

Nov. 20, 1951

W. G. MITCHELL
ROTARY TOOL

2,575,524

Filed Oct. 10, 1946

2 SHEETS—SHEET 1

Fig. 1

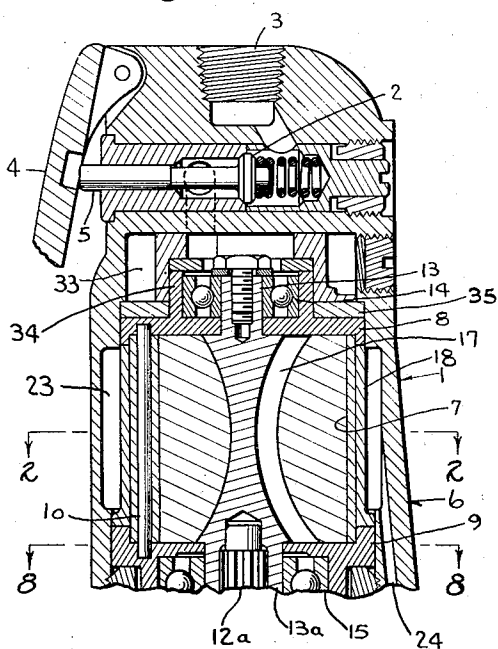


Fig. 2

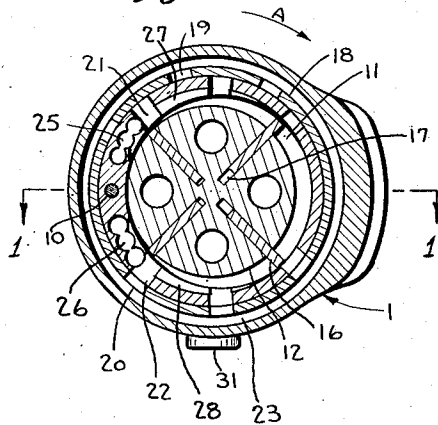


Fig. 8

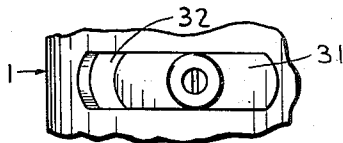
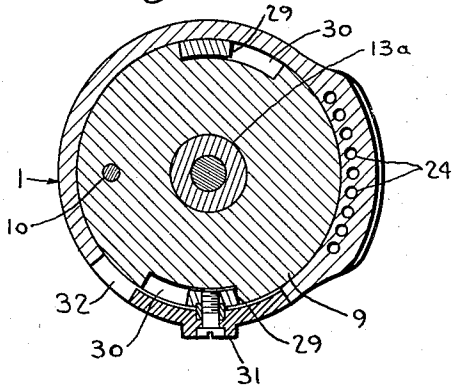
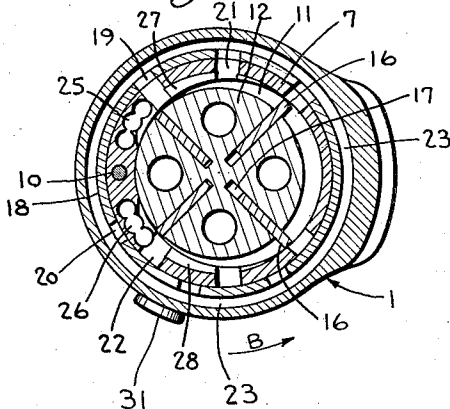


Fig. 9

Fig. 3



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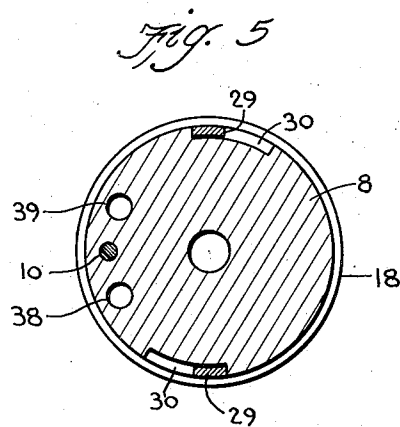
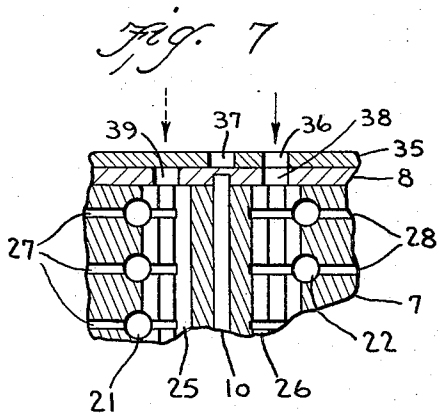
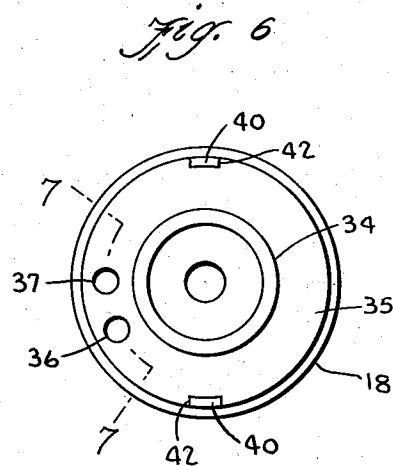
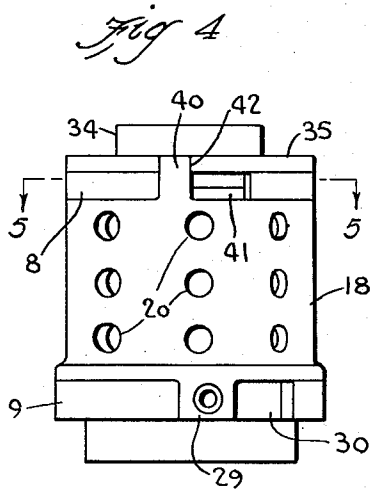
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ROTARY TOOL

Filed Oct. 10, 1946

2 SHEETS—SHEET 2



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2,575,524

ROTARY TOOL

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4 Claims. (Cl. 121—34)

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This invention relates to improvements in fluid actuated rotary tools of the portable, hand held, pneumatically operated type designed for drilling, nut and bolt driving and kindred operations.

The general object and purpose of my invention is to improve and simplify the means embodied in the tool device for controlling the supply of fluid pressure to the tool motor for rotating it in opposite directions.

In keeping with the foregoing object, I dispose said means at one end of the tool device and operate it from a sleeve which is mounted on and shiftable relatively to the cylinder bushing of the tool motor for changing the direction of the tool motor, the sleeve and the bushing having a complement of exhaust ports to be brought into and out of register in the shifting of the sleeve.

A further object of my invention is to have the inlet passages for the tool motor in the cylinder bushing and opening through the end of the same at said means so that the supply of fluid pressure to the tool motor for operating it may be furnished from one end of the tool device for compactness of the tool structure for convenience in handling and grasping by the operator about the motor section of the tool.

A further object of my invention is to revolvably mount the sleeve about the cylinder bushing so that the sleeve may be turned for controlling the direction of rotation of the tool motor, the sleeve having a handle member or equivalent part at one side of the tool for turning the sleeve.

A further object of my invention is to provide the handle on the sleeve in the form of a knob or other member extending through a slot in the outer casing of the tool for accessibility from a position intermediate the ends of the tool device.

A further object of my invention is to provide the means first mentioned in the form of a valve connected with and operated by the sleeve on turning or shifting it by said handle member.

A further object of my invention is to provide said valve in the form of a port provided plate revolvably mounted on one of the end plates of the tool motor.

The invention consists further in the structural features and combination of parts hereinafter described and claimed.

In the accompanying drawings—

Fig. 1 is a longitudinal sectional view with parts in elevation of the connected motor and throttle valve sections of a portable pneumatically operated rotary tool embodying the features of my invention, the section being taken approximately on line 1—1 of Fig. 2 with the motor in a position

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with a pair of its blades in the plane of the section;

Fig. 2 is a transverse sectional view taken on line 2—2 of Fig. 1 showing the reversing sleeve of the motor unit shifted to a position for rotating the motor in one direction;

Fig. 3 is a similar sectional view showing the reversing sleeve shifted into a position for rotating the motor in the opposite or reverse direction;

Fig. 4 is a side elevational view of the sleeve and bushing assembly removed from the tool for the purpose of illustration;

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 4 to show the interfitting engagement of the lugs on the sleeve with the recesses in the valve plate to be hereinafter described;

Fig. 6 is a top plan view of the assembly shown in Fig. 4;

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 6 to illustrate the porting system for admitting fluid pressure to the tool motor;

Fig. 8 is a transverse sectional view taken on line 8—8 of Fig. 1 to show the handle member secured to the reversing sleeve for shifting it; and

Fig. 9 is a front view of the tool at said handle member.

In the drawings, 1 indicates the outer casing of the tool, the latter being of the portable, hand held, pneumatically operated rotary type having a work driving spindle (not shown) at its front or outer end and a manually depressible throttle valve 2 at or adjacent its rear or inner end as shown in Fig. 1. The throttle valve 2 controls the supply of fluid pressure or compressed air to the tool motor for rotating it, and, hence, the starting and stopping of the tool is controlled. Said valve 2 is mounted in the tool case 1 at the fluid pressure inlet passage 3 to which an air supply hose (not shown) is connected as in tools of the character shown.

The valve 2 is spring biased towards closed position and is movable towards unseated or open position by an actuating lever 4 pivoted on the tool case and extending over the outer end of the valve stem 5 to engage it. The lever 4 is arranged to extend along the motor section 6 of the tool to be conveniently operated by the hand of the operator grasping and holding the tool about its outer casing 1 at the motor section 6.

Arranged with the motor section 6 is a cylinder bushing 7 clamped between the end plates 8, 9 of the motor unit and held against rotation by a dowel pin or key 10 extending through the bushing and fitting at its ends in apertures or recesses

in the respective end plates 8, 9 as shown in Fig. 1. The pressure exerted by the casing sections in clamping them together holds the bushing 7 and its end plates 8, 9 in non-rotative relation and provides a rotor chamber 11 for a rotor 12 to be next referred to.

Eccentrically mounted within the chamber 11 is a rotor 12 which divides the rotor chamber 11 into two sections to provide the high and the low pressure chambers, respectively, for the motor as in devices of this character.

The shaft extensions 13, 13a at the opposite ends of the rotor 12 are mounted in anti-friction bearings 14, 15 supported by the end plates 8, 9 for journalling the rotor 12 for rotation in the bushing 7. The lower shaft extension 13a has a splined connection at 12a with the tool mechanism to be driven by the tool motor. In the tool illustrated, this mechanism comprises an impact clutch unit for driving and setting nuts and bolts by the power of the tool. In this connection, I may point out that the tool spindle which is at the front or outer end of the tool casing 1 has a nut or bolt head engaging socket (not shown) as in impact wrenches of the character mentioned.

The rotor 12 is equipped with blades 16, 16 slidably mounted in radial slots 17 in the rotor. The blades work against the inner cylindrical surface of the bushing 7 as in motor devices of the kind shown.

Mounted on and surrounding the bushing 7 is sleeve 18 for controlling the direction of rotation of the rotor 12 in accordance with my invention. The sleeve 18 is located between the end plates, 8, 9 and has a ground and revoluble fit therewith and similarly with the outer cylindrical surface of the bushing 7 to avoid air leakage therebetween in the operation of the tool. This is indicated in Figs. 1, 2 and 3.

The sleeve 18 has two sets of ports 19, 20 arranged in groups, one on each side of the line of minimum clearance of the bushing 7 with the rotor 12 as shown in Figs. 2 and 3. The ports of each group are arranged in parallel, circumferentially, spaced rows extending axially of the sleeve 18 with the ports spaced apart in each row to serve the effective length of the motor unit as shown in Fig. 4.

The bushing 7 is provided with a like arrangement of exhaust ports 21, 22. The ports 21 comprise the group employed in association with the ports 19, while the ports 22 comprise the group employed in association with the ports 20. The ports 19, 20 in the sleeve 18 extend therethrough and connect at their outer ends with an exhaust chamber 23 provided by the outer casing 1 entirely about the outer cylindrical side of the sleeve 18 as shown in Figs. 1 to 3. The outer casing 1 of the tool has a series or group of exhaust passages 24 leading from said chamber 23 to the atmosphere exterior of the tool.

The bushing 7 is provided with a pair of longitudinally extending passages 25, 26 located on opposite sides of, but relatively close to, the line of minimum clearance of the rotor 12 with the bushing 7 as shown in Figs. 2 and 3. These passages 25, 26 serve to selectively supply fluid pressure to the opposite sides of the rotor to rotate it in reverse directions. The passage 25 is used to rotate the rotor 12 to the right or in a clockwise direction as indicated by the arrow *a* in Fig. 2, while the passage 26 is used to rotate the rotor 12 to the left or in a counter-clockwise direction as indicated by the arrow *b* in Fig. 3. This change of direction of rotation of the rotor 12 is

under the control of the sleeve 18 as will hereinafter more fully appear.

The bushing 7 is provided in its inner cylindrical surface with a number of circumferentially extending slots 27, 28, the first being associated with the passages 25 and the second being associated with the passages 26 as indicated in Figs. 2 and 3. The slots 27, 28 are in the plane of their respective ports 21, 22 and intersect them as indicated in Figs. 2, 3 and 7. By this arrangement the slots 27, 28 in their respective sets convey live air from adjacent the point of minimum clearance of the rotor 12 with the bushing 7 to approximately the bushing port farthest removed therefrom, circumferentially of the bushing. Hence, fluid pressure is supplied to the bushing from an inlet passage 25 or 26 to the fullest extent of the circumferential area of the bushing occupied by the respective group of ports 21, 22, respectively. Moreover, the porting system enables the blades to be under effective fluid pressure for more than 180 degrees in either direction from the pin or key 10 as shown in Figs. 2 and 3. This increases the power and effectiveness of the motor unit as compared with previous designs.

When the sleeve 18 is turned to the position shown in Fig. 2, the ports 19 in the sleeve are moved out of register with the ports 21 in the bushing 7, while the ports 20 in the sleeve are brought into register with the ports 22 in the bushing 7. This closes the bushing ports 21 to the exhaust chamber 23 and fluid pressure is admitted into the bushing 7 through the passage 25 to act on the blades 16 to rotate the rotor 12 in the clockwise direction of the arrow *a* in Fig. 2. The exhaust at this time will be from the rotor chamber 11 through the registering ports 20, 22 on the now low pressure side of the rotor chamber as shown in Fig. 2.

Shifting the sleeve 18 into the position shown in Fig. 3 registers the ports 19 and 21 of the sleeve 18 and the bushing 7 for an exhaust from the now low pressure side of the motor unit, while the ports 22 in the bushing are now closed with respect to the ports 20 in the sleeve and the rotation of the rotor 12 is in the counter-clockwise direction of the arrow *b* as shown in Fig. 3.

To limit the extent to which the sleeve may be rotated, I provide the sleeve with a pair of diametrically disposed, depending lugs 29, 29 integral or otherwise fixed to the sleeve and extending into similarly disposed arcuate notches or recesses 30, 30 in the peripheral edges of the lower end plate 9 which is fixed against rotation within the tool assembly as hereinbefore mentioned. The lugs 29 are at the outer periphery of the sleeve 18 and to one of them is secured a handle member 31 which works in an arcuate guide slot 32 in the outer casing 1 of the tool as detailed in Fig. 8. This handle member 31 is accessible from the outside of the tool casing and is actuated to rotate or shift the sleeve to control direction of rotation of the rotor 12.

The fluid pressure, in accordance with my invention, is supplied to a chamber 33 in the tool casing 1 at the upper end thereof, namely, about the upper shaft extension 13, when the throttle valve 2 is opened. Mounted on the hub portion 34 of the upper plate 8 is a turnable valve plate 35 which as shown in Figs. 6 and 7 is provided with a pair of ports 36, 37 to be brought alternately into and out of register with the inlet passages 25, 26 in the bushing 7 through matching ports 38, 39 in the interposed end plate 8 as shown in Fig. 7. The plate 35 seats on the

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end plate 8 and is engaged by a pair of diametrically disposed lugs 40, 40 extending upwardly from the upper end of the sleeve 18 as shown in Fig. 4. The lugs 40 extend through arcuate recesses 41 in the periphery of the end plate 8 and interengage with recesses or notches 42 in the valve plate 35. Hence, the valve plate 35 and the sleeve 18 are connected together for rotation in unison. The length of the recesses 30, 41 determines the extent to which the sleeve may be turned, the end walls of at least one of said recesses serving as stops for such purpose.

When the plate 35 is turned to the position shown in Fig. 7, the port 36 in the plate 35 is brought into register with the inlet passage 26 in the bushing 7 and live air is supplied to the tool motor to rotate it in one direction (arrow *b* in Fig. 3). The other port 37 in the plate 35 is at this time out of register with the passage 25. Turning the plate 35 in the opposite direction shifts the port 37 into register with the passage 25 and the tool motor is rotated in the reverse direction (arrow *a* in Fig. 2).

It will be noted from Fig. 7, that the passages 25, 26 open through the upper end of the bushing 7 and the supply of fluid pressure to the tool motor is from the chamber 33 which is in direct communication with the plate ports 36, 37. This contributes to the compactness of the tool and reduces its outside diameter for convenience in grasping and holding about the motor section 6 as heretofore mentioned. In brief, with the arrangement shown, the valve mechanism which is controlled by the sleeve 18 does not hinder the location of the throttle valve 2 at the rear end of the tool.

Moreover, with the sleeve 18 revolvably mounted in the tool casing about the bushing 7 the handle member 31 may be located at the side of the tool and extend out of the tool case intermediate its ends to free the upper or inner end of the tool for the control valves as herein shown. This contributes to the compactness of the tool device for ease of handling and manipulation of the tool as is apparent.

As detailed in Figs. 8 and 9, the slot 32 extends beyond the ends of the companion slot 30 and the handle member 31 is constructed to fully cover the inner slot 30 in all positions of handle member.

The details of construction and arrangement of parts shown and described may be variously changed and modified without departing from the spirit and scope of my invention, except as pointed out in the annexed claims.

I claim as my invention:

1. In a fluid actuated rotary tool, an outer casing, a cylinder bushing non-rotatably mounted in said outer casing and providing a rotor chamber, a rotor eccentrically mounted in said chamber, a pair of longitudinally extending inlet passages in the bushing and connected with said chamber on opposite sides of the rotor for selectively supplying fluid pressure to the opposite sides of the chamber for rotating the rotor in opposite directions, a sleeve disposed between said casing and said bushing and fitting about said bushing and shiftable relatively thereto and relatively to the casing, said sleeve and said bushing having exhaust ports therein to be selectively brought into and out of register in the shifting of the sleeve to control the direction of rotation of the rotor, means for shifting the sleeve, an end plate at one end of said bushing having a pair of inlet passages in register with the inlet pas-

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sages of the bushing, and a valve plate revolvably mounted on said end plate and connected to a source of fluid pressure and having inlet ports adapted to alternately register with said end plate inlet passages to supply fluid pressure to said rotor chamber through said end plate and said bushing.

2. In a fluid actuated rotary tool, an outer casing, a cylinder bushing and end plates therefor non-rotatably mounted in said outer casing and providing a rotor chamber, a rotor eccentrically mounted in said chamber, a pair of longitudinally extending inlet passages in said bushing and connected with said chamber on opposite sides of the rotor for selectively supplying fluid pressure to the opposite sides of the chamber for rotating the rotor in opposite directions, a pair of inlet passages in one of said end plates in alignment with the inlet passages of the bushing, a sleeve revolvably fitted about said bushing, said sleeve and said bushing having exhaust ports therein to be selectively brought into and out of register in the rotation of the sleeve to control the direction of rotation of the rotor, a valve plate revolvably mounted on said one end plate and connected with the sleeve for rotation therewith, said valve plate having ports to alternately register with said inlet passages of the end plate to control the supply of fluid pressure thereto in the shifted positions of the sleeve, and means for rotating the sleeve.

3. In a fluid actuated rotary tool, an outer casing, a cylinder bushing and end plates therefor non-rotatably mounted in said outer casing and providing a rotor chamber, a rotor eccentrically mounted in said chamber, a pair of longitudinally extending inlet passages in the bushing and connected with said chamber on opposite sides of the rotor for selectively supplying fluid pressure to the opposite sides of the chamber for rotating the rotor in opposite directions, a pair of inlet passages in one of said end plates in register with the inlet passages of the bushing, a sleeve revolvably fitted about said bushing, said sleeve and said bushing having exhaust ports therein to be selectively brought into and out of register in the rotation of the sleeve to control the direction of rotation of the rotor, a valve plate rotatably mounted on said one end plate and having ports to alternately register with said inlet passages of the end plate to control the supply of fluid pressure thereto in the shifted positions of the sleeve, lugs on the sleeve interconnecting the valve plate with the sleeve for rotation therewith, the interposed end plate having slots to receive said lugs, and means for rotating the sleeve.

4. In a fluid actuated rotary tool of the reversible type, the combination of a cylindrical bushing providing a rotor chamber, a rotor operatively mounted in said chamber, said bushing being provided with a pair of longitudinally extending inlet passages for admitting motive fluid at one end of said bushing and said bushing having circumferentially extending grooves at its inner surface for supplying motive fluid from said inlet passages to opposite sides of said chamber for rotating said rotor in opposite directions, inlet valve means comprising a shiftable valve plate at said one end of said bushing for regulating the admission of motive fluid to one or the other of said inlet passages, exhaust valve means comprising a shiftable valve sleeve surrounding said bushing, said bushing and said sleeve being provided with a plurality of exhaust ports adapted to be registered selectively by shifting of said sleeve to

control the direction of rotation of said rotor, and means operatively connecting said sleeve and said plate whereby to permit simultaneous shifting movement thereof.

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