United States Patent [19]

Ringerud

[11] **3,866,493**

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[54] **AIR-OPERATED HAND TOOL**

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[52] **U.S. Cl.**..... **81/57.11,** 81/57.39, 81/58.1

[51] **Int. Cl... B25b 17/00,** B25b 21/00, B25b 13/00

[58] **Field of Search**..... 81/57.11, 57.31, 57.39, 81/57.44, 58.1, 59.1

[56] **References Cited**

UNITED STATES PATENTS

2,484,364	11/1949	Whitledge	144/32 X
2,786,379	3/1957	Blackinton	81/52.4 R
2,973,676	3/1961	Nelson	81/52.4 R
3,329,185	7/1967	Hettich et al.	81/59.1

FOREIGN PATENTS OR APPLICATIONS

1,949,415	3/1969	Germany	81/57.11

Primary Examiner—James L. Jones, Jr.

[57] **ABSTRACT**

What is disclosed is an air-operated hand tool which utilizes pressurized air to drive a screw, set a nut, or perform other similar tasks. The tool is hand-held and its driving mechanism is activated when the tool is pressed against the screw, nut or other item being worked. The tool may also be utilized as a hand-operated tool and allows instant conversion from the power-operated mode to the hand-operated mode.

8 Claims, 8 Drawing Figures

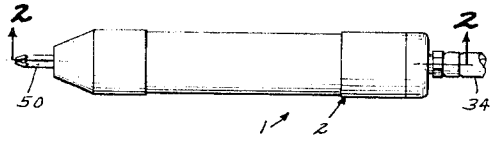


FIG. 2

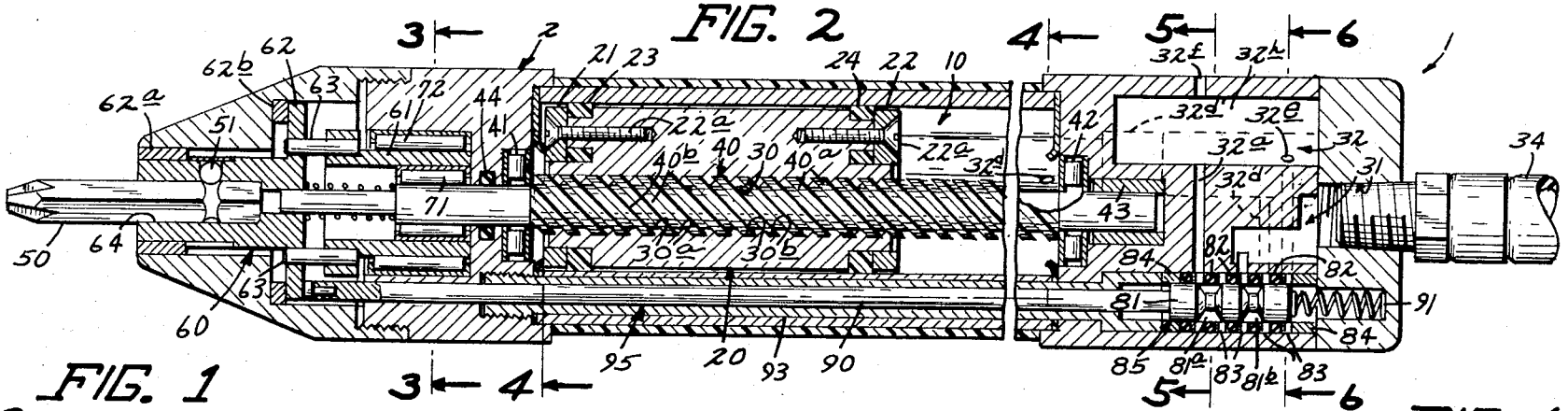


FIG. 1

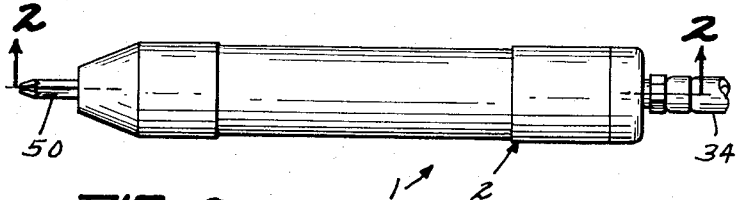


FIG. 3

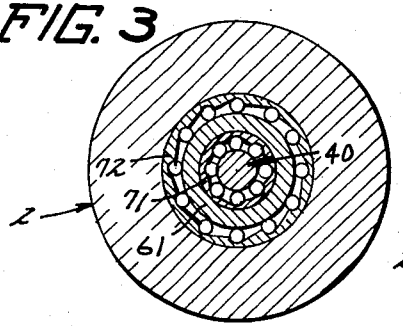


FIG. 4

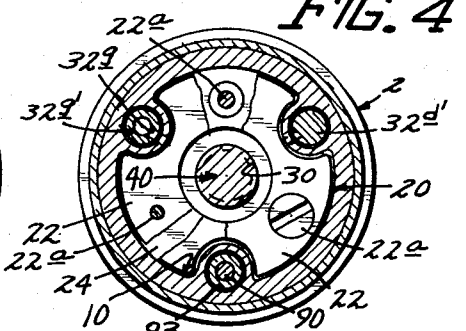


FIG. 8

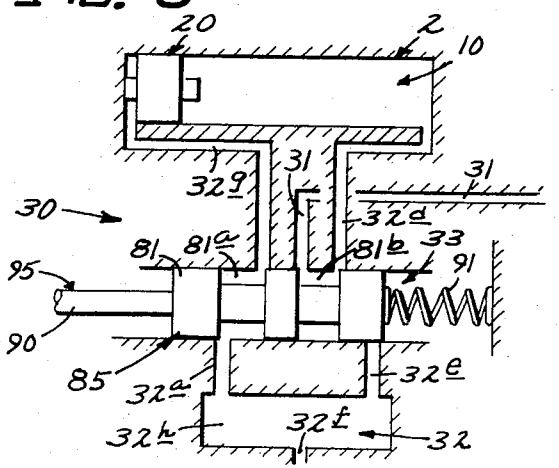


FIG. 7

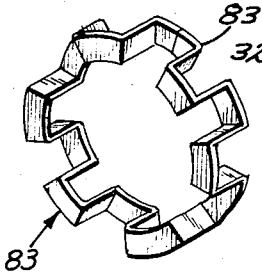


FIG. 5

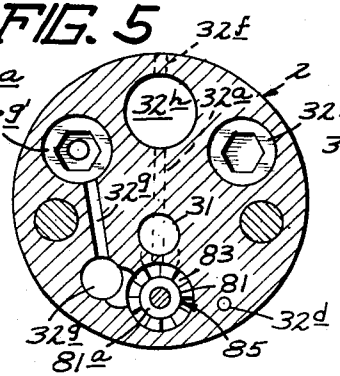
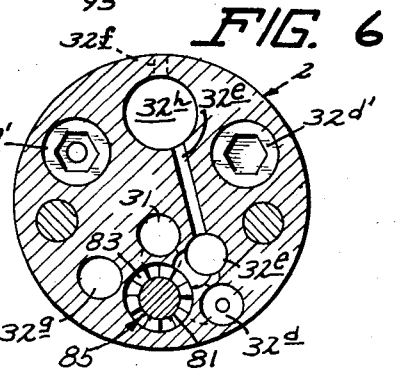


FIG. 6



AIR-OPERATED HAND TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a hand tool for driving screws, setting nuts and performing similar tasks by using either pressurized air or manual effort as the driving force.

2. Description of the Prior Art

Air driven hand tools have long been used to save time and reduce physical effort in performing tasks of a relatively simple and repetitive character. Such tools are found particularly useful in high volume assembly operations requiring the repetitious driving of screws and setting of nuts. The use of pressurized air to drive such tools allows the use of a common source of power with relatively simple driving mechanism contained within the tool itself. The pressurized air is usually distributed to individual tools through flexible hoses which attach to the tools.

The utilization of pressurized air to drive the tools and its control is effectuated by various means in the existing art. In certain instances the compressed air is converted into a rotary motion by the use of an air turbine (see Patents: E. R. Whitledge, U.S. Pat. No. 2,484,364; E. D. Burnett et al., U.S. Pat. No. 3,323,395; and R. C. Blackinton, U.S. Pat. No. 2,786,379). This method of providing a rotational movement from the pressurized gas uses a relatively large amount of pressurized air in the turning of the turbine blades. It may find limited application in instances where it is desired to conserve the energy being used to provide the pressurized air. An alternative type of device for providing a rotational movement from pressurized air is the use of a reciprocating piston in the tool. This concept has been used in U.S. Pat. No. 2,484,364 (Supra) and in U.S. Pat. No. 2,973,676 by G. R. Nelson.

There are two general means by which the rotary motion of these tools is controlled. The first is the use of a triggerlike device which controls the flow of air to the hand tool. (See U.S. Pat. Nos. 2,973,676 and 3,323,395, Supra). The use of such a trigger device may in some instances restrict the ease with which a tool is handled by making the modes of gripping the tool less versatile and perhaps interfering with the exertion of a firm grip upon the tool. An alternative means of controlling the application of power to the tool is the use of a pressure sensitive switching means. Such a means reacts to pressure being exerted upon the tool bit when in use. This pressure in turn activates a valve means to control the flow of compressed air to the tool (see U.S. Pat. No. 2,484,364, Supra).

The use of compressed air to operate compact, handheld tools provides a relatively limited supply of power with which a nut or screw can be driven. This is due to the necessary limitation of tool part size and weight restrictions. In particular, the limited size and strength of the vein assembly in a turbine type tool and the limited size and strength of the piston means in a reciprocating piston tool limits the maximum amount of torque which such tools can produce. As a result, if in the operation to which the tool is being applied, a particularly difficult screwing or bolting operation arises for which the hand tool power is insufficient, a larger tool or a separate hand tool must be used to complete the task. This limits the versatility of existing air powered hand tools.

SUMMARY OF THE INVENTION

The Applicant's invention is an improved air-operated hand tool which has a manual operation capability. The tool is powered by pressurized air which enters the tool through a flexible hose. The pressurized air drives a reciprocating piston which in turn imparts a rotary motion to an interchangeable tool bit. The supply of pressurized air to the piston is controlled by a mechanical switch which opens and closes a flow-control valve in response to the tool bit being engaged and disengaged from a workpiece. This provides a simple means of turning the tool on and off without the use of a hand operated trigger or similar device.

The proposed invention has a unique manual-operation capability. At the end of the power stroke of the piston, a double clutch arrangement allows the tool bit to be turned by rotating the tool body by hand. In this manner the tool becomes a hand-tool which can be used to selectively tighten the workpiece or to complete a task which the power operation was incapable of performing due to its limited torque capability.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of a preferred embodiment of the air-operated hand tool.

FIG. **2** is a cross-sectional view through a vertical plane of the embodiment illustrated in FIG. **1.**

FIG. **3** is a sectional view as seen from the line **3—3** showing the double clutch arrangement.

FIG. **4** is a partial sectional view as seen from the line **4—4** showing the piston and tool body support members.

FIG. **5** is a sectional view as seen from the line **5—5** showing various passageways in the tool body.

FIG. **6** is a sectional view as seen from the line **6—6** showing various passageways in the tool body.

FIG. **7** is a detailed orthogonal view of the castellated gating ring.

FIG. **8** is a schematic diagram showing the various passageways and their interconnection.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like reference numerals are used throughout the several views to indicate like elements of the invention, the air operated hand tool **1** includes a tool body **2.** While various body contours are possible, in the preferred embodiment tool body **2** has the elongated cylindrical shape. This contour is intended to facilitate the random positioning of the tool **1** in the operator's hand and to allow it to be tightly gripped for manual operation.

Power is provided to the tool **1** by pressurized air which is converted to a usable mechanical form of energy by means of a reciprocating non-rotary piston **20** which is sealably housed in a cylinder **10** in tool body **2.** Attached to opposite ends of piston **20** are a first end plate **21** and a second end plate **22.** End plates **21** and **22** are used to hold seals **23** and **24** in place on piston **20.** Seals **23** and **24** are fashioned of a flexible rubber-like material and are intended to prevent the movement of air from an area of high pressure at one end of the piston **20** to an area of low pressure at the opposite end. In the preferred embodiment, seals **23** and **24** can be removed for replacement by disengaging screws **22***a* which attach end plates **21** and **22** to piston **20.**

Non-rotating piston **20** reciprocates in opposite drive and return directions in cylinder **10** in response to a pressure differential across its two ends, thus generating mechanical power from the pressurized air. This pressure differential is by the by selective introduction of pressurized air into one end of cylinder **10** and the simultaneous venting of air from the opposite end. A passageway network **32** (shown schematically in FIG. **8**) is formed in tool body **2** to direct this flow of air. The detailed structure of passageway network **32** will be described later. The selective control of the air flow in the various passageways is provided by a valve means **85** and a valve control means also to be described later.

The movement of piston **20** in a drive direction drives a tool bit **50** by means of a drive shaft **40** and a chuck assembly **60.** Drive shaft **40** is mounted in tool body **2** by means of bearings **41–43** and extends through a cylindrical bore **30** which extends longitudinally and coaxially through piston **20.** In the preferred embodiment bearings **41** and **42** are roller bearings and bearing **43** is an oilite type rotational bearing. O-ring **44** provides a seal around drive shaft **40.**

To impart the reciprocating motion of piston **20** to drive shaft **40,** a series of helical lands **40***a* and grooves **40***b* on the surface of drive shaft **40** are utilized as a power train. Lands **40***a* and grooves **40***b* engage matching lands **30***a* and grooves **30***b* formed in the surface of cylindrical bore **30** which extends through piston **20.** As piston **20** moves axially in cylinder **10,** lands **30***a* and grooves **30***b* bear against the lateral surfaces of lands **40***a* and grooves **40***b* on drive shaft **40** to impart a rotational motion to drive shaft **40.**

The rotational drive of drive shaft **40** is communicated indirectly to tool bit **50** by means of chuck assembly **60.** Chuck assembly **60** consists of a drive portion **61** and a socket portion **62.** Both portions are rotatable in tool body **2.** In addition, socket portion **62** can move axially with respect to drive portion **61.** This axial independence of socket portion **62** from drive portion **61** is provided by means of peg-like guide rails **63** which interconnect drive portion **61** and socket portion **62.** These guide rails **63** allow the communication of rotational movement to socket portions **62** from drive portion **61** while allowing an axial sliding of socket portion **62** without a corresponding axial sliding of drive portion **61.** The desirability of this axial independence is related to a valve control means to be described later.

A tool bit **50** is removably inserted into chuck socket portion **62** by means of a socket recess **64** in socket portion **62.** The tool bit **50** is held in place in recess **64** by means of a ball-detent device **51** located in socket portion **62.** The ball-detent **51** is of a conventional design. While FIG. **2** shows tool bit **50** to be a Phillips-type screwdriver bit, any suitable bit such as a straight edge screwdriver or a nut socket may be used in its place.

Socket portion **62** of chuck **60** is supported in tool body **2** by bearings **62***a* and **62***b.* In the preferred embodiment, bearing **62***a* is rotational oilite type bearing and bearing **62***b* is an oilite type thrust bearing. Where desirable, other types of bearings may be used to support socket portion **62.**

Rotational movement of drive shaft **40** in one direction is imparted to chuck **60** by means of two cylindrical cup-roller clutches **71** and **72.** Clutch **71** communicates the rotational movement of drive shaft **40** to chuck **60** and clutch **72** communicates the rotational movement of tool body **2** to chuck **60.** This is the essence of the manual operation capability of hand tool **1.** Additionally, the clutch **72** holds the chuck **60** against reverse rotation during movement of the piston **20** in the return direction of its reciprocatory movement. By means of clutches **71** and **72** the tool bit **50** can be rotated either by the power drive of drive shaft **40** or by hand turning of tool body **2.**

FIGS. **2** and **3** show the mounting arrangement of clutches **71** and **72** in tool body **2.** Clutches **71** and **72** are mounted coaxially forming a cylindrical bearing layering, with drive shaft **40** extending through the center of clutch **71.** Cylindrical chuck drive portion **61** is mounted between clutches **71** and **72.** Thus clutch **72** is interspaced between tool body **2** and chuck drive portion **61** to communicate rotational movement of tool body **2** to chuck drive portion **61** and clutch **71** is interposed between drive shaft **40** and chuck drive portion **61** to communicate the rotational movement of drive shaft **40** to chuck drive portion **61.**

Clutches **71** and **72** each have a drive rotational direction and a non-engaging rotational direction. In the drive rotational direction, a turning of one race of the clutch transmits a rotational motion to the other race of the clutch. In the non-engaging rotational direction, a turning of one race merely free wheels the other race with no motion imparted to the other race. To accomplish the desired manual operation capability of hand tool **1,** the drive rotational direction of clutch **71** is opposed to the drive rotational direction of clutch **72.** This permits the tool body **2** to drive the tool bit **50** independent of movement of drive shaft **40** and vice versa.

As noted earlier, piston **20** reciprocates axially in cylinder **10** in response to a pressure differential maintained across the two ends of piston **20.** The selective flow of air to and from cylinder **10** which is necessary to maintain this pressure differential is accomplished by means of the passageway system **30** shown schematically in FIG. **8.** This passageway system is comprised of three interconnected passageways **31, 32** and **33.** The general purpose of passageway **33** is to serve as an air flow distribution point and it contains an air flow control valve **85** which will be described later. The general purpose of passageway **31** is to carry pressurized air from its source to passageway **33** where it is distributed. Passageway **32** is intended to carry pressurized air through tool body **2** to cylinder **10** and to then exhaust air from cylinder **10** through tool body **2** to the outside air.

Passageway **31** is formed by channels or openings in tool body **2** and communicates pressurized air from a conduit **34** to passageway **33.** As is shown in FIG. **2,** conduit **34** is a flexible hose or similar structure carrying pressurized air to tool body **2** from a pressurized air source (not shown).

Passageway **32** comprises several interconnected portions designated **32**i a, **32***d*, **32***e*, **32***f*, **32***g* and **32***h.* These passageway portions are shown schematically in FIG. **8** and in their structural positions in FIGS. **2, 4, 5,** and **6.** Portions **32***g* and **32***d* serve to supply pressurized air to one end of piston **20** in cylinder **10** and to simultaneously vent air from the opposite end of piston **20.** This provides the pressure differential across piston **20** which is its motivating force. In the preferred embodiment, passageways **32***d* and **32***g* consist of hollowed out portions of tool body **2** and a hollow bolt **32***g'* respec-

tively. The hollow bolt 32*g'* may serve the dual function of providing passageways and also holding various portions of tool body **2** together when assembled. Passageways **32***a* and **32***e* communicate between passageway **33** and chamber **32***h* which joins with passageway **32***f* which exits from body **2** to the outside air. Chamber **32***h* is a baffle to the flow of gas through passageways **32***a* and **32***e* and thus acts as a muffler chamber. While FIGS. **2** and **8** show exhaust passageway **32***f* as a single bore, multiple bores may also be used. In addition, an exhaust line (not shown) could be attached to passageway **32***f* to carry exhaust gas from the working area. Thus, passageways **32***a* and **32***e* vent air out of cylinder **10** through passageway **33** on the exhaust stroke of piston **20.**

Passageway **33** is a hollowed out area of body **2** and serves as a common confluence point of passageway **31** and portions of passageway **32.** It is the purpose of passageway **33** to house a valve means **85** which selectively directs air flow through the various passageways mentioned. In particular, the valve means is intended to selectively direct pressurized air from supply passageway **31** to either end of cylinder **10** and to simultaneously vent air from the opposite end of cylinder **10** to the atmosphere.

Valve means **85** consists primarily of a reversing spool **81** which is sealably and slidably located within passageway **33.** Reversing spool **81** has an uneven contour which forms two circumferential channels **81***a* and **81***b*. Surrounding reversing spool **81** is a stacked array of O-rings **82** and castellated gating rings **83** positioned in passageway **33** by spacers **84** (see detail FIG. **7**). The O-rings and gating rings are alternately positioned. The openings in the gating rings **83** adjoin respective passageways **32***a*, **32***g*, **31**, **32***d* and **32***e*, where they enter passageway **33.** Thus, the openings in the gating rings **83** serve as extensions of the aforementioned passageways. The O-rings **82** serve as barriers between these various passageways. The flow in passageways **32***a*, **32***g*, **31**, **32***d*, and **32***e* can be selectively joined when the circumferential channels **81***a* and **81***b* are in various selected positions. This is possible because channels **81***a* and **81***b* are wide enough to extend between any two adjacent gating rings and their associated passageways. Thus, air flowing to one of the gating rings is directed to another gating ring by means of either of channels **81***a* or **81***b*. In this manner, reversing spool **81** serves as an air flow control valve in passageway **33.**

Reversing spool **81** has a first and a second position in passageway **33.** Its first position is a biased position. Referring to FIG. **8** where reversing spool **81** is shown in its first position, channel **81***b* communicates pressurized air from passageway **31** to cylinder **10** by means of passageway **32***d* and simultaneously channel **81***a* communicates exhaust air from cylinder **10** through passageways **32***g*, **32***a*, **32***h* and **32***f*. This flow of air urges piston **20** in its exhaust direction of movement in cylinder **10.** When reversing spool **81** is in its second position channels **81***a* and **81***b* are in a different location and pressurized air moves into cylinder **10** through the passageways which serve as exhaust passageways when reversing spool **81** was in its first position. This movement of air forces piston **20** in its power stroke direction. It is thus seen that the control of the position of reversing spool **81** in passageway **33** controls the application of power to the hand tool **1.**

To control the movement of reversing spool **81** a valve control means **95** is utilized. The two major components of valve control means **95** are an elongated rod **90** which extends through tool body **2** and bears against reversing spool **81** at one of its ends and a helical coil spring **91** which is housed in tool body **2** and bears against the opposite end of reversing spool **81.** It is the purpose of helical coil spring **91** to hold reversing spool **81** in its biased first position. Elongated rod **90** extends through tool body **2** from reversing spool **81** to a position adjacent to chuck socket portion **62.** Control rod **90** is slideably located within a hollow bolt **93** which also serves to secure portions of tool body **2** together after assembly.

Elongated rod **90** moves in response to axial movement of chuck socket portion **62** and in so doing bears against reversing spool **81** urging it from its biased position to its second position. As was noted earlier, chuck socket portion **62** moves axially when tool bit **50** engages a work piece. Movement of reversing spool **81** varies the position of channels **81***a* and **81***b* relative to passageways **32***a*, **32***g*, **31**, **32***d* and **32***e* thereby changing the communication of air flow in the various passageways. Thus by pressing tool bit **50** against a work piece, valve control means **95** is activated and it in turn changes the position of reversing spool **81** to control the flow of pressurized air to and from cylinder **10.**

The operation of hand tool **1** can be briefly summarized as follows. When tool bit **50** of the air operated hand tool **1** engages a work piece, pressure is exerted on the tool bit **50.** This pressure causes the axial movement of the socket portion **62** of chuck **60.** This motion in turn urges an elongated control rod **90** in an axial direction within tool body **2.** Attached to elongated control rod **90** is a reversing spool **81** which is part of a valve means **85.** The function of valve means **85** is to control the flow of pressurized air which moves a piston to provide power for the hand tool **1.** Pressurized air which enters the tool body **2** through a flexible hose **34** and then through a passageway **31,** is directed by reversing spool **81** through selected portions of passageway system **30** to and from piston cylinder **10.** This movement of pressurized air causes a pressure differential across piston **20** which in turn urges the piston in a power direction.

As the piston **20** moves in this power direction, it imparts its axial movement to a drive shaft **40** which extends through piston **20.** The axial movement of piston **20** imparts rotational motion to drive shaft **40** by means of matching sets of lands and grooves **30***a*–**30***b* and **40***a*–**40***b* which form a power train between piston **20** and drive shaft **40.** Thus, as piston **20** moves in cylinder **10** on its power stroke, it causes drive shaft **40** to rotate. The rotation of drive shaft **40** is communicated to a chuck **60** which holds tool bit **50.** Drive shaft **40** is operatively connected to chuck **60** by means of a cylindrical cup roller clutch **71.**

When piston **20** reaches the ends of its stroke in cylinder **10,** the motion of drive shaft **40** ceases and the tool bit **50** is no longer turned by the application of pressurized air. If the workpiece is only partially driven, pressure thereon is relieved, by easing pressure of the tool against the workpiece sufficiently to impart relative movement to the reversing spool **81** to cause the piston **20** to partake of return movement to the opposite end of the cylinder **10.** During this movement of the piston **20,** the tool bit **50** is held against reverse ro-

tation by the clutch **72.** The reversing operation may be repeated until the workpiece is seated. When the workpiece being acted upon by tool bit **50** has been properly seated in place, the function of the hand tool **1** is completed. However, if the limited torque provided by hand tool **1** has been insufficient to properly seat the workpiece being acted upon, the hand tool **1** may be used as a manually operated tool. This is accomplished by merely rotating the tool body **2** while the tool bit **50** is still engaged in the workpiece. The hand rotation of tool body **2** engages a second cylindrical cup roller clutch **72** which is operatively connected to chuck **60.** Since the rotational direction of cup roller clutch **72** is opposite that of clutch **71,** the power rotation of chuck **60** by drive shaft **40** is not communicated to tool body **2.**

After the proper amount of hand turning has been imparted to the workpiece, the hand tool **1** is disengaged from the workpiece by withdrawing tool bit **50.** This releases the pressure on elongated control rod **90** which allows the reversing spool **81** to return to its biased position. In this biased position, the communication of flow between the various passageways causes pressurized air to flow into cylinder **10** in such a way as to urge piston **20** in an exhaust direction which returns it to its starting position. Piston **20** then is maintained in this position by the application of pressurized air until the tool bit **50** again engages work which will then restart the cycle by urging reversing spool **81** from its biased position.

What is claimed is:

1. An air-operated hand tool, which is also capable of manual operation, having a rotary output, said tool comprising:

a. a tool body;

b. means defining a hollow cylinder within said tool body;

c. a piston sealably located in said cylinder and mounted for reciprocal movement in said cylinder, said movement having a power direction and an exhaust direction; said piston having opposed first and second ends and having a longitudinally extending cylindrical bore extending axially through said piston between said first and second ends, said piston being moveable in said cylinder when subjected to air pressure on one end different from the air pressure on the second end;

d. air conduit means for directing pressurized air flow from a source to said cylinder and for venting air from said cylinder to cause movement of said piston;

e. drive shaft having a generally cylindrical outer surface and extending coaxially through said longitudinal bore in said piston, said drive shaft being rotatably moveable;

f. power train means for converting reciprocatory motion of said piston into rotary motion of said drive shaft;

g. tool bit for engaging a work piece;

h. rotatable chuck means carried by said body for holding said tool bit in axial alignment with said drive shaft;

i. power drive clutch means for operatively connecting said drive shaft with said chuck means to permit power rotation of said tool bit; and

j. manual drive clutch means for operatively connecting said tool body with said chuck means to thereby permit the tool bit to be rotated by manual rotation of said tool body.

2. The air-operated hand tool of claim **1** wherein said air conduit means comprise means for defining a first, second and third passageway; said first passageway directing pressurized air flow from a source to said third passageway; said third passageway placing certain of said second passageway portions in communication with one another and in communication with said first passageway; said second passageway comprising a plurality of interconnectable passageway portions for directing pressurized air flow to said cylinder from said third passageway and for venting air from said cylinder.

3. The air-operated hand tool of claim **2** wherein said power train means comprise a first helical channel formed in the cylindrical surface of said drive shaft forming a first combination of lands and grooves and a second helical channel formed in the surface of the longitudinal bore in said piston forming a second combination of lands and grooves; said first combination operatively engageable with said second combination to urge said drive shaft into rotational movement in response to axial movement of said piston.

4. The air-operated hand tool of claim **3** wherein said chuck means comprise a socket portion rotatable and slideable in said tool body and a drive portion rotatable in said tool body; said socket portion engageable with said tool bit and rotatably connected with said drive portion such that rotation of said drive portion operatively rotates said socket portion; said socket portion slideably moveable in said tool body in response to pressure applied to said tool bit.

5. The air-operated hand tool of claim **4** wherein said power drive clutch means comprise a cylindrical cup-roller clutch for operatively connecting said drive shaft with said chuck drive portion to transmit the rotational movement of said drive shaft to said chuck drive portion; said power drive clutch having a drive rotational direction and a non-engaging rotational direction.

6. The air-operated hand tool of claim **5** wherein said manual drive clutch means comprise a cylindrical cup-roller clutch for operatively connecting said tool body with said clutch drive portion to transmit the rotational movement of said tool body to said chuck drive portion; said manual drive clutch having a drive rotational direction and a non-engaging rotational direction, said drive rotational direction opposed to the drive rotational direction of said power drive clutch such that rotation of said drive shaft is not transmitted to said tool body.

7. The air-operated hand tool of claim **6** wherein valve means are provided for selectively controlling the flow of pressurized air from said first passageway into said second passageway and for selectively placing portions of said second passageway in communication with certain other portions to control the reciprocation of said piston; said valve means comprising a reversing spool sealably and slideably located within said third passageway; said reversing spool having a first and second position, said first position being a biased position which permits said reversing spool to join the flow in said first and second passageways and portions thereof such that said piston is urged in said exhaust direction; said second position permitting said reversing spool to join the flow in said first and second passageways and portions thereof such that said piston is urged in said power direction.

8. The air-operated hand tool of claim 7 including a valve control means for urging said valve means from said biased first position to said second position in response to said tool bit being pressed against said work piece; said control means comprising an elongated rod slideably extending from said valve to said chuck socket portion; said rod urging said valve from said first position to said second position in response to axial movement of said chuck socket portion caused by pressure exerted upon said tool bit.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,866,493
DATED : Feb. 18, 1975
INVENTOR(S) : CHESTER A. RINGERUD

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, Line 5 "by the by" should be --created by the--

Column 4, Line 58 "32 i a," should be --32a--

Signed and sealed this 13th day of May 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks