

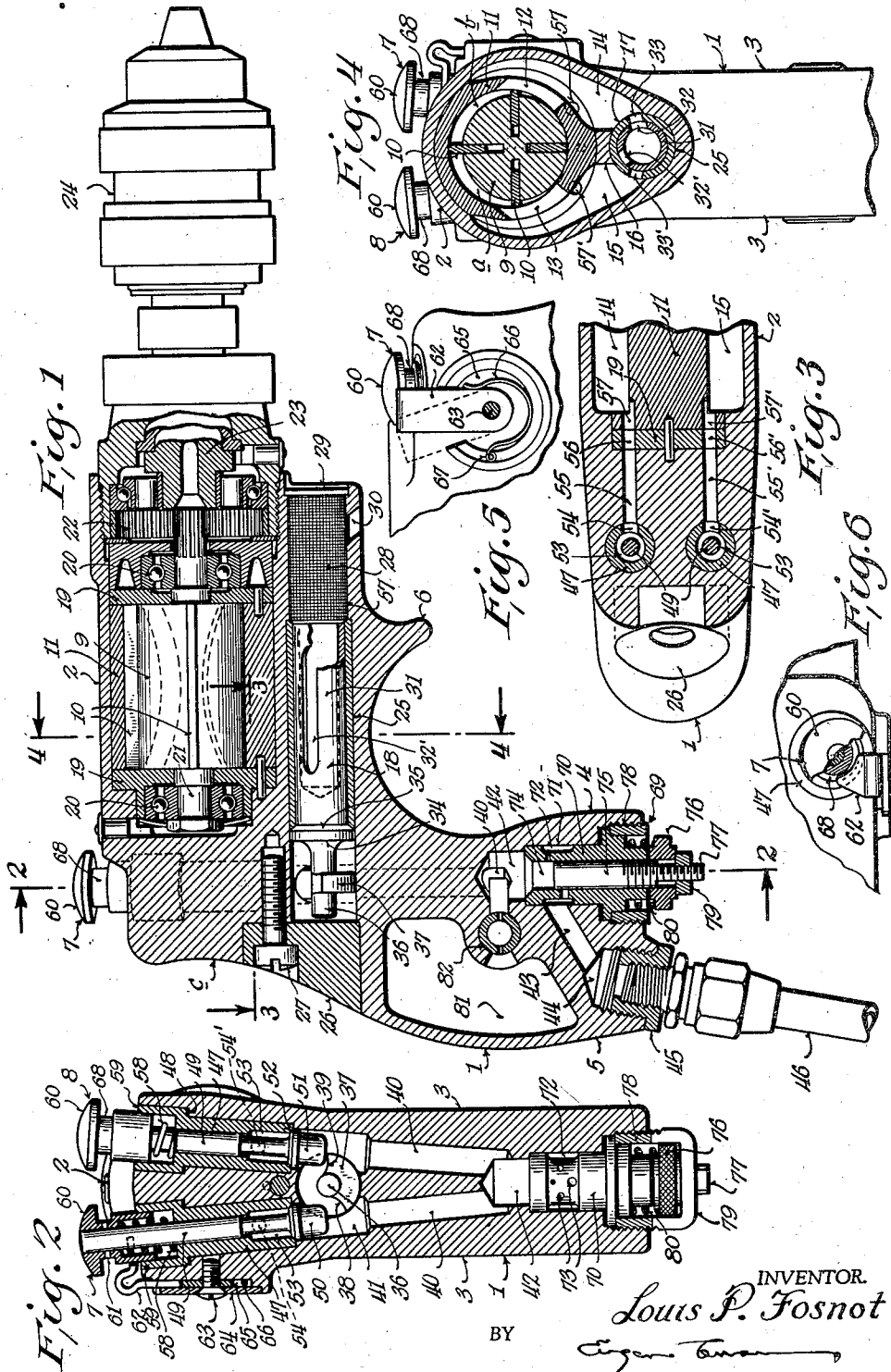
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PORTABLE ROTARY REVERSIBLE TOOL

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PORTABLE ROTARY REVERSIBLE TOOL

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This invention relates to pneumatically actuated reversible rotary portable hand tools adapted for tapping, reaming, drilling, screw driving and other kindred operations and having a pistol grip handle at the rear end of the tool for the operator to hold and manipulate the tool in one hand by said handle.

The main purpose and object of my invention is to provide such a tool with a pair of easily operable control valves of the push button type for controlling the operation of the tool motor in opposite directions, said valves being mounted in the tool handle and operable at the upper end thereof by the thumb of the operator's hand holding and grasping the tool by said handle.

A further object of my invention is to locate said control valves relatively close together, and preferably in side by side relation, so that said valves may be selectively operated by the operator by merely shifting his thumb from one valve to the other without loosening or changing the grip of his hand on the tool handle.

A further object of my invention is to have these valves biased to closed positions by spring means included in the valve structures and movable into open positions in an axial direction and thus allow for the operation of the valves by a depression of the operator's thumb on the upper ends of the valves towards the tool handle.

A further object of my invention is to incorporate a revoluble exhaust valve in the motor case for changing the rotative direction of the tool motor and have said exhaust valve common to and operable by the push button valves in the depression thereof.

It is also an object of my invention to provide a novel valve structure in the tool handle for controlling the amount of pressure fluid admitted to the tool motor for controlling its speed of rotation as may be required in the use of the tool.

The invention also contemplates the provision of a novel latch device for holding the forward valve in open position, when it is desired to run the tool motor in a direction to drive a tool bit or other working element into the work without requiring the operator to hold his thumb on the control valve to keep the tool motor running.

The invention consists further in the features hereinafter described and claimed.

In the accompanying drawing—

Fig. 1 is a longitudinal sectional view, with parts in elevation, of a pneumatically operated reversible rotary portable hand tool having a pistol grip handle and embodying the features of my invention;

Fig. 2 is a vertical sectional view taken through the tool at the handle portion thereof on line 2—2 of Fig. 1;

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view taken on line 4—4 of Fig. 1;

Fig. 5 is an elevational view showing a part of the latch mechanism to be hereinafter more fully described; and

Fig. 6 is a top plan view, partly broken away and in section respectively, of the parts shown in Fig. 5.

In the tool shown in the drawing, 1 indicates the pistol grip handle at the rear end of the tool, and 2 indicates the motor case of the tool and from which motor case the handle extends downwardly as shown. The handle 1 and the motor case 2 may be integrally connected in which event they would be cast in one piece.

As depicted in Figs. 2 and 4, the side surfaces 3, 3 of the handle portion 1 are relatively flat, while the front and rear surfaces 4, 5 of the handle are suitably rounded or curved to provide a convenient grip and hand-hold for the operator's hand when holding and using the tool.

The motor case 2 is provided on its under-surface with a relatively short downwardly extending lug 6 which provides a purchase for the outer end of the operator's first finger when holding the tool at the grip handle 1. The lug 6 is sufficiently forward of the handle 1 to cause the operator's hand when holding the tool to more or less firmly grip it with the first finger at the lug and with the other three fingers below the motor case and about the handle portion 1 on its side opposite to said first finger. The other side of the handle is engaged by the palm of the operator's hand and the thumb is uppermost and free to reach over the upper end of the handle to selectively actuate the two push button control valves 7, 8 with which the tool is provided in accordance with my invention.

In the tool shown, the motor case 2 contains a rotary motor comprising a rotor 9 with radial piston blades 10 and a surrounding rotor chamber 11. This construction is depicted in Fig. 4, wherein it will be noted that the rotor is eccentrically mounted within the chamber 11 and has a one-point peripheral contact therewith as in structures of this character. This arrangement in conjunction with the piston blades divides the chamber 11 into two fluid pressure sections a, b on opposite sides of the motor axis. Said sections are respectively connected by ports 12, 13

in the surrounding wall of the chamber 11 with fluid pressure passages 14, 15 provided by the motor case 2 on the outer side of said chamber as detailed in Fig. 4. The passages 14, 15 are divided at their lower ends by a web wall 16 and a cooperating bushing 17, both located within the motor case 2 below the chamber 11.

It may be remarked at this point that the motor exhausts through either the passage 14 or the passage 15 in the operation of the tool depending upon the rotative direction of the motor. The passage 14 is used to run the motor forwardly, while the passage 15 is used to run the motor in the reverse direction. The motor is run forwardly, that is, towards the right, when tapping or reaming, and in the reverse direction or towards the left when withdrawing the tap or reamer bit from the work.

The push button valves 7, 8 control the admission of motive fluid, such as compressed air, to the rotor chamber 11 and also control the selection of the passages 14 and 15 for the exhaust. This is brought about by having the valves 7, 8 actuate an exhaust valve 18 located within the bushing 17. In the tool shown, the valve 7 is the "forward valve," while the valve 8 is the "reverse valve." Designations to this effect may be marked either on the valves themselves or on the motor case adjacent to them.

The rotor chamber 11 is closed at its opposite ends by end plates 19, 19 which also provide supports for anti-friction bearings 20, 20 for the opposite ends of the rotor shaft 21 as shown in Fig. 1. The forward end of the rotor shaft is connected by a suitable planetary reduction gearing 22 with the driving spindle 23 of the tool. This construction is shown in Fig. 1, and it will be noted that the spindle 23 is equipped with a chuck 24 for holding a bit for tapping, reaming or drilling as the occasion may demand. For screw or nut driving operations, the chuck would be replaced by an attachment designed for such purposes.

The bore 25 in the motor case for the bushing 17 extends beyond the opposite ends of the bushing as shown in Fig. 1. The rear end of this bore extends through the handle 1 of the tool, that is, the upper portion c of the handle where it joins the motor case 2 and closes the rear end of the same. The bore 25 is closed at its rear end by a plug 26 secured in place by a screw 27. The front portion of this bore mounts a cylindrical screen 28 located between the front end of the bushing 17 and a closure plug 29 as shown. The tool case has an exhaust opening 30 below the screen as shown.

The bushing 17, which is fixed against rotation in the motor case, serves to mount the exhaust valve 18. The latter has a hollow, cylindrical portion 31 rotatably fitted within the bushing and provided with two longitudinally extending slots 32, 32'. These slots may be of equal length and are circumferentially spaced about the portion 31. The bushing 17 has corresponding slots 33, 33', one for each of the valve slots. The arrangement is such that by rotating the valve member 31, the slots referred to may be selectively brought to register. This is apparent from Fig. 4 which shows the bushing 17 and the valve slots 32, 33 in register to connect the passage 14 with the bore of the valve cylinder 31 and hence with the exhaust port 30 through the screen 28. It will be noted from Fig. 1, that the valve cylinder 31 opens at its forward end into said screen.

The other ports 32', 33' in the bushing 17 and

the valve element 31 are out of register when the parts are positioned as in Figs. 1 and 4, and the passage 15 is cut-off from the exhaust. The section b of the rotor chamber 11 is now on the low pressure or exhaust side of the tool motor, while the section a of said rotor chamber is on the high pressure or inlet side of said motor. The pressure fluid for operating the rotor is now admitted to the high pressure side of the chamber 11 through the passage 15. When running the rotor in a reverse direction, the chamber 15 is connected to the exhaust through the bushing 17 and the pressure fluid for operating the rotor is supplied to the section b of the rotor chamber through the passage 14 as will presently appear.

The rear end of the valve member 31 is closed to provide an end surface 34 and a beveled surface 35, the latter to seat against the rear end of the bushing 17. A stem 36 extends rearwardly from the valve member 31 in axial alignment therewith and is provided with a radial projection 37 having milled surfaces 38, 39 on opposite sides of the valve axis. The handle 1 is provided with a pair of fluid pressure passages 40 below the bore 25 and intersecting the same to provide a chamber 41. The latter accommodates the stem 36 and its projection 37 and certain valve members to be presently described. The passages 40 connect at their lower ends with a common chamber 42 which is connected by a passage 43 with the main pressure fluid supply chamber 44 at the lower end of the handle 1. The chamber 44 is threaded as shown in Fig. 1 to receive a supply hose nipple connection 45, the supply hose being shown at 46.

The drillings for the passages 40 continue through the upper portion c of the handle 1 to the rear of the motor case and accommodate bushings 47, one for each of the push valves 7, 8. With the passages 40 in side by side relation, the valves are similarly located to facilitate their selective depression to open positions by the thumb of the operator's hand grasping the handle 1. This arrangement also positions the valves 7, 8 in line with the projection 37 for turning the same. The bushings 47 extend from the chamber 41 to the upper end of the handle 1 and seat against shoulders 48 therein as shown. The bushings are held in place and against rotation by set screws (not shown), one for each bushing.

Each push button valve 7, 8 has a rod 49 slidably mounted within its associated bushing 47. The rods 49 extend through the bushing and are provided at their lower ends with the valve members heretofore referred to. These valve members seat against the lower ends of the bushings 47, the valve members being marked 50 and 51, respectively. The member 50 is on the rod 49 for the forward valve 7 and the member 51 is on the rod for the reversing valve 8. The valve members 50, 51 are within the chamber 41 below the bushings and are movable into and out of closing relation to beveled valve seats 52 at the lower ends of the bushings.

The valve members 50, 51 also act on the projection 37 to turn the exhaust valve 18 in opposite directions. For this purpose the valve members 50, 51 are immediately above the projection on opposite sides of its rotative axis. Hence, on depressing the rod 49 of the forward valve 7, the valve member 50 will turn the exhaust valve 18 in one direction, while the valve member 51 on being depressed will turn the exhaust valve in the opposite direction. This oc-

curs in alternation if the valves 7, 8 are operated in that manner. On the other hand, after the exhaust valve 18 has been turned by a push valve, the exhaust valve will remain in that position until turned by the other push valve. This will be apparent from Fig. 2 which shows the exhaust valve 18 set for a forward rotation of the tool motor. The forward valve 7 may now be opened and closed as often as desired without changing the exhaust valve because the projection 37 is against the reversing valve member 51. The valve members 50, 51 limit the rotary movement of the exhaust valve 18, and the under surfaces of said valves and the milled surfaces 38, 39 are curved to facilitate the action of the parts.

It will be noted that the bushing 17 supports the exhaust valve 18 for rotative movement and also locates the end surface 34 in the chamber 41. This subjects the end surface 34 to the pressure fluid in said chamber and seats the exhaust valve against the bushing 17 to prevent leakage from the chamber 41 to the bushing 17.

The rods 49 of the push valves have sliding engagement within their bushings 47 above chambers 53, 53 which the bushings provide at their lower ends. These chambers have ports 54, 54' which connect with fluid pressure passages 55, 55' in the tool case between the bushings 47 and the adjacent end plate 19. Said passages connect with ports 56, 56' in said end plate and said ports register with ports 57, 57' in the adjacent end of the rotor chamber 11 at the passages 14, 15 as shown. The end plates 19 are fixed in the motor case against rotation by dowel pins as illustrated herein.

When the valve member 50 is unseated pressure fluid enters the section a of the tool motor to rotate the rotor 9 forwardly. The path of the pressure fluid from the chamber 41 to the passage 15 is through the chamber 53 at the forward valve 7 and the connected ports and passages 54, 55, 56 and 57 as shown in Fig. 3. The exhaust valve 18 is now in position connecting the low pressure side b of the motor with the passage 14 as shown in Fig. 4. When the valve member 51 is unseated the fluid pressure is supplied to the section b of the tool motor and the rotor is run in the reverse direction. The path of the pressure fluid is now from the chamber 41 to the passage 14 through the chamber 53 at the reversing valve 8 and the connected ports and passages 54', 55', 56' and 57' as will be apparent from Fig. 3. At this time the exhaust valve 18 is connected to the motor section a.

It is to be understood that the valves 7, 8 must be held depressed to supply motive fluid to the tool motor. When a valve is released, its spring 58 raises the valve and cuts off the motive fluid supply to the bushing which it serves. Each spring 58 is located adjacent the upper end of its valve 7 or 8, the bushing 47 being enlarged at 59 to house and support the spring. The valve rods 49 carry cap elements 60, one on the upper end of each rod, to fit over its spring 58. The latter bears at its upper end against its cap and at its lower end against the bushing as shown in Fig. 2. The caps 60 also provide enlarged heads on the upper ends of the valve rods to facilitate their depression by the operator's thumb.

To lock the forward valve 7 in open position when so desired, I provide a latch element 62 on the side of the handle 1 at said valve as shown in Fig. 2. This latch element is mounted on a pivot screw 63. A cover plate 64 is held by this

screw over a recess 65 in which the latch element is located and said cover plate also retains in said recess a spring member 66 which normally urges the latch to a releasing position out of engagement with the cap member 60 of the valve 7. As shown in Fig. 5, the spring 66 has one end anchored at 67 to the handle casting and its free end bears against the opposite side of the latch. The cap element 60 at the upper end of the valve 7 provides an annular channel 68 to receive the free end of the latch 62 to hold the valve 7 depressed as shown in Fig. 6. The upward pressure of the valve spring 58 will hold the parts against accidental release. The channel 68 is wide enough to provide for the automatic release of the latch on pressing the valve 7 downwardly.

To control the amount of motive fluid which may be supplied to the tool motor, I provide a regulating valve 69 in the tool handle 1 at its lower end, that is, in the depending grip portion as shown in Figs. 1 and 2. This valve comprises a bushing 70 fitting within a bore 71 in the tool handle. The bore 71 is a downward continuation of the chamber 42 and is intersected by the passage 43 as shown. The bushing 70 has a surrounding exterior groove 72 at the passage 43 and a number of ports 73, 73 of different sizes connecting the groove with the bore 74 of the bushing, the latter opening into the chamber 42 as shown. To control these ports, the bushing 70 mounts a valve rod 75 which by a turnable nut 76 on the screw threaded lower end 77 of the valve rod 75 adjusts said rod to open and close all or some of the ports 73 as will be apparent from Fig. 1.

The bushing 70 is seated in the bore 71 by a threaded sleeve 78 which carries a yoke shaped bracket 79 exposed below the handle 1 to accommodate the nut 76 and make it accessible for turning from below the handle as clearly indicated in Fig. 2. A coiled spring 80 is located within the sleeve 78 between the nut 76 and the bushing 70 to hold the nut for turning in the bracket 79. The screw threaded lower end of the rod 75 is flattened and this flattened end extends through and cooperates with the flat sides of a slot in the yoke 79 to hold the rod against turning. Hence, the rod may be adjusted up or down by turning the nut 79 in the desired direction.

The handle 1 may be provided with a reservoir chamber 81 for holding a supply of oil for lubricating the operative parts of the tool. An oil filter and feeding device 82 controls the supply of oil to the stream of pressure fluid as it passes through the inlet chamber 42. The handle 1 is provided with a filling opening for the reservoir and an opening to insert and remove the filter.

It will be noted that the upper ends of the push button valves 7, 8 normally extend above the handle at the rear end of the tool and thus are positioned within convenient and easy reach of the thumb of the operator's hand grasping and holding the tool at said handle. Moreover, with these valves opening with a downward movement they may be readily depressed by the thumb without disturbing or changing the grip of the operator's hand about the handle. With the handle carrying a forward valve and a reversing valve, the tool motor may be run in the direction desired at the will of the operator.

Another important feature is the interaction between the control valves 7, 8 and the exhaust valve 18. The latter is common to the push valves and hence said push valves may be lo-

cated relatively close together for the thumb operation referred to.

The tool is relatively light in weight and is compact in design. Being of the pistol grip type, it may be held and operated in one hand and hence is adapted for drilling, tapping, reaming and screw and nut driving operations as before stated in close and confined quarters.

The control valve 69 is another important feature of my invention. This valve by its various sizes of ports 73 and its adjustable valve rod 75 enables the amount of pressure fluid admitted to the tool motor to be so regulated as to control the speed of its rotation. This allows the motor speed to be adjusted to the particular character of work to be performed by the tool.

I claim as my invention:

1. In a pneumatically operated reversible rotary portable hand tool having a grip handle at the rear end of the tool, a reversible motor and a spindle driven thereby, a pair of depressible push button valves mounted in the handle for controlling the supply of motive fluid to the tool motor for rotating the same in opposite directions, means for biasing said valves to closed positions, and means providing operable portions for the valves and available at the upper end of the handle whereby the valves may be selectively depressed into open positions by the thumb of the operator's hand grasping and holding the tool by said handle.

2. In a pneumatically operated reversible rotary portable hand tool having a grip handle at the rear end of the tool, a reversible motor and a spindle driven thereby, a pair of depressible push button valves mounted in the handle for controlling the supply of motive fluid to the tool motor for rotating the same in opposite directions, means for biasing said valves to closed positions, and means providing operable portions for the valves in side by side relation at the upper end of the handle within the lateral confines of the tool whereby the valves may be selectively depressed into open positions by the thumb of the operator's hand grasping and holding the tool by said handle.

3. In a pneumatically operated rotary portable hand tool having a motor case and a pistol grip handle secured thereto at the rear end of the tool, said handle having its upper portion to the rear of the motor case and its lower end portion extending downwardly therefrom, a motor in said case, a spindle driven by said motor, a depressible push button valve mounted in the upper portion of the handle to the rear of the motor case in substantially normal relation to the longitudinal axis thereof for controlling the supply of motive fluid to the tool motor for rotating the same, means for biasing said valve to closed position, and means providing an operable portion for the valve at the upper end of the handle whereby the valve may be depressed into open position by the thumb of the operator's hand grasping and holding the tool by said handle.

4. In a pneumatically operated reversible rotary portable tool having a motor case and a grip handle secured thereto at the rear end of the tool, a reversible motor in said case, a spindle driven by said motor, a pair of depressible push button valves mounted in the handle for controlling the supply of motive fluid to the tool motor, means for biasing said valves to closed positions, means providing operable portions for said valves and available at the upper end of

the handle whereby the valves may be depressed into open positions by the thumb of the operator's hand grasping and holding the tool by said handle, and an exhaust valve operable by the push button valves for changing the direction of rotation of the motor.

5. In a pneumatically operated reversible rotary portable hand tool having a motor case and a grip handle secured thereto at the rear end of the tool, a reversible motor in said case, a spindle driven by said motor, a pair of depressible push button valves mounted in the handle for controlling the supply of motive fluid to the tool motor, means for biasing said valves to closed positions, means providing operable portions for the valves and available at the upper end of the handle whereby said valves may be selectively depressed into open positions by the thumb of the operator's hand grasping and holding the tool by said handle, and an exhaust valve rotatably mounted in the motor case and turnable in opposite directions by the push button valves for changing the rotative direction of the tool motor.

6. In a pneumatically operated reversible rotary portable hand tool having a motor case and a grip handle secured to said case at the rear end of the tool, a reversible motor in said case, a spindle driven by said motor, a pair of push button valves mounted in the handle for controlling the supply of motive fluid to the tool motor, means for biasing said valves to closed positions, means providing operable portions for the valves and available at the upper end of the handle whereby the valves may be selectively depressed into open positions, and an exhaust valve for said motor, said exhaust valve being revolvably mounted in the motor case and having projections on opposite sides of its rotative axis for engagement by the push button valves on the depression thereof for changing the direction of rotation of the tool motor.

7. In a pneumatically operated reversible rotary portable hand tool having a motor case and a grip handle secured to the motor case at the rear end of the tool, a reversible motor in said case, a spindle driven by the motor, a pair of push button valves mounted in the handle for controlling the supply of motive fluid to the motor, means for biasing the valves to closed positions, means providing operable portions for the valves at the upper end of the handle whereby the valves may be selectively depressed into open positions, and an exhaust valve for the motor, said exhaust valve being revolvably mounted in the motor case and having radial projections on opposite sides of its rotative axis for engagement by the push button valves in the depression thereof for changing the rotative direction of the motor, said push button valves providing stops for limiting the rotative movement of the exhaust valve.

8. In a pneumatically operated reversible rotary portable hand tool having a motor case and a grip handle secured to said case at the rear end of the tool, a reversible motor in said case, a spindle driven by the motor, said handle having a passage-way therein for supplying motive fluid to the motor, an exhaust valve for the motor, said exhaust valve being revolvably mounted in the motor case and having a radial projection in said passage-way, and a pair of depressible valve members mounted in said passage-way for controlling the flow of motive fluid therethrough and engageable with said projec-

tion for turning the exhaust valve for changing the rotative direction of the tool motor, and rods connected with said valve members and slidably mounted in the handle for selectively opening the valve members and changing the position of the exhaust valve.

9. In a pneumatically operated rotary portable hand tool having a grip handle at the rear end of the tool, a motor and a spindle driven thereby, a depressible push button valve mounted in the handle for controlling the supply of motive fluid to the tool motor, means for biasing said valve to closed position, means providing an operable portion for the valve at the upper end of the handle whereby the valve may be depressed into open position by the thumb of the operator's hand grasping and holding the tool by said handle, and a latch device carried by the handle for releasably holding said valve in open position.

10. In a pneumatically operated rotary portable hand tool having a grip handle at the rear end of the tool, a motor and a spindle driven thereby, a depressible push button valve mounted in the handle for controlling the supply of motive fluid to the tool motor, means for biasing said valve to closed position, means providing an operable portion for the valve at the upper end of the handle whereby the valve may be depressed into open position by the thumb of the operator's hand grasping and holding the tool by said handle, a latch member pivotally mounted on the handle and movable into engagement with said valve for holding the same in open position, and spring means biasing the latch to its release position.

11. In a pneumatically operated reversible rotary portable hand tool having a grip handle at the rear end of the tool, a reversible motor and a spindle driven thereby, said handle hav-

ing a fluid pressure supply passage therein for the motor, an exhaust valve mounted in the motor case for the motor and having a radial projection in said passage, depressible valve members in said passage and selectively operable against the projection for turning the exhaust valve for changing the rotative direction of the motor, rods slidably mounted in the handle and connected with the valve members, and bushings in the handle for said rods, said bushings providing seats at their lower ends for the valve members.

12. In a pneumatically operated portable hand tool having a motor and a grip handle at the rear end of the tool, said handle having a passage-way for supplying pressure fluid to the tool motor, and a valve device carried by the tool in said passage-way for regulating the amount of pressure fluid admittable to the tool through said passage-way, said valve device having a bushing located in said passage-way and having a number of ports of different sizes, and a valve rod adjustably mounted in said bushing for opening and closing said ports.

13. In a pneumatically operated portable hand tool having a motor and a pistol grip handle at the rear end of the tool, said handle having a passage-way therein for supplying motive fluid to the tool motor, a valve device in said passage-way, said valve device having a bushing in said passage-way and provided with a number of axially disposed ports of different sizes, a valve rod slidably mounted in said bushing for opening and closing said ports, and a turnable nut engaged with a threaded portion of said rod for adjusting the position thereof with respect to said ports.

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