April 27, 1948. W. K. BECKWITH 2,440,457

PNEUMATIC TOOL

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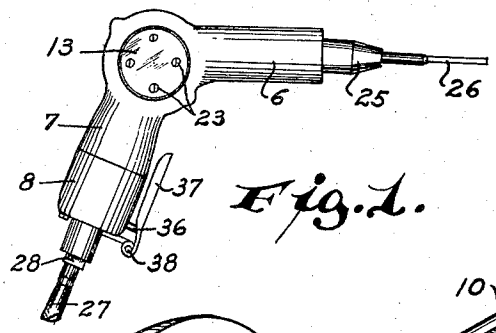


Fig. 1.

Fig. 2.

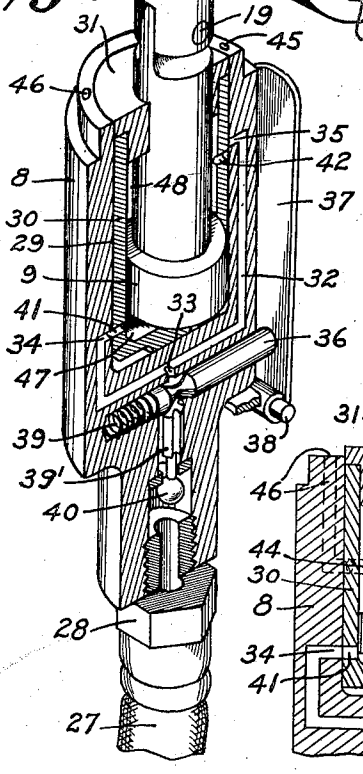


Fig. 3.

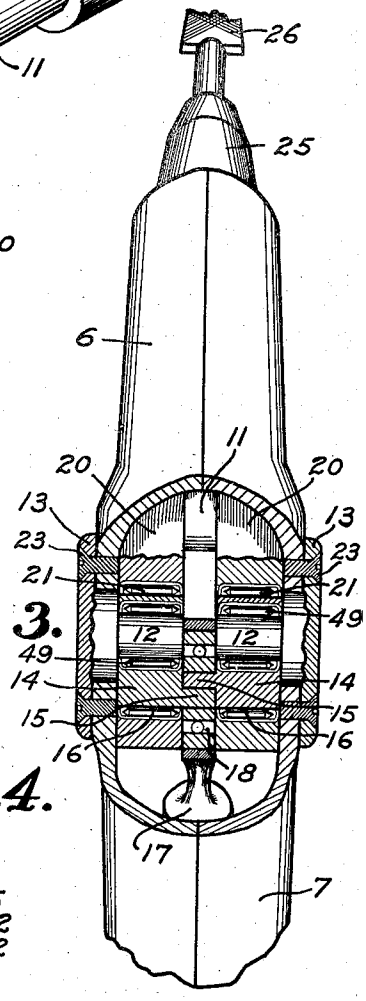
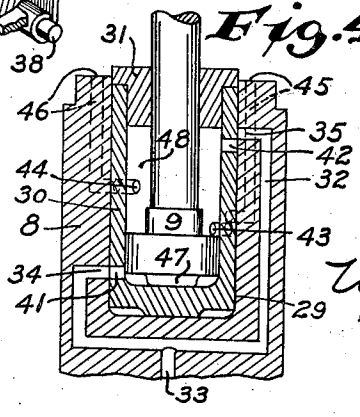


Fig. 4.



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PNEUMATIC TOOL

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10 Claims. (Cl. 121—32)

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The present invention relates generally to improvements in tools, and relates more specifically to improvements in the construction and operation of pneumatically actuated reciprocable tools such as files, cutters, sanders, or the like.

The primary object of my invention is to provide an improved power driven portable tool holder which is simple in construction and efficient in use, and which is moreover flexible in its adaptations.

It is frequently desirable to have available a power operated portable tool holder and driving mechanism which is adapted to positively reciprocate implements such as files, and which is compact but powerful in action. While it has heretofore been proposed to utilize electric motors for driving files in portable assemblages, these motors were undesirably large and bulky and the transmission mechanisms associated therewith were relatively frail and ineffective and could not be properly lubricated. Then too, it was impossible with these prior motor driven files, to eliminate overheating and to prevent filings from entering the mechanisms, so that the devices would not last for any great length of time without requiring replacement of worn parts. Although there have been some prior attempts at driving such tools pneumatically, these have not met with a great deal of success due to complicated construction thereof and failure to provide sufficient power.

The present invention therefore contemplates provision of an improved pneumatically operated reciprocable tool holder and driver, which eliminates all of the above-mentioned undesirable features, and which is adapted to positively reciprocate tools or implements of various types in a most effective manner.

Another object of the invention is to provide a compact but powerful pistol-grip type of pneumatically actuated tool holder, of light weight but of sturdy construction, and wherein the parts are well lubricated and protected against ingress of filings or the like.

A further object of my invention is to provide an improved driving mechanism for reciprocable tools such as files, which may be readily assembled and dismantled, and all parts of which are conveniently accessible for inspection.

Still another object of this invention is to provide improved power transmitting mechanism for transmitting reciprocating motion from a compact motor or source of power thru a manipulating handle around a corner to a tool or implement which is reciprocable at an angle to the

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direction of reciprocation of the prime mover, with minimum loss of power, and with the handle disposed at any desired angle.

An additional object of the invention is to provide a durable pneumatically operated file, wherein the motor and all bearings are amply lubricated at all times, and in which the spent air is utilized to prevent filings from entering the mechanism.

These and other objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the features constituting my present improvement, and of the mode of constructing and of manipulating a portable pneumatic tool embodying the invention, may be had by referring to the drawing accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a side elevation of one of the improved pistol-grip pneumatically actuated tool assemblages especially adapted for filing operation;

Fig. 2 is an enlarged part sectional exploded and perspective view of the pneumatic motor and motion transmitting mechanism of the improved assemblage, the main casing having been omitted;

Fig. 3 is a fragmentary and part sectional top view of the improved assemblage, looking directly at the corner formed by the two tubular guide portions of the main casing; and

Fig. 4 is a central longitudinal section through the improved air driven motor.

While the invention has been shown and described as being especially adapted for use in propelling or reciprocating implements such as files, it is not my intention to thereby unnecessarily restrict the utility of the improved features.

Referring to the drawing, the improved pneumatically actuated tool holder shown therein comprises in general a portable pistol-shaped main housing or casing having a tubular barrel or guide portion 6 and a tubular handle or guide portion 7, the central axes of which intersect at an oblique angle; a pneumatic motor having a cylinder 8 and a concentric reciprocable piston 9 disposed in axial alinement with the handle portion 7; an anti-friction guide bearing 10 confined within and in central alinement with the barrel portion 6 and having a tool carrying spindle 11 reciprocable therein; a pair of oppositely directed concentric stub shafts 12 formed integral with opposite side plates 13, these shafts being secured to and projecting into the main

casing near the point of intersection of the guide axes; a two-piece eccentric having alined similar parts 14 provided with eccentrically disposed integral half-pins 15 and with eccentric peripheral surfaces 16, this eccentric having a bore journalled for rotation upon the alined stub shafts 12; a connecting element or rod 17 rotatably engaging the half-pins 15 through an anti-friction or ball-bearing 18 and being swingably connected to the piston 9 by means of a pivot pin 19; and a pair of similar connecting elements or cranks 20 rotatably coacting with the peripheral eccentric surfaces 16 through anti-friction or roller bearings 21 and being swingably connected to the spindle 11 by means of a pivot pin 22.

The main pistol-shaped casing is preferably formed of two similar sections or halves which may be detachably but firmly united in any suitable manner and the side plates 13 may be removably attached to these casing sections by means of screws 23 so as to rigidly position the stub shafts 12 and to thoroughly seal the chamber within which the motion transmitting eccentric and other mechanism is housed. The anti-friction guide bearing 10 should also be firmly clamped within the barrel portion 6 of the main casing, and this bearing 10 is preferably of the ball type and coacts with the spindle 11 so as to provide openings or passages extending along the spindle for permitting free flow of lubricant and exhaust air therealong. The inner end of the bearing 10 is open to the eccentric chamber, but the outer end thereof may be provided with a flexible sealing plate 24 which will permit outward flow of air and entrained oil, but will prevent ingress of foreign matter, and the outer end of the spindle 11 is provided with a chuck 25 for detachably engaging the shank of a file 26 or other implement which is to be operated.

The improved pneumatically operated motor, the cylinder 8 of which is also firmly but detachably clamped between the handle portions 7 of the main casing, is shown in detail in Figs. 2 and 4, and is adapted to be supplied with compressed air from any suitable supply source through a flexible conduit or hose 27 secured to the lower end of the handle by a coupling 28. The piston 9 of the air motor has a relatively long stroke as compared to that of the file 26, and this piston 9 does not coact directly with the cylinder bore 29, but is embraced by and confined within a reciprocable valve cylinder 30 having a removable end closure cap 31. The cylinder 8 has an air conducting passage 32 therein, the medial portion of which communicates with a compressed air supply port 33, and the opposite ends of which communicate with lower and upper ports 34, 35 respectively, both terminating at the cylinder bore 29; and the supply port 33 is controllable by a spring pressed plunger valve 36 which is operable by a hand grip lever 37 swingably suspended from the cylinder 8 by a pivot pin 38. This plunger valve 36 has a medial taper which is cooperable with a reciprocable actuating stem 39' which in turn coacts with a ball valve 40, and when the lever 37 is pressed inwardly, as in Fig. 2, the valve 36 compresses the spring 39 and moves the stem 39' to open the ball valve 40, thus placing the port 33 into open communication with the air supply hose 27.

The reciprocable valve cylinder 30 is provided with lower and upper air supply ports 41, 42 respectively, which are alternately communicable with the main cylinder air supply ports 34, 35 respectively; and the valve cylinder 30 is also provided with lower and upper air exhaust ports 43, 44 which are alternately communicable with exhaust passages 45, 46 respectively formed in the fixed cylinder 8 and communicating with the eccentric housing chamber of the main casing. The lower exhaust port 43 is communicable with the passage 45 only when the upper movable supply port 42 is in open communication with the fixed upper air supply port 35, and the upper exhaust port 44 is likewise communicable with the passage 46 only when the lower movable supply port 41 is in open communication with the fixed lower air supply port 34; and the piston 9 is movable in opposite directions by compressed air admitted alternately to the lower and upper displacement chambers 47, 48 of the valve cylinder 30, while the valve cylinder 30 is movable in opposite directions by the reciprocating piston 9.

The improved eccentric motion transmitting mechanism which is housed within the main casing between the guide portions 6, 7 thereof, is adapted to convert the powerful long stroke reciprocating motion of the piston 9, into shorter stroke reciprocating motion of the spindle 11, by virtue of the fact that the two-part pin 15 has more eccentric throw or eccentricity than the peripheral eccentric surface 16. The fixed stub shafts 12 have their inner ends spaced apart so as to permit free gyration of the adjacent end of the connecting rod 17 therebetween; and the two parts 14 of the eccentric are likewise spaced apart, but are prevented from rotating relative to each other by the two coacting parts of the pin 15 which are formed integral with the eccentric parts 14, see Fig. 3. The eccentric parts 14 besides coacting through the ball-bearing 18 with the connecting rod 17, and through the annular roller bearing 21 with the connecting cranks 20, also coacts with the fixed stub-shafts 12 through an anti-friction or roller bearing 49. The pivot pin 22 may likewise be caused to coact with roller bearings 50 mounted in the cranks 20, thus reducing the friction losses to a minimum. This assemblage of elements provides a compact motion or power transmitting mechanism of durable construction normally confined and concealed within the main casing, and all parts of which are readily accessible by merely separating the casing sections. The improved motion transmitting mechanism also permits the handle 7 to be disposed at any desired angle relative to the barrel 6, and even in axial alinement therewith.

During normal use and operation of the improved portable pneumatic tool, the compressed air supply hose 27 should be connected to a suitable source of compressed air supply, and the desired type of file 26 should be applied to the chuck 25, whereupon the handle portion 7 and cylinder 8 of the assemblage may be gripped by the operator, and the tool may be applied to the work in any desired position. When it is desirable to reciprocate the file 26, the operator need only to press upon the hand lever 37 so as to cause the valve 36 and plunger 39' to open the ball valve 40. Compressed air from within the hose 27 will then flow through the central port 33 into the distributing passage 32. If the parts are positioned as illustrated in Figs. 2 and 4, compressed air will then flow through the registering ports 33, 41 into the lower piston displacement chamber 47, whereupon the piston 9 will be elevated to initially close the exhaust port 43 and to thereafter close the exhaust port 44, whereupon air confined above the piston will be compressed sufficiently to move the valve cylinder 30 along the cylinder bore 29

sufficiently to bring the upper air inlet port 32 in registry with the fixed air supply port 35. Simultaneously with this registration of the upper ports, the lower valve cylinder port 41 will be disconnected from the fixed lower air supply port 34 and the lower valve cylinder exhaust port 43 will be uncovered by the piston 9 and will be brought into registry with the exhaust passage 45. The compressed air will then be exhausted from the lower cylinder chamber 47 through the passage 45 and into the eccentric confining chamber of the main casing. When the port 42 is brought into registry with the fixed air supply port 35, the exhaust port 44 will be disconnected from the passage 46, and promptly thereafter compressed air will be admitted to the upper displacement chamber 48 to cause the piston 9 to move downwardly. As the piston 9 moves downwardly sufficiently to cut off the lower exhaust port 43, the air confined within the lower displacement chamber 47 will be compressed and the valve cylinder 30 will be moved downwardly until the ports 34, 41 are again brought into registry, and the exhaust port 44 of the valve cylinder is brought into communication with the exhaust passage 46. The compressed air from within the upper displacement chamber 48 will then be exhausted into the eccentric confining chamber of the main casing, so that the spent air is repeatedly being delivered into this eccentric confining chamber. As the air pressure within this chamber builds up, compressed air is discharged from within the main casing longitudinally of the guide bearing 10, and past the sealing plate 24 toward the chuck 25 and file 26, thus positively preventing filings or other foreign matter from entering the enclosed main casing. In order to cause the air thus flowing through the unit to constantly lubricate all of the internal bearings of the pneumatic motor and of the motion transmitting mechanism, quantities of oil may be admitted with the fresh supply of compressed air through the hose 27, and this oil will be in atomized condition and will abundantly lubricate all of the bearings and will ultimately be delivered from the tool past the sealing plate 24 with the exhaust air. The expansion of the exhaust air delivered into the main casing will also maintain the apparatus in cool condition at all times, and the mechanism may obviously be set in motion at will by merely gripping the lever 37 which is disposed adjacent to the manipulating handle 7. When this lever 37 is released, the motor will promptly cease operating since the spring 39 will then become effective to promptly close the plunger valve 36.

From the foregoing detailed description it will be apparent that my present invention provides an improved pneumatically operated reciprocable tool, which is simple, compact and durable in construction and which is highly efficient in operation and readily manipulable. The improved air motor is both compact and powerful, and the transmission mechanism which is interposed between the propelling motor and the implement driving spindle, may have a relatively long and powerful stroke which is automatically converted into shorter stroke reciprocation at the file 26. The improved motion transmitting mechanism moreover permits the axes of the motor and of the reciprocating driven part to be disposed at any desired angle, without interfering with the efficiency thereof, and the use of compressed air containing lubricant, not only insures abundant lubrication of all of the bearings at all times, but also positively prevents ingress of foreign matter to the interior of the main casing. The use of the anti-friction bearings throughout the major portion of the assemblage, reduces friction losses to a minimum, and while the transmission mechanism is normally thoroughly concealed and protected, it may be readily assembled and dismantled and all parts of the device are conveniently accessible. The mechanism may obviously be manufactured and operated at moderate cost, and can be used for many purposes other than driving files 26 as herein specifically illustrated.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In combination, a casing having guides the central axes of which intersect at the adjoining ends of the guides, a cylinder disposed coaxial with one of said guides, a guide bearing disposed coaxial with the other guide, an eccentric journalled in said casing for rotation about a transverse axis disposed near the point of intersection of said guide axes, said eccentric having an annular peripheral eccentric surface and an eccentric bearing portion disposed between said surface and the center of rotation thereof, a piston reciprocable within said cylinder and being operatively connected to said eccentric bearing portion to rotate said eccentric, and a tool holder reciprocable relative to said guide bearing and being operatively associated with said peripheral eccentric surface, said eccentric surface and bearing portion being formed to transform the relatively long stroke of said piston into a shorter stroke of said tool holder.

2. In combination, a casing having tubular guides the central axes of which intersect near the adjoining ends of the tubes, a cylinder disposed coaxial with one of said guides and having a piston reciprocable therein, a guide bearing disposed coaxial with the other guide and having a tool holder reciprocable therein, and an eccentric journalled for rotation in said casing between said piston and said tool holder, said eccentric having one eccentric bearing portion operatively connected to said piston and another eccentric bearing portion of lesser eccentricity operatively connected to said tool holder.

3. In combination, a casing having tubular guides the central axes of which intersect near the adjoining ends of the tubes, a cylinder disposed coaxial with one of said guides and having a piston reciprocable therein, a guide bearing disposed coaxial with the other guide and having a tool holder reciprocable therein, an eccentric journalled for rotation in said casing between said piston and said tool holder and having two eccentric bearing portions of different eccentricity, a connecting element swingably associated with said piston and rotatably engaging one of said eccentric bearing portions, and another connecting element rotatably engaging the other eccentric bearing portion and being swingably associated with said tool holder, said eccentric bearing portions being formed to transform the relatively long stroke of said piston into a shorter stroke of said tool holder.

4. In combination, a casing having tubular guides the central axes of which intersect near the adjoining ends of the tubes, a cylinder disposed coaxial with one of said guides and having

a piston reciprocable therein, a guide bearing disposed coaxial with the other guide and having a tool holder reciprocable therein, an eccentric journalled for rotation in said casing between said piston and said tool holder and having two eccentric bearing portions of different eccentricity, a connecting element pivotally attached to said piston and rotatably engaging the eccentric bearing portion having greatest eccentricity, and another connecting element rotatably engaging the eccentric bearing portion having lesser eccentricity and being pivotally attached to said tool holder.

5. In combination, a casing having a tubular barrel and a tubular handle disposed at an oblique angle relative to the barrel, an anti-friction guide bearing confined within said barrel, a tool carrying spindle reciprocable within said bearing, a pneumatic motor secured to said handle and having a piston reciprocable therein, and a double throw eccentric rotatable within said casing and cooperating with said piston and spindle to convert the relatively long stroke reciprocating motion of the piston into shorter stroke reciprocation of the spindle.

6. In combination, a longitudinally divided casing having barrel and handle portions communicating with an intervening chamber, a tool carrying spindle reciprocable within said barrel portion, a fluid pressure operated motor secured to said handle portion and having a piston reciprocable therein, alined stub shafts secured to the divisions of said casing and projecting into said chamber, an eccentric having spaced parts rotatable upon said stub shafts and each part being provided with half of an eccentric pin and with eccentric peripheral surfaces, a connecting rod interposed between said piston and said pin to impart rotation to said eccentric, and connecting cranks interposed between said peripheral surfaces and said spindle to impart reciprocation to the spindle.

7. In combination, a longitudinally divided casing having a medial chamber and tubular portions extending away from the chamber in different directions, a spindle reciprocable in one of said portions, a piston reciprocable in another of said portions, stub shafts secured to the divisions of said casing and projecting into said chamber, an eccentric having spaced sections journalled for rotation upon said shafts and each section being provided with an eccentric pin and with an eccentric peripheral surface having lesser radius of throw than said pin, a connecting rod interposed between said piston and said pin, and a connecting crank interposed between said surface and said spindle.

8. In combination, a longitudinally divided casing having tubular portions separated by an intervening chamber, a spindle reciprocable in one of said portions, an air motor having a piston reciprocable in another of said portions, alined stub shafts detachably secured to the divisions of said casing and extending into said chamber, an eccentric having two separated parts journalled for rotation on said shafts and each part being provided with an integral half-pin cooperating to form a unitary eccentric pin spanning the space between the parts, means connecting said piston and said eccentric pin, and means drivingly connecting said eccentric and said spindle.

9. In combination, a longitudinally divided casing having tubular portions separated by an intervening chamber, a spindle reciprocable in one of said portions, an air motor having a piston reciprocable in another of said portions, alined stub shafts mounted in separate divisions of said casing and extending into said chamber, an eccentric having two separated parts journalled for rotation on said shafts and each part being provided with an integral half-pin cooperating to provide a unitary eccentric pin spanning the space between the parts, a connecting rod interposed between said piston and said eccentric pin to rotate said eccentric about said shafts, and connecting means interposed between each of said eccentric parts and said spindle to reciprocate the spindle.

10. In combination, a longitudinally divided casing having tubular portions separated by an intervening chamber, a spindle reciprocable in one of said portions, an air motor having a piston reciprocable in another of said portions, alined stub shafts mounted in separate divisions of said casing and extending into said chamber, an eccentric having two separated parts journalled for rotation on said shafts and each part being provided with an integral half-pin cooperating to provide a unitary eccentric pin spanning the space between the parts, means connecting said piston and said eccentric pin, means drivingly connecting said eccentric and said spindle, and means for directing lubricant laden exhaust air from said motor through said chamber.

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