United States Patent

[11] 3,587,365

[72] Inventor **Raoul H. De Gaston**
Lynwood, Calif.

[21] Appl. No. **840,146**
[22] Filed **July 9, 1969**
[45] Patented **June 28, 1971**

[54] **AIR-POWERED WRENCH**
7 Claims, 5 Drawing Figs.

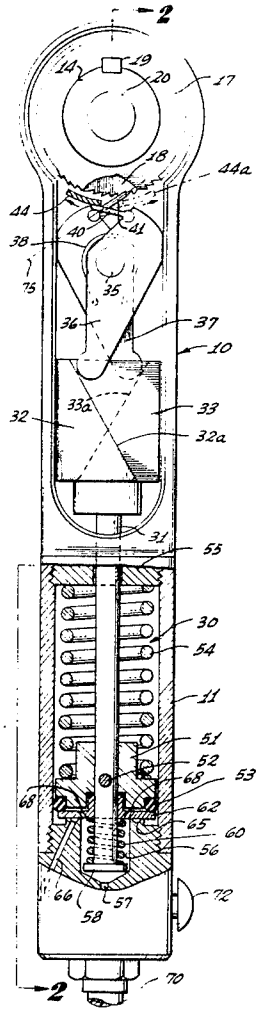
[52] **U.S. Cl.** **81/58.1,** 74/142
[51] **Int. Cl.** **B25b 13/00**
[50] **Field of Search** ..... 81/57.39, 58.1, 63.1, 62; 74/142; 173/108, (Inquired)

[56] **References Cited**
UNITED STATES PATENTS

2,758,569	8/1956	Peterson	81/58.1X
2,508,568	5/1950	Ellison	81/58.1X

Primary Examiner—James L. Jones, Jr.
Attorney—Forrest J. Lilly

ABSTRACT: This wrench is essentially a hand tool provided with auxiliary power in the form of an air motor for rapidly turning nuts or other threaded fasteners when moving freely with relatively low torque. At the same time, the tool is capable of normal use as a hand-operated tool.



PATENTED JUN 28 1971

3,587,365

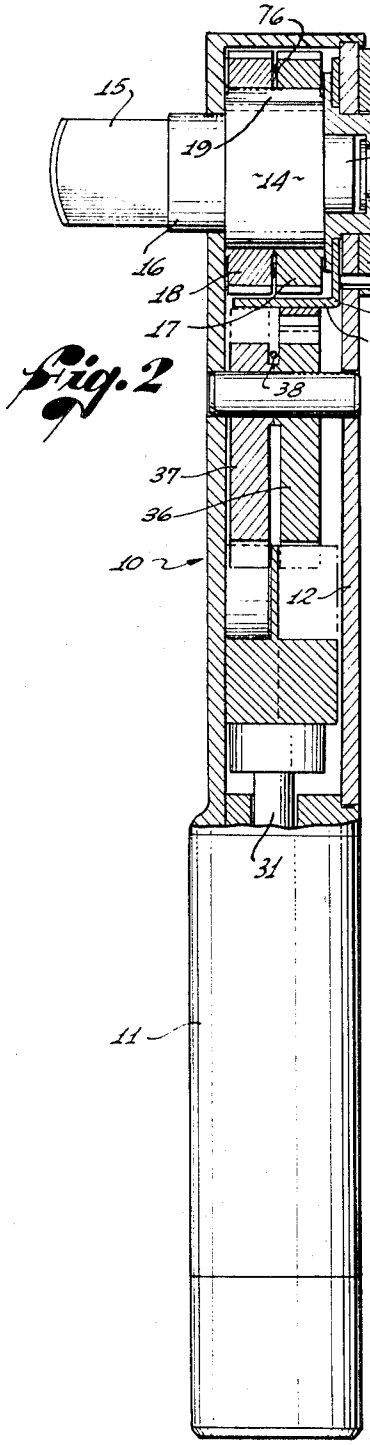


Fig. 2

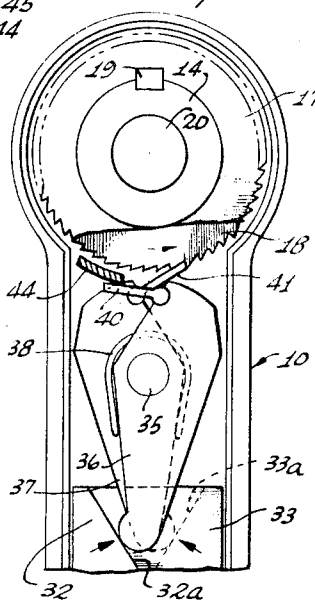


Fig. 3

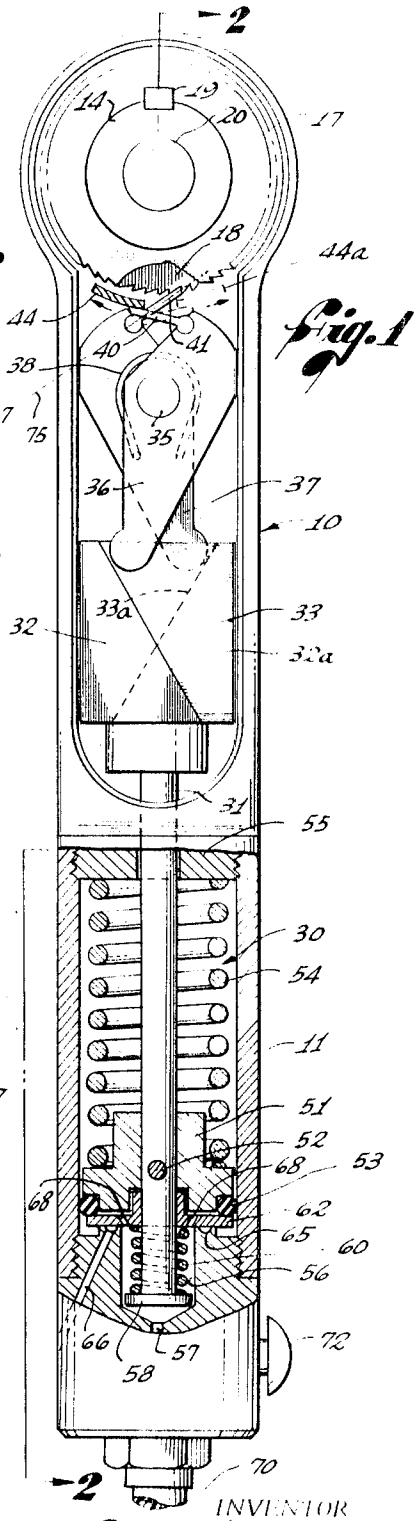


Fig. 1



Fig. 4

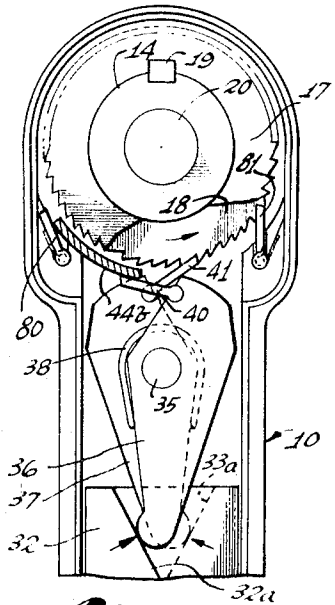


Fig. 5

INVENTOR
RAOUL de GASTON
BY Forrest J. Lilly
ATTORNEY

AIR-POWERED WRENCH

BACKGROUND OF THE INVENTION

The present invention relates generally to hand tools and more particularly to a wrench that can be operated in the normal manner as a hand tool, but is provided with a small air-powered motor as an auxiliary power source for performing rapidly low-torque jobs.

When applying a nut to a bolt or initially seating a machine screw, the fastener can normally be turned with ease through several complete revolutions before it begins to tighten up against the object being held in place. When this operation is being repeated a large number of times, a substantial amount of time can be saved by using a fast-turning powered wrench which is able to run up the fastener through these initial free-turning revolutions. The fastener is then finally set tight by hand since this is within the strength of the operator and requires considerably more power than is required to run up the fastener to this point.

Conversely, breaking loose a nut or machine screw can conveniently and quickly be done by hand by an operator. The remaining work of removing the freely turning nut or other fastener is then easily accomplished but is somewhat tedious if done by hand so that a lightly powered wrench is a big advantage from the standpoint of saving time.

These circumstances indicate the need for a light weight tool that is simple and inexpensive and is in the general class of a hand tool. Preferably it should be capable of use as a hand tool without any difficulty, but considerable time can be saved in many operations where a high-speed motor can, with only a small power output, turn a nut or bolt rapidly for several revolutions. A tool of this character eliminates the need for a relatively heavy and expensive power tool.

Thus it becomes a general object of the present invention to provide a combined tool which can be operated as a hand tool and which has also incorporated in it an auxiliary power source for low-torque jobs.

It is also an object of the present invention to provide a reversible wrench of novel construction that can be operated by a reciprocating motor located in the handle.

A further object of the invention is to provide a combined hand and powered tool which may be operated either by air power or by hand and which is novel in design and simple in construction.

SUMMARY OF THE INVENTION

These and other objects and advantages of the present invention are achieved in a wrench embodying the invention by providing an elongated body a portion of which serves as a handle, a drive shank rotatably mounted in the body, one or more ratchet wheels secured to the drive shank and each intermittently rotated by an associated pawl carried by a lever pivotally mounted on the body, and means for oscillating the lever to rotate the drive shank, such means including an air-powered reciprocating motor. In a preferred embodiment, the wrench is reversible, requiring a pair of ratchet wheels of opposite hand, each drive by a separate pawl and lever and including means for manually shifting a selected driving pawl to an inoperative position at which it disengages the associated ratchet wheel whereby the drive shank and wheel are rotated in a selected direction by the reciprocating motor.

DESCRIPTION OF THE DRAWING

How the above objects an advantages of the present invention, as well as others not specifically mentioned, are achieved will be more readily understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a top plan view of a wrench constructed according to the present invention with the cover plate removed and part of the body broken away to disclose interior parts;

FIG. 2 is a combined longitudinal median section and side elevation viewed as on line 2–2 of FIG. 1;

FIG. 3 is a fragmentary plan similar to FIG. 1 showing the position of the levers when the reciprocating pushrod is advanced to turn a ratchet wheel;

FIG. 4 is an enlarged side elevation of a driving pawl and the spring associated with it; and

FIG. 5 is a view similar to FIG. 3 showing a modified form having holding pawls to prevent undesired reverse rotation.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, and particularly to FIG. 1, it will be seen that the wrench illustrated therein comprises a body indicated generally at **10** and preferably made in plurality of sections which may be joined in any suitable manner, as by screw-threaded joints. The body is elongated in shape and hollow. At one end the body is shaped to provide a handle **11**, while at the other end the body is open at one side to permit insertion of moving parts of the wrench, the opening in the body being close by cover plate **12**, shown in FIG. **2**.

the end of body **10** remote from handle **11** is preferably somewhat enlarged in order to form a recess that receives driven body **14**. This driven body includes polygonal shank **15** which extends outwardly from the body at one side thereof and is adapted for connection to sockets (not shown) of different sizes. Inwardly of drive shank **15**, the driven body comprises a cylindrical section **16** passing through a circular opening in body **12** to provide a bearing for the driven member to rotate with respect to the handle.

Inside body **10**, two ratchet wheels **17** and **18** are nonrotatable secured to driven body **14** by any suitable means, for example by a key **19**. Body **14** also has a second cylindrical section **20** which is received in socket **21** that provides a journal bearing for the driven member. Socket **21** extends outwardly of the wrench body through cover plate **12** to properly position the socket.

Outside of socket **21** is washer **22** beneath which is a spring washer **23** that bears at its other side against shift ring **24**, the function of which will be explained later. The shift ring and the washer are held assembled on bearing socket **21** by rivet **25**.

Power for actuating the ratchet and shank **15** is obtained from an air motor indicated generally at **30** and contained in handle section **11**, as will be described later. Motor **30** reciprocates pushrod **31** to one end of which there is connected a pair of cams **32** and **33**. As shown in FIG. **1**, the two cams have planar operating faces **32***a* and **33***a*, respectively, disposed at an angle to the axis of pushrod **31**, the inclination of the cam faces being equal and opposite with respect to this axis.

Pivotally mounted within body **10** by pin **35** are two levers **36** and **37** which respectively bear against cam faces **32***a* and **33***a*. Yielding contact with the cam faces by the levers is maintained by spring **38** looped around pivot **35**, the two ends of the spring being bent laterally in opposite directions and seated in openings in the two opposed faces of levers **36** and **37**.

At the ends of the levers remote from cams **32** and **33**, each of the levers is provided with a pawl, as shown best in FIG. **1**. Lever **36** carries pawl **40**, while lever **37** carries pawl **41**, these two pawls being disposed to cooperate respectively with peripheral teeth on ratchet wheels **17** and **18**. Each pawl is provided with spring means which normally urges the pawl into operative engagement with the ratchet teeth. As an example of such spring means there is shown in FIG. **4** a coil spring **42**. One end of the spring bears against the pawl and the other against the lever.

However, since it is desired to have one pawl in engagement with a ratchet wheel at a time, there is provided shift curtain **44** which is interposed between the pawls and the ratchet wheels in such a manner that the curtain can engage one or the other of pawls **40** and **41**, as desired, and move In pawl to an inoperative position in which it disengages the ratchet teeth against the normal urging of the spring means as mentioned.

Shift curtain 44 is a platelike member which depends from ring 45 rotatably supported on a radial flange that is part of socket 21. Ring 45 carries pin 46 which projects through an arcuate slot in cover plate 12 into a socket in shift ring 24. This arrangement permits the operator to manipulate shift ring 24 in order to move the shift curtain from the full-line position of FIG. 1 to the dotted line position 44*a*. In the first position, pawl 40 is engaged and rendered inoperative, while in the second or alternate position pawl 41 is engaged and rendered inoperative while pawl 40 is released to engage the teeth of ratchet wheel 17.

Any suitable type of reciprocating air motor may be employed for reciprocating push rod 31; and thus the motor herein illustrated may be considered as exemplary of such motors. This motor is described in greater detail and claimed in my earlier U.S. Pat. No. 3,230,839 issued Jan. 25, 1966.

The interior of handle section 11 is a smooth cylindrical bore within which is slidably mounted piston 51. Piston 51 is pinned at 52 to rod 31 and is provided with peripheral sealing means at 53 to sealingly engage the cylindrical bore. The piston is normally urged to the position of FIG. 1 by spring 54 which bears at one end against piston 51 and at the other end against abutment 55 at forward end of the cylinder. The abutment is a portion of the wrench body and has a central aperture therethrough to act as a guide for push rod 31.

At one end, pushrod 31 extends into air inlet chamber 56 into which air is introduced through flow restricting orifice 57. The end of piston rod 31 is enlarged at 58 in order to provide an abutment against which bears one end of coil spring 60 surrounding the pushrod. The other end of spring 60 bears against valve disc 62 which is slidable on rod 31 and is engageable with an annular seat 63 surrounding air inlet passage 56, as shown in FIG. 1. Valve disc 62 is normally urged into this seating position by force exerted on it from piston 51. In this position, disc 62 closes an annular recess 65 in seat 63 which serves as an exhaust manifold that communicates with the atmosphere through a plurality of exhaust passages 66.

Valve disc 62 is provided with a plurality of inlet air passages 68 which admit air from passage 56 into the cylinder bore rearwardly of piston 51 to exert pressure on the piston.

A suitable inlet valve, not shown in detail in the drawing, is provided to control admission of air through port 57 to the motor from supply line 70 which is connected to any suitable supply of air under pressure, not shown on the drawing. The inlet valve is operated by pushbutton 72 which gives the user control over the operation of the wrench.

In operation, when button 72 is depressed, compressed air is admitted through orifice 57 into chamber 56 and thence through passages 68 into the operating cylinder. The fluid pressure against piston 51 drives it upwardly in FIG. 1, advancing pushrod 31 toward levers 36 and 37. As cams 32 and 33 move toward the levers, the levers swing in opposite directions about pivot 35, the ends of the levers being brought together as shown in FIG. 3. The movement at the other end of the levers causes pawl 41 to move clockwise to the right in FIG. 3, rotating lower ratchet wheel 18 in a counterclockwise direction. The other pawl 40 is free to move in the opposite direction as it is disengaged from its associated ratchet wheel by shift curtain 44 and so is inoperative.

At some point in the advance of pushrod 31, spring 60 is compressed and valve disc 62 is unseated, allowing the air in the cylinder to exhaust through annular passage 65 and exhaust passage 66. Reduction in fluid pressure on the piston permits spring 54 to return the piston to the starting position in the cylinder and to seat disc 62 again. This return movement retracts cams 32 and 33; and levers 36 and 37 now swing in opposite directions under the influence of spring 38, restoring pawls 40 and 41 to their initial positions as shown in FIG. 1. This sequence of operations constitutes a complete cycle of operation. The cycle is repeated in rapid succession as long as air is admitted into the reciprocating air motor by depressing button 72. Upon release of this button, actuation of shank 15 by the air motor ceases.

During the sequence of operations above-described, pawl 41 is operative and shank 15 is rotated in a counterclockwise direction to remove a nut or bolt having a normal right-hand thread. To reverse the direction of rotation of shank 15, curtain 44 is manually shifted counterclockwise to the position 44*a* by the operator by manipulating shift ring 24. In the alternate position, pawl 41 is held in an inoperative position while pawl 40 engages operatively the upper ratchet wheel 17. Under these conditions, the direction of rotation of shank 15 is reversed and is clockwise, this being the direction for tightening a nut or bolt with a standard thread.

Wrench 10 can be used as a hand tool in the usual manner, without the auxiliary power from motor 30. To accommodate to hand usage, each lever 36 and 37 has a surface 36*a* and 37*a*, respectively, that engages the inside surface of body 10 as shown in FIG. 1, at the end of the return stroke under the influence of spring 58. These surfaces on the levers are located forwardly of pin 35, and are moved out of contact with the body during each power stroke of the levers, as seen in FIG. 3.

The thrust from the body, when used as a manual wrench, passes through a lever 36 or 37 in a direction parallel to the length of a pawl as indicated by line 75 in FIG. 1. This thrust line 75 passes through the area of contact between the body and lever, thus removing stress from any element of the drive between motor 30 and the levers when high-torque loads are applied to shank 15 by the tool.

It is preferable to insert a spring washer 76 between the two ratchet wheels 17 and 18. They are sufficiently loosely mounted on body 14 that the washer forces the two ratchet wheels apart. Ratchet wheel 17 frictionally engages the face of the flange on socket 21 while ratchet 18 similarly engages the inside face of body 10. This frictional contact provides sufficient drag on each of the ratchet wheels that they do not turn in a reverse direction during the return stroke of either of the driving pawls 40 and 41.

This feature is of advantage when driven shank 15 is connected to a loose nut or other fastener that offers no appreciable resistance to rotation.

Positive holding means to prevent reverse rotation of the ratchet wheels may be provided instead, if desired. Such positive means are shown in FIG. 5 in the form of two holding pawls 80 and 81 pivotally mounted inside housing 10.

Each of pawls 80 and 81 is normally urged into engagement with a ratchet wheel by spring means such as shown in FIG. 4. A selected holding pawl can be rendered inoperative by shift curtain 44*b* which is like curtain 44 but has been enlarged in a circumferential direction for a distance sufficient that the shift curtain disengages an appropriate holding pawl from contact with one ratchet wheel when it is in position to render inoperative a driving pawl for the other ratchet wheel. Means for preventing reverse rotation of the ratchet wheels make for more positive action of the wrench when driven by the air motor because of the rapid motion of the driving elements.

It will be apparent that various changes in the sizes, details and arrangements of the parts constituting the present invention may occur to persons skilled in the art without departing from the spirit and scope of the present invention. Consequently, the above description is considered to be illustrative of, rather than limitative upon, the invention disclosed herein.

I claim:

1. An air-powered wrench comprising:
- an elongated body providing a handle;
- a drive shank rotatably mounted in the body;
- a ratchet wheel secured to the drive shank coaxially thereof;
- a lever pivotally mounted in the body;
- a driving pawl pivotally mounted on one end of the lever to engage the ratchet wheel;
- means urging the pawl into engagement with the ratchet wheel;
- a cam reciprocable longitudinally of the handle in engagement with the lever to oscillate the lever and thereby to periodically advance the pawl and ratchet wheel; and

air-powered motor means in the body reciprocating the cam.

2. A reversible combination hand and air-powered wrench comprising:

an elongated body providing a handle;

a drive shank rotatably mounted in the body;

a pair of ratchet wheels of opposite hand secured to the drive shank and coaxial therewith;

a pair of levers pivotally mounted on a common axis;

a driving pawl carried on each lever and engageable with one ratchet wheel;

means for urging each driving pawl into operative engagement with an associated ratchet wheel,

means manually operable to disengage a selected driving pawl from the associated ratchet wheel; and

means for oscillating the levers about said pivot and thereby periodically to advance a pawl in engagement with a ratchet wheel to rotate the drive shank in a selected direction including air-powered motor means.

3. A reversible wrench according to claim 2 in which the means for oscillating the levers comprises:

a pair of cams reciprocable within the body, each cam engaging one of said levers; and

a pushrod connected to both cams and reciprocated by the motor means.

4. A reversible wrench according to claim 3 in which the two cams have oppositely inclined faces each slidably engaging one of the levers.

5. A reversible wrench according to claim 2 that also includes means for opposing reverse rotation of a ratchet wheel.

6. A reversible wrench according to claim 2 that also includes means creating a frictional drag on each ratchet wheel opposing rotation of the ratchet wheels.

7. A reversible wrench according to claim 2 that also includes:

a pair of holding pawls mounted on the body; and

means for urging each holding pawl into operative engagement with an associated ratchet wheel to prevent reverse rotation of the associated wheel;

the means for disengaging a driving pawl also being operative to simultaneously disengage a holding pawl from a ratchet wheel.