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E. T. ABLE

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BOLT TIGHTENING TOOL

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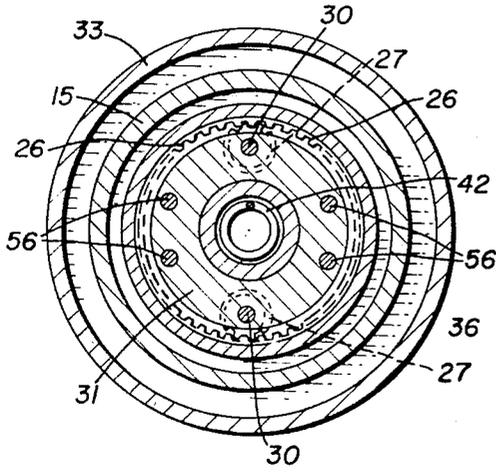


Fig - 6

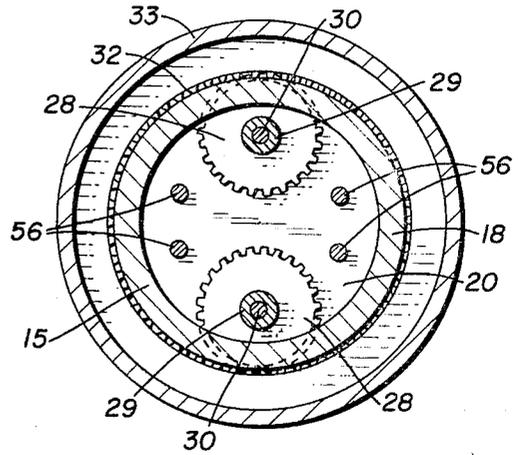


Fig - 7

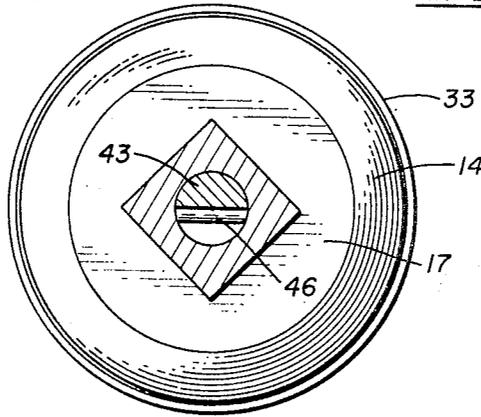


Fig - 8

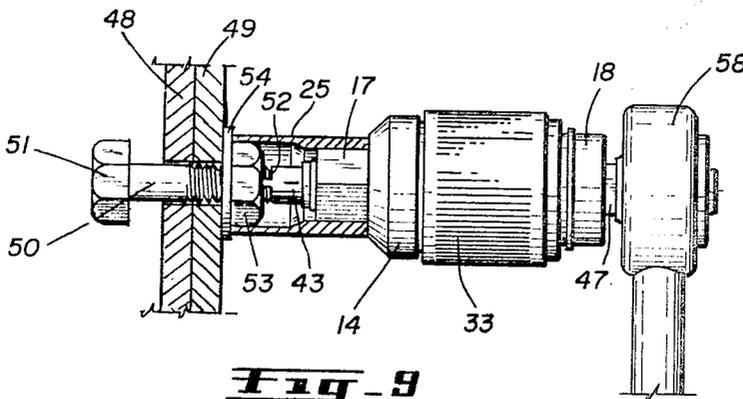


Fig - 9

INVENTOR.
EDWARD. T. ABLE
BY

R. H. Calbreath
ATTORNEY

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BOLT TIGHTENING TOOL

Edward T. Able, Denver, Colo., assignor to B. K. Sweeney Manufacturing Co., Denver, Colo.
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While not limited thereto, this invention is designed for use on, and includes, a special bolt, usually referred to as a "blind" bolt, comprising a threaded shank, having a fixed head at its first extremity and fixed tool-engaging means at its second extremity, such as a screw driver slot, by means of which torque may be applied to the second extremity of said shank while a nut is threaded thereon without requiring access to the head of the bolt.

Briefly, the invention comprises an adapter tool provided, at one extremity, with an input socket to receive the output stud of a conventional socket wrench, more particularly a power-driven impact wrench, and provided at its other extremity with two out-put elements the first of which engages the shank of the said "special" bolt and the second of which engages a nut being threaded thereon. Gear trains are incorporated in the adapter to positively and simultaneously drive both the output elements in a common direction, the second at a faster speed than the first, until the shank is stopped by a work element, thence continue to tighten the nut on the stationary shank to complete the tightening operation. An overrunning clutch is incorporated in the adapter to allow the first output element to overrun the second output element to prevent damage to the gear trains should a power-driven impact wrench be used to drive the input socket.

The principal object of the invention is to provide an adapter which may be applied to a conventional power driven wrench such as an impact wrench and which will convert the single torque output of the wrench into a double torque output so that the conventional wrench may be used to simultaneously apply differential torques to each of two threaded-together elements, such as the shank and nut of the above described "special" bolt.

The invention will be found particularly useful in threading a friction lock nut, such as an "Esna" or "Gripco" nut, upon a bolt shank. It is presently necessary, due to the frictional drag of the nut, to hold the bolt shank with a holding wrench applied to the bolt head while the nut is rotated by a second tool such as a power driven impact wrench. With use of this invention, the necessity for the holding wrench is completely eliminated and the entire operation can be accomplished by one hand of a single operator.

The invention will also be found to be useful for installing and tightening bolts which are so positioned that the conventional bolt heads are out of reach or are not conveniently accessible to be held by a holding wrench while the nut is rotated thereon. With the use of this invention and the above described "special" bolt, there is no necessity for contact with the inconvenient or inaccessible bolt head.

A further object is to provide a socket wrench adapter with a bolt shank-engaging tool surrounded by a nut-engaging socket so that the tool-engaging means of a "special" bolt shank and a nut threaded thereon will be simultaneously engaged and rotated at different speeds to effectively travel the nut on the threaded shank.

A still further object is to provide an adapter for the above purposes in which the shank-engaging tool and the nut-engaging socket can be quickly and easily replaced to adapt the adapter to various types of bolts and nuts.

Other objects and advantages reside in the detail construction of the invention, which is designed for sim-

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licity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is made to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

FIG. 1 is a reduced scale, side elevational view of a wrench adapter in which this invention is embodied;

FIG. 2 is a front view of the adapter of FIG. 1;

FIG. 3 is a rear view thereof;

FIG. 4 is a substantially full size, longitudinal section taken on the line 4-4, FIG. 2;

FIGS. 5, 6, 7 and 8 are cross sections taken on the lines 5-5, 6-6, 7-7 and 8-8, respectively in FIG. 4;

FIG. 9 is a reduced scale side view, partly in section, illustrating the application of a wrench to a "special" bolt through the medium of the adapter of this invention.

In FIG. 9, one type of "special" bolt is illustrated clamping two elements 48 and 49 together. The bolt comprises a threaded bolt shank 50 having a head 51 at its inner extremity and provided with a screw driver slot 52 in its threaded extremity. A clamp nut 53 is threaded on the bolt shank 50 to clamp a suitable washer 54 against the elements 48 and 49.

The adapter, as illustrated employs a cylindrical, cup-shaped front housing element 14 and a cylindrical cup-shaped, rear housing element 15 which are fixedly threaded together, as shown at 16, to form a unitary housing for the adapter. A non-circular (usually square) socket wrench stud 17, provided with an axial, tool-receiving bore 40 is formed on and projects axially forward as an integral part from the front housing element 14 and a wrench boss 18 is formed on and projects axially rearward as an integral part from the rear housing element 15. The wrench boss 18 is provided with an axially positioned, wrench-receiving socket 19 which corresponds in shape and size to the socket wrench stud 17, and which is closed at its forward extremity by a circular bottom plate 20.

To adapt the adapter to any typical wrench, preferably an impact wrench such as indicated at 58, the wrench socket, indicated at 25, is removed from the output stud, indicated at 47, of the conventional wrench and placed on the socket wrench stud 17 of the adapter, as illustrated in FIG. 9. The output stud 47 of the wrench is then inserted in the wrench receiving socket 19 of the adapter to provide the input for the latter.

A hollow cylindrical rotor 21 is concentrically and rotatably mounted within the rear housing element 15 in a suitable, annular anti-friction bearing 22. The rotor 21 is maintained in axial alignment with the housing by means of a hollow clutch cylinder 23, formed thereon and extending forwardly therefrom, and which is journalled at its forward extremity in the front housing element 14 in a second annular anti-friction bearing 24. The rear extremity of the rotor 21 is internally toothed to form a first internal ring gear 26 through which rotation is imparted to the rotor 21 from two oppositely positioned planet pinions 27 which mesh with the first ring gear 26.

Each planet pinion 27 is combined as a unit with an adjacent, axially aligned, planet gear 28, of larger diameter, to form two planet gear sets 29 each of which is rotatably mounted upon a planet gear shaft 30. The planet gear shafts 30 are mounted at their rear extremities in the wrench boss 18 of the rear housing element 15 and at their forward extremities in an annular slip ring 31 which is rotatably mounted in the rear of the rotor 21. The slip ring 31 is caused to rotate as a unit with the

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wrench boss 18 and the rear housing element 15 by means of roll pins 56 which are force-fitted into the boss 18 and the bottom plate 20 and into the slip ring 31 as shown in FIGS. 6 and 7.

The oppositely-positioned planet gears 28 circumferentially project through oppositely positioned gear slots 61 milled in the opposite sides of the rear housing element 15 into mesh with a second internal ring gear 32 the teeth of which project inwardly from adjacent the rear extremity of a knurled grip collar 33 which surrounds the adapted housing elements 10 and 11. The collar 33 is maintained in proper concentric and axial position by means of a forward stepped bearing 34 and rear stepped bearing 35 which are maintained in proper longitudinal position by means of a snap ring 59 inset in a ring groove in the wrench boss 18.

A tool-receiving socket member 36 is concentrically mounted within the hollow of the hollowed clutch cylinder 23 in radially-spaced relation to the latter. The forward extremity of the socket member 36 is reduced in diameter and is journaled in a receiving socket 37 in the front housing element 14. The rear extremity of the socket member 36 is also reduced in diameter and is concentrically journaled in the rotor 21 in a spacer ring 38 which bears against annular shoulders on both the socket member 36 and the rotor 21 to prevent relative axial movement therebetween.

Rotation is imparted to the tool socket member 36 from the clutch cylinder 23 of the rotor 21 through the medium of an annular, over-running clutch unit 39 which is positioned in the annular space between the tool socket member and the clutch cylinder. The over-running clutch unit 39 may be of any suitable conventional type, such as a "Torrington Drawn Cup Roller Clutch," having spaced ratchet rollers in inclined ramps so as to allow the tool socket member 36 to override the clutch cylinder 23 so as to allow the tool 43 to be freely turned in a clockwise direction, viewed from the output extremity of the adapter, when the rotor 21 is stationary and which will transmit rotation from the rotor 21, in a counter-clockwise direction to the tool-receiving socket member 36 when the rotor is rotated counter clockwise.

The tool socket member 36 is formed with an axially-positioned tool-receiving socket 41 which is circumferentially aligned with the tool-receiving bore 41 in the stud 17 so that any desired bolt-shank-engaging tool 43 may be inserted through the bore 40 into the socket 41 against the bias of a compression spring 42 positioned in the bottom of the socket 41. The bolt-shank-engaging tool 43 illustrated in FIGS. 1, 2 and 3 of the drawing, is of the screw driver type having a screw driver blade 44 of any desired type formed on its outer extremity. The tool 41 is replaceable by other tools having different types of bolt-shank-engaging means such as a conventional, hexagonal "Allen" wrench stud in place of the blade 44 depending upon the particular type of "blind" bolt to be worked upon. In any event, each tool would be provided with an elongated, longitudinally extending, cutaway, key way 45 formed in one side of its inner portion to engage a transverse roll key pin 46 in the tool-receiving socket 41 to prevent relative rotation between the tool and the tool socket member 36. A click ball 60 is inset in the side of the key way which snaps past the roll pin 46 to retain the tool in place.

In use, the screw driver blade 44 is inserted in the shank slot 52 of the bolt shank 50 and the adapter is forced forwardly, against the bias of the spring 42, and the wrench socket 25 is placed about the clamp nut 53. The forward movement forces the shank inwardly so that the nut 53 and the washer 54 are clamped against the work element 49 and the head 51 is spaced from the work element 48, as shown in FIG. 9. The spring 42 maintains the blade 44 of the tool 43 in the screw driver slot 52.

The knurled grip collar 33 is then gripped in the

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hand, or held stationary in any other desired manner, and the wrench 58 is rotated in a clockwise direction, viewed from the wrench extremity of the adapter, to rotate the complete housing 14-18 and the nut 53 clockwise as a unit at a 1 to 1 ratio.

Since the two planet gear sets 29 are journaled eccentrically in the housing they orbit in a clockwise direction around the axis of the housing at a 1 to 1 ratio with their planet gears 28 in mesh with the stationary second ring gear 32 and their planet pinions 27 in mesh with the internal ring gear 26. This results in a clockwise rotation of the internal ring gear 26 and its clutch cylinder 23 at a less than 1 to 1 ratio or at a slower speed than the housing. The clutch unit will then transmit a clockwise torque through the tool socket member 36 to the screw driver tool 43 to the bolt shank 50. Thus, both the nut 53 and the shank 50 will be rotated clockwise, the former rotating at greater r.p.m. than the latter. In a typical adapter the gear ratios are such that the bolt shank will be turned at approximately one-half the speed of the nut. The result is, the bolt shank lags in r.p.m. behind the nut so that the shank threads through the nut to draw the bolt head 51 into contact with the work element 48 to complete the tightening operation. If the wrench 58 be a power driven impact wrench the impacts tend to violently and intermittently rotate the nut more than twice as fast as the bolt. This causes the overrunning clutch 39 to override at each impact so as to eliminate damage to the gear trains.

While a specific form of the invention has been described and illustrated herein, it is to be understood that the same may be varied within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. The combination with a bolt of a type comprising a threaded bolt shank with a nut threaded thereon, said shank having a head at its one extremity and tool-engaging means at its other extremity, of a shank tool detachably engaging said tool-engaging means, a nut socket detachably engaging said nut and means for positively and simultaneously rotating both said shank tool and said nut socket in the same direction at respectively different speeds to cause said nut to travel longitudinally of said shank.

2. Means for causing respective longitudinal movement between a threaded bolt shank and a nut threaded thereon comprising: a shank tool; connecting means for detachably connecting said tool to and in alignment with said shank to prevent relative rotation therebetween; a nut socket surrounding said tool and adapted to detachably engage said nut for rotating the latter; and means for positively and simultaneously rotating both said shank tool and said nut socket in the same direction and at a different speed from a single torque input.

3. Means as described in claim 2 in which the means for simultaneously rotating said shank tool and said nut socket comprises: a cylindrical housing; a socket wrench stud projecting fixedly and concentrically forward from said housing into engagement with said nut socket, said shank tool extending axially through and projecting concentrically forward from said stud; means for imparting rotary movement to said housing; and transmission means in said housing transmitting torque to said shank tool in consequence of the rotary movement of said housing.

4. Means as described in claim 3 in which the transmission means comprises: a tool socket member axially and rotatably positioned in said housing and receiving said shank tool; a rotor surrounding said tool socket member; a grip collar rotatably surrounding said housing; planet gear sets eccentrically journaled in said housing in intermeshing engagement with both said rotor and said grip collar so that when said housing is rotated and said grip collar is held stationary rotation will

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be transmitted through said planet gear sets to said rotor for rotating the latter; and means for transmitting the rotation of said rotor to said tool socket member and said shank.

5. An adapter for converting the single torque output of a wrench into a double torque output for simultaneously rotating a bolt shank and a nut threaded on said shank comprising: a housing; means at one extremity of said housing to be engaged by said wrench; a nut socket member mounted on the other extremity of said housing for engaging and rotating said nut; a tool socket member rotatably and axially mounted in said housing; a shank-engaging tool axially mounted in and projecting axially forward from said tool socket member and into said nut socket for engaging said bolt shank; a cylindrical grip sleeve rotatably surrounding said housing; a cylindrical rotor rotatably and concentrically surrounding said tool socket member; annular clutch means positioned between said rotor and said tool socket member for transmitting rotation from the former to the latter; and planet gear sets interposed and intermeshed between said grip sleeve and said rotor for transmitting rotation to said rotor when said grip sleeve is held stationary and said housing is rotated.

6. An adapter as described in claim 5 in which said annular clutch means is unidirectional so that torque will be transmitted from said rotor to said tool socket member only when said housing is being rotated in a nut-tightening direction.

7. An adapter as described in claim 6 in which the gear ratios through said planet gear sets are such that said tool socket member will rotate in the same direction and at a slower speed than said housing when the latter is rotated in a nut-tightening direction.

8. An adapter as described in claim 6 in which the planet gear sets are journaled in said housing eccen-

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trically of the axis of the latter so said planet gears will be revolved in a concentric annular orbit when said housing is rotated.

9. An adapter as described in claim 8 having a first concentric internal ring gear in said rotor and a second concentric internal ring gear in said grip sleeve said planet gear sets being intermeshed between said two ring gears.

10. An adapter as described in claim 9 in which each planet gear set consists of a large planet gear and a smaller planet gear concentrically mounted together as a unit the small planet gears being meshed with the first ring gear and the large planet gears being meshed with the second ring gear.

11. Means for securing an inner work element and an outer work element together comprising: a threaded bolt shank adapted for passing through both elements; an enlarged head on the inner extremity of said shank in spaced relation to said inner work element; an enlarged nut threaded on the outer extremity of said shank and positioned against said outer work element; and a single wrench means for positively and simultaneously rotating both said shank and said nut in the same direction and at differential speeds to draw said head into contact with said inner work element.

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JAMES L. JONES, JR., *Primary Examiner.*