Nov. 25, 1941. E. B. LEAR 2,263,736

PORTABLE TOOL

Filed June 9, 1939

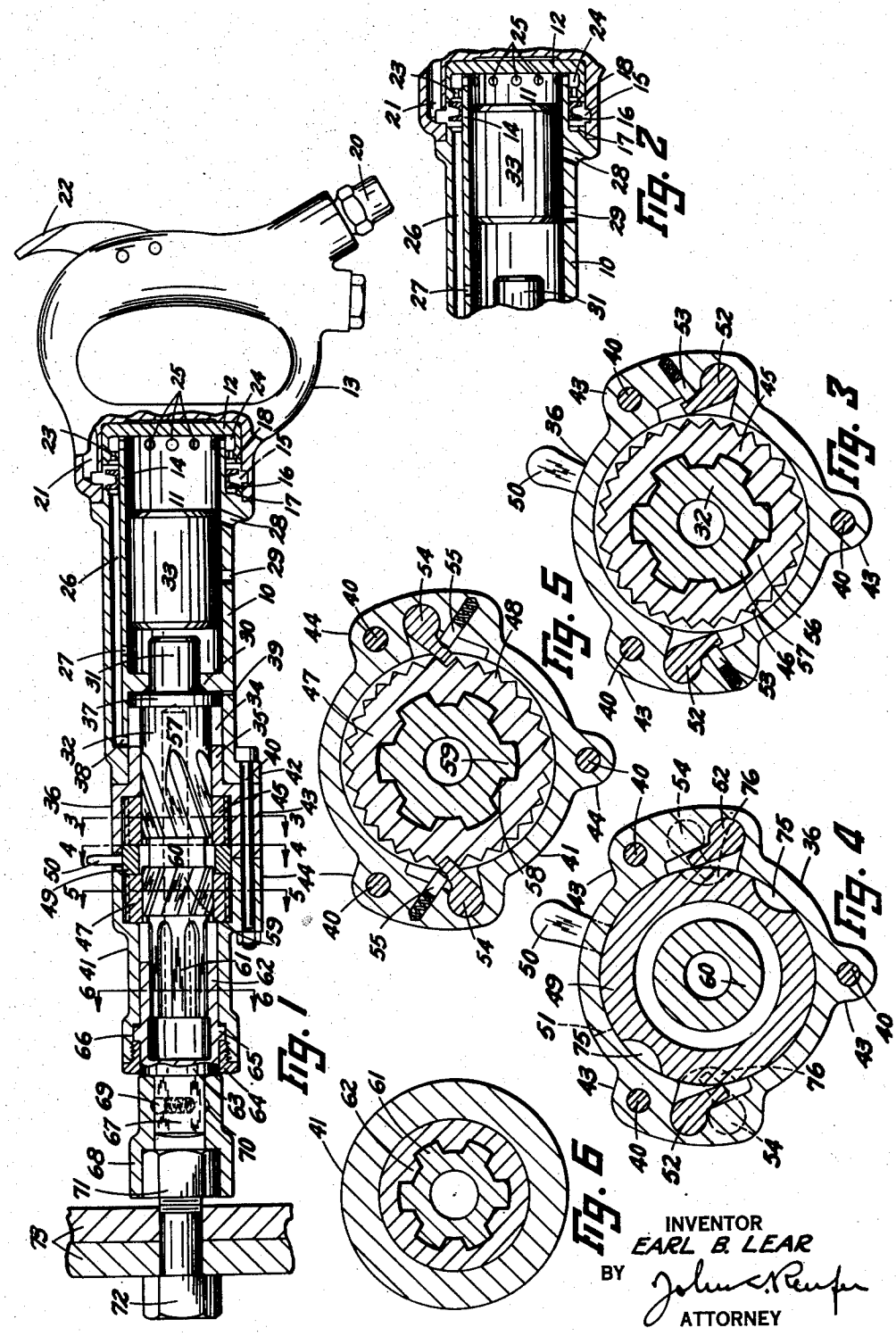


Fig. 1

Fig. 2

Fig. 3

Fig. 5

Fig. 4

Fig. 6

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Patented Nov. 25, 1941 2,263,736

UNITED STATES PATENT OFFICE

2,263,736

PORTABLE TOOL

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Application June 9, 1939, Serial No. 278,213

6 Claims. (Cl. 81—54)

This invention relates broadly to fluid actuated portable tools, but more particularly to portable tools especially fitted for setting or removing bolts, nuts or the like.

One object of this invention is to produce a fluid actuated reciprocatory motor with means for automatically transforming the reciprocatory motion of the motor into rotary motion capable of being transmitted to the work in either direction.

Another object of this invention is to produce a simple and efficient power wrench through which reciprocatory motion of a power actuated element may be transformed into an intermittent rotary motion of a driven member, the wrench including means for selectively controlling the direction of rotation of the driven member.

Another object of this invention is to produce such a portable tool forming a compact and slender assembly, which can be handled and operated without difficulty.

Other objects and advantages more or less ancillary to the foregoing reside in the specific construction and aggroupment of the elements peculiar to this structure, as will become apparent from a more complete examination of this specification.

In the drawing:

Fig. 1 is a longitudinal sectional view of a tool embodying the invention.

Fig. 2 is a fragmental view of the upper end portion of the tool shown in Fig. 1, with the movable parts in another position.

Fig. 3 is an enlarged cross sectional view taken in a plane indicated by line 3—3 in Fig. 1.

Fig. 4 is an enlarged cross sectional view taken in a plane indicated by line 4—4 in Fig. 1.

Fig. 5 is an enlarged cross sectional view taken in a plane indicated by line 5—5 in Fig. 1.

Fig. 6 is an enlarged cross sectional view taken in a plane indicated by line 6—6 in Fig. 1.

Referring to the drawing, 10 represents a cylinder formed with a piston chamber 11. The upper end of this chamber is closed by a cap 12 clamped on the cylinder by a handle 13 which is rigidly secured to the cylinder by any suitable means. The handle 13 extends partway over the upper end of the cylinder 10, which is reduced to form a sleevelike portion 14 spaced from the interior of the handle 13 to provide a valve chamber 15 within which is reciprocably mounted a valve 16 adapted to seat on an annular shoulder 17 formed on the cylinder 10, and on the opposed end 18 of the cap 12. The valve 14 is nothing more than the usual ring valve subjected to pressure conditions within the chamber 15 for automatically engaging either the seat 17 or 18, thereby controlling the admission of the motive fluid into the piston chamber 11 as hereinafter explained.

To the handle 13 is also secured a connection 20 through which motive fluid may be admitted into a port 21 by depressing a throttle trigger 22. The port 21 opens into the valve chamber 15 from which leads a plurality of ports 23 located through the valve seat 18 and opening into the upper end of the piston chamber 11 through an annular groove 24 and radial ports 25. Leading from the valve chamber 15 through the valve seat 17, there is one or more ports 26 opening into the front end of the piston chamber 11 through a radial port 27, while the chamber 11 is provided with an upper exhaust port 28 and a lower one 29.

Near its front end, the cylinder 10 has an apertured partition 30 extending thereacross and through which is slidably mounted the shank 31 of a splined stem or spindle 32, which shanks extends into the piston chamber 11 to receive impacts from a piston 33 reciprocably mounted therein. Below the partition 30, the cylinder 10 is again formed with a cushion chamber 34, which is closed by the sleeve portion 35 of a spacer 36, the former extending into the chamber 34 while the latter abuts against the front end of the cylinder 10 as clearly shown in Fig. 1. On the stem 32 is formed an annular flange or collar 37 reciprocably mounted within the cushion chamber 34, which chamber has its lower end in constant communication with the port 26 through a radial port 38 and its upper end with the atmosphere through a vent 39.

Clamped against the spacer 36 by bolts 40, there is a front casing 41 disposed coaxially with the center axis of the cylinder 10. As shown in Fig. 1, the bolts extend through apertured lugs 42, 43 and 44 formed on the cylinder 10, the spacer 36 and the front housing 41 respectively. The adjacent end portions of the spacer 36 and front housing 41 are internally machined, the former to accommodate a rotatable ratchet ring 45 having teeth 46 formed on the peripheral wall thereof, while the latter accommodates a similar ring 47 formed with teeth 48. These two ratchet rings are spaced by a third ring 49 having a handle 50 rigidly secured thereto and extending laterally therefrom to the exterior of the front casing 41 through a slot 51 cut through the side wall of the casing. Adjacent the ratchet ring 45, the spacer 36 is adequately machined to pivotally accommodate one or more pawls 52 constantly urged in engagement with one side of the teeth 46 by a spring pressed plunger 53, while the front housing 41 adjacent the ratchet ring 47 is similarly machined to pivotally receive the pawls 54 engageable with the one side of the teeth 48 and urged inwardly by spring pressed plung-

ers 55. As shown in Fig. 3, the pawls 52 are located in a manner preventing rotation of the ring 45 in a clockwise direction, while in Fig. 5 the pawls 54 are located in a manner preventing rotation of the ring 47 in a counterclockwise direction. The pawls 52 and 54 are somewhat longer than the width of the rings 45 and 47, and consequently extend partway over the ring 49, which has its peripheral wall adjacent the pawls 52 provided with two diametrically opposed notches 75 and adjacent the pawls 54 with two similar notches 76. Internally, the ring 45 is provided with left hand relical splines 56 engaged by complemental splines 57 formed on the portion of the stem 32 extending through the ring. The ratchet ring 47 is internally machined with helical right hand splines 58 engaged by similar splines 59 formed on the adjacent portion of the stem 32. Between the splines 57 and 59 of the stem 32, there is provided an annular recess 60 of a width calculated to prevent possible engagement of the spines 57 with the spline 58 of the ring 47 or of the splines 59 with the splines 56 of the ring 45.

The stem 32 extends beyond the portion formed with the splines 59, where it is slightly reduced in diameter and is provided with straight splines 61 meshing with corresponding internal splines 62 formed within the upper end portion of a chuck 63 rotatably mounted within the front housing 41 and held therein against endwise movement by a retaining nut 64 engaging an annular flange 65 formed on the chuck and located within a counterbore 66 forming the lower end of the front housing 41. The chuck 63 extends beyond the front end of the front housing 41 where it is made of a polygonal cross section as at 67 to receive a socket 68 held thereon against gravity by a spring pressed ball 69 carried by the chuck 64 and extending into detents 70 formed within the socket 68, which socket is adapted to engage the work such as a nut 71 threaded on the bolt 72 for clamping together two plates 73.

In the operation of the tool, when motive fluid is admitted into the valve chamber 15 through the port 21, if the valve 16 is positioned as shown in Fig. 1, the motive fluid will flow through the ports 23 into the groove 24 and therefrom into the upper end of the piston chamber 11 through the ports 25, thereby acting on the piston 33 for driving it downwardly. As the piston approaches the end of its working stroke, the atmospheric air stored within the front end of the piston chamber 11 will be compressed by the piston causing upward pressure to be exerted on the valve 16, which pressure will together with a drop of pressure taking place within the upper end of the piston chamber 11 when the piston uncovers the exhaust port 28, cause the shifting of the valve from the position shown in Fig. 1 to the position shown in Fig. 2. After the piston 33 has delivered its impact on the shank 31, it will immediately be driven rearwardly by the action of the motive fluid admitted into the front end of the piston chamber 11 through the passage 26 and port 27. As the piston reaches the upper end of its return stroke, the air compressed within the upper end of the piston chamber 11 together with a drop of pressure within the front end of that chamber by the piston uncovering the exhaust port 29, will again cause the valve 16 to shift from the position show in Fig. 2 to that in Fig. 1, thus completing the cycle.

From the above explanation, it will be understood that by depressing the trigger of the throttle valve 22, automatic reciprocation of the piston 33 is effected for imparting a rapid succession of impacts to the shank 31 of the stem or spindle 32. It will also be understood that any suitable type of reciprocatory motor may be included in the mechanism without in any way departing from the scope of the invention.

Referring now more particularly to the invention, it is again pointed out that the impacts of the piston on the shank 31 will cause longitudinal motion of the stem 32, which motion is limited by motive fluid being admitted into the cushion chamber 34 through the port 38 concurrently with the admission of the motive fluid into the front end of the piston chamber 11 through a port 27 for effecting the return stroke of the piston. In other words, after impacts of the piston 33 on the shank 31 effecting the working strokes of the stem, the motive fluid will automatically be admitted under the collar 37 of the stem 32 for effecting return movement of the stem into the position shown in Fig. 1, in which instance, the chamber back of the collar is vented to the atmosphere via the vent 39.

When the ring 49 is positioned as shown in Fig. 4, the notches 75 are located out of registration with the pawls 52, causing them to rest on the peripheral wall of the ring 49 and consequently maintaining them out of engagement with the teeth 46 of the ratchet ring 45. In this position of the ring 49, the notches 76 are located for registration with the pawls 54 enabling them to engage the teeth 48 of the ratchet ring 47 for normally preventing rotation of the ring in a counterclockwise direction in Fig. 5. In this instance, during the working strokes of the stem 32, its splines 57 cooperating with the splines 56 of the ratchet ring 45 are rendered ineffective due to the disengagement of the pawls 52 with the teeth of the ring 45, while the stem's splines 59 engaging the splines 58 of the ratchet ring 47 will, during the working stroke of the stem 42, tend to rotate the ring 47 in a counterclockwise direction in Fig. 5, which rotation is prevented due to the engagement of the pawls 54 with the teeth 48 of the ring, thus causing rotation in a clockwise direction in Fig. 5 to be imparted to the stem 32, which rotation is in turn transmitted to the chuck 63 by the driving connection including the splines 61 and 62 of the stem 32 and sleeve 62 respectively. From the chuck 63, rotation is finally transmitted to the socket 68 for rotating the work engaged thereby.

During the return stroke of the stem 32, the splines 59 cooperating with the splines 58 of the ring 47 will now impart rotation to the ring in a clockwise direction in Fig. 5, while the pawls 54 simply ride over the teeth 48, thus enabling return stroke of the stem without imparting rotation thereto and consequently enabling the work 71 heretofore rotated in one direction to remain momentarily stationary. Subsequently the impact of the piston 33 on the shank 31 will again effect the working stroke of the stem 32 and its consequential rotation in a clockwise direction for again rotating the work.

When it is desired to rotate the work in the other direction, the ring 49 may be rotated to bring its handle 50 to the other end of the slot 51, in which instance the notches 75 will be located for registration with the pawls 52 to enable the engagement of the pawls with the teeth 46 of the ratchet ring 45, while the notches 76 will be moved out of registration with the pawls 54 resulting in the engagement of the pawls 54 with

the peripheral wall of the ring **49** to maintain the pawls out of engagement with the teeth of the ring **47**. In this last position of the ring **49**, during the working stroke of the plunger **32** resulting from the impact of the piston **33** on the shank **31**, the stem spline **57** cooperating with the spline **56** of the ratchet ring **45** will normally tend to rotate the ring in a clockwise direction in Fig. 3, which rotation is prevented by the engagement of the pawls **52** with the teeth **46** of the ring, thus resulting in the rotation of the stem in a counterclockwise direction. In this instance, this rotation of the stem in a counterclockwise direction is also transmitted to the socket **68** for rotating the nut **71** to remove it from the bolt **72**, that is, for rotating the work in a direction adverse to that previously referred to. During the return stroke of the plunger **32**, its spline **57** active on the spline **56** of the ratchet ring **45** will rotate the ring in a clockwise direction in Fig. 3, which rotation will take place while the pawls **32** simply ride the teeth **46** of the ring and the stem **32** is moved back into the position shown in Fig. 1 without having any rotation imparted thereto.

From the foregoing explanation, it will be understood that impacts of the piston **33** on the stem **32** result in the rotation of the stem in one or the other direction, which direction will be controlled by the simple rotation of the ring **49**. Due to the impacts of the piston **33** on the stem **32**, the rotation thus transmitted to the stem and therefrom to the socket **68** will be a sudden and powerful rotation found to be very effective for setting or removing the nut **71** or its equivalent. Because of the rapid reciprocation of the piston **33** and consequently the rapid succession of impacts on the stem **32**, the intermittent rotation transmitted to the socket **68** actually takes the appearance of a continuous rotation which is transmitted to the nut **71** by imparting to the nut a vibratory action resulting from the reversal of the piston stroke **33** and intermittent torque transmitted to the nut **71**, which vibratory action is known to be effective in setting or removing the work similar to the nut **71**.

Although the foregoing description is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology is not intended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In a tool of the character described, a housing, a rotatable spindle reciprocable within said housing, means including a pneumatic hammer coaxially with said spindle and active thereon for effecting its reciprocation, two sets of longitudinally spaced oppositively disposed helical splines on said spindle, a ratchet mechanism operatively associable with one or the other set of said splines for effecting rotation of said spindle in one or the other direction by virtue of the strokes of said spindle in one direction, and means for selectively controlling the operative engagement of said mechanism with one or the other set of said splines.

2. In a tool of the character described, a housing, a work engaging chuck journaled within said housing, a reciprocable and rotatable stem connected with said chuck against rotation relative thereto, two sets of longitudinally spaced oppositively disposed helical splines on said stem, a ratchet ring for each set of splines operatively associated therewith, pawls carried by said housing engageable with said ratchet rings for effecting rotation of said stem in one or the other direction by virtue of its strokes in one direction, rotatable means for selectively controlling the engagement of said pawls with said rings, a pneumatic hammer connected with the housing and having a piston for imparting blows to said stem resulting in its strokes in said one direction, and means on said stem subjected to the live air pressure supplied to the hammer for effecting the strokes of said stem in the other direction.

3. In a tool of the character described, a housing, a work engaging chuck journaled within said housing, a reciprocable and rotatable stem connected with said chuck against rotation relative thereto, two sets of longitudinally spaced oppositively disposed helical splines on said stem, a ratchet ring for each set of splines operatively associated therewith, pawls engageable with said ratchet rings for effecting rotation of said stem in one or the other direction by virtue of its working strokes, rotatable means for selectively controlling the engagement of said pawls with said rings, a pneumatic hammer connected with the housing and having a piston active on said stem for effecting the working strokes thereof, a head on said stem, and means for subjecting said head to live air pressure supplied to said hammer for effecting the return strokes of said stem concurrently with the return strokes of said piston.

4. In a tool of the character described, a housing, a rotatable spindle reciprocable within said housing, means including a pneumatic hammer coaxially disposed with said spindle and active thereon for effecting its reciprocation, two sets of oppositively disposed helical splines on said spindle one above the other, means operatively associated with said splines for effecting rotation of said spindle in one or the other direction by virtue of the stroke of said spindle in one direction, and means for selectively controlling the direction of rotation of said spindle.

5. In a tool of the character described, a housing, a rotatable spindle reciprocable within said housing, including a pneumatic hammer coaxially disposed with said spindle and active thereon for effecting its reciprocation, a rotation mechanism within said housing including longitudinally spaced means on said spindle responsive to its strokes in one direction for effecting its rotation in either direction, and means operatively associated with said mechanism for selectively controlling the direction of rotation of said spindle.

6. In a tool of the character described, a housing, a rotatable spindle reciprocable within said housing, means including a pneumatic hammer coaxially disposed with said spindle and active thereon for effecting its reciprocation, two sets of longitudinally spaced oppositively disposed helical splines on said spindle, a ratchet ring for each set of splines operatively associated therewith, pawls engageable with said ratchet rings for effecting rotation of said spindle in one or the other direction by virtue of its strokes in one direction, and means for selectively controlling the engagement of said pawls with said rings.

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