under pressure to said piston chambers selectively including a two position valve effective in each position to control the admission of air to one piston chamber and the exhaust of air from the other piston chamber, and means including relatively adjustable interengaging stops for limiting the extent of advancing movement of the motor relative to the body.

5. A portable power driven tool comprising an elongated body adapted to be mounted in fixed relation to a workpiece, a rotary air motor, a tool spindle driven by the motor, said body having a chamber in which the motor is guided axially relative to the body for movement toward and from the workpiece, a pneumatic actuator for reciprocating the motor including a plunger with piston means thereon, said body having advancing and retracting piston chambers disposed in axial alinement with the motor chamber, and means controlling the supply of air under pressure to said piston chambers selectively and to said motor, said plunger having a rearward extension and relatively adjustable interengaging stops on the body and plunger extension for limiting the extent of advancing movement of the plunger.

6. A portable power driven tool comprising an elongated tubular body, a rotary air motor in the forward end portion of the body having a casing guided by the body for movement axially thereof, and a rotor in said casing having a forwardly projecting tool spindle, said air motor being substantially greater in length than in diameter, a pneumatic actuator in the body disposed entirely rearward of the motor and comprising a plunger connected at its forward end to the motor casing and having piston means thereon, said body having advancing and retracting piston chambers in axial alinement with the motor, and valve means for controlling the admission and exhaust of air under pressure to and from the respective piston chambers to effect reciprocation of the motor.

7. A portable power driven tool comprising an elongated tubular body, a rotary air motor in the forward end portion of the body having a cylin-

drical casing guided by the body for movement axially thereof, and a rotor in said casing having a forwardly projecting tool spindle, said air motor being substantially greater in length than in diameter, a pneumatic actuator in the body disposed entirely rearward of the motor and comprising a plunger connected at its forward end to the motor casing and having piston means thereon, said body having advancing and retracting piston chambers in axial alinement with the motor, and a single two-position valve for controlling the admission and exhaust of air under pressure to and from the respective piston chambers to effect reciprocation of the motor, said motor casing having an air inlet communicating with the advancing piston chamber, whereby air is supplied to the motor coincident to the advance of said plunger.

8. A portable power driven tool comprising an elongated tubular body, a rotary air motor having a forwardly projecting tool spindle, a cylindrical casing enclosing said motor, said casing being guided by the body for axial movement in the forward portion thereof, said body having a centrally apertured partition therein rearwardly of the motor, a plunger comprising a piston rod slidable through said partition and having two

axially spaced pistons on opposite sides of the partition, the forward one of said pistons comprising a disk on the piston rod removably secured to the rear end of the cylindrical motor casing so as to form a rear wall therefor, said partition defining with said pistons forward and rear piston chambers, the forward piston being apertured for the passage of air from the forward piston chamber to the motor, and valve means controlling the admission and exhaust of air under pressure to and from said piston chambers alternately.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
484,224	McConnell	Oct. 11, 1892
1,200,826	Forman	Oct. 10, 1916
1,628,621	Taylor	May 10, 1927
2,103,252	Gartin	Dec. 28, 1937
2,141,697	Russell	Dec. 27, 1938
2,406,482	Tucker	Aug. 27, 1946
2,488,992	Taylor	Nov. 22, 1949
2,541,306	Taylor	Feb. 13, 1951

FOREIGN PATENTS

Number	Country	Date
2,499	Great Britain	May 26, 1882