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[11] **3,815,211**

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[54] **METHOD AND APPARATUS FOR REMOVING AND TIGHTENING NUT-TYPE FASTENERS OR THE LIKE**

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[52] **U.S. Cl.** **29/427,** 81/56, 81/57.3

[51] **Int. Cl.** **B23p 19/02**

[58] **Field of Search** ..... 81/56, 57.3, 57.14, 57.32, 81/57.36, 57.46, 53, 54, 121 R; 29/258, 259, 261, 262, 263, 264, 265, 266, 427, 260

[56] **References Cited**

UNITED STATES PATENTS

2,243,948	6/1941	Eyrick	81/56
2,478,935	8/1949	Moritz et al.	81/57.3
2,541,772	2/1951	Lockard	81/53 R
2,586,185	2/1952	Stuwe	81/54
2,630,731	3/1953	Imboden	81/56
3,066,559	12/1962	Harvel	81/53 R

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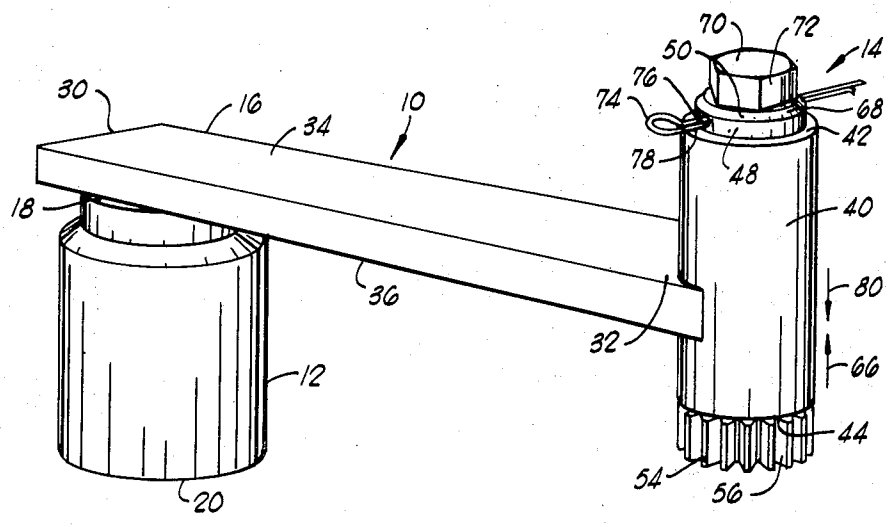
[57] **ABSTRACT**

An improved method and apparatus for tightening and removing nut-type fasteners or the like wherein a guide member, having a geared surface, is positioned so that the geared surface surrounds the fastener and a torque wrench apparatus is connected to the fastener and to the geared surface for rotatingly tightening or removing the fastener, the torque wrench apparatus basically comprising: a socket head removably engageable with the fastener, a drive member having gear teeth formed about a portion thereof, a connecting bar connecting the socket head and the drive member in a predetermined spaced relationship, the drive member being journally supported via the connecting bar; and a drive assembly connectable with the drive member for rotatingly driving the drive member, the drive member moving along the geared surface of the guide member and rotatingly tightening or removing the fastener via the interconnecting connecting bar as the drive member is rotatingly driven via the drive assembly. In one aspect, the method and the apparatus of the present invention are particularly useful for removing and tightening the gland nut connecting a flywheel to a crankshaft of an automobile engine.

11 Claims, 6 Drawing Figures



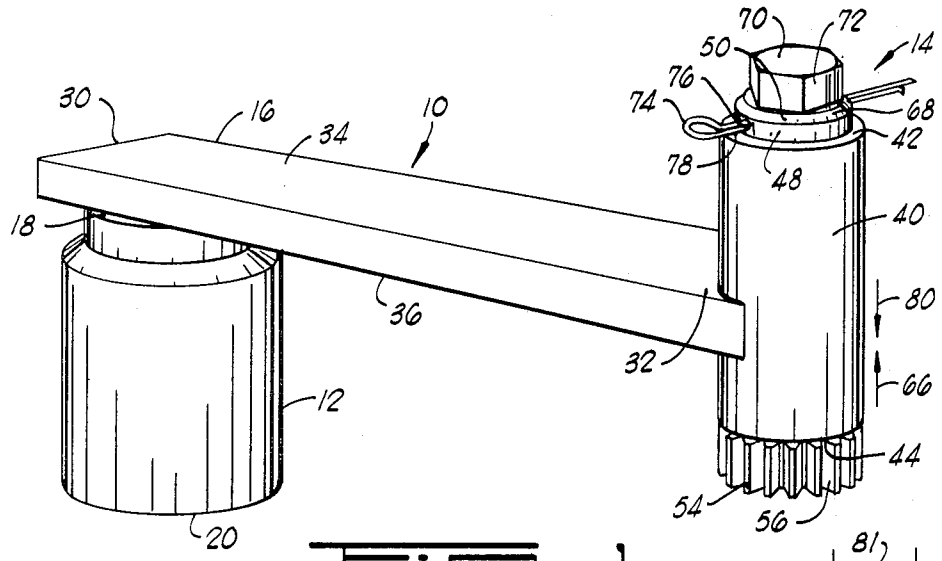


FIG. 1

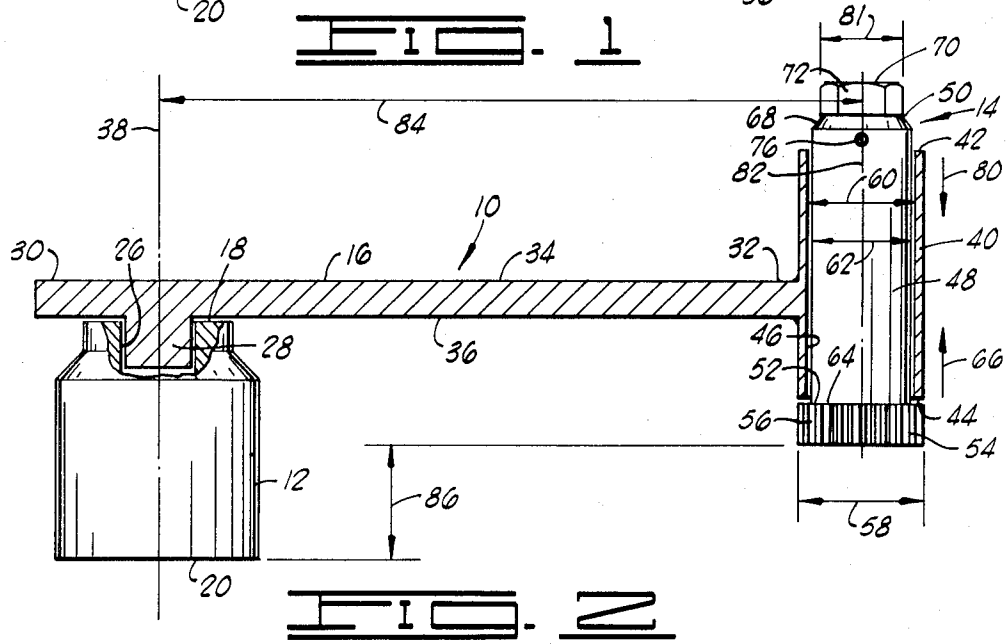


FIG. 2

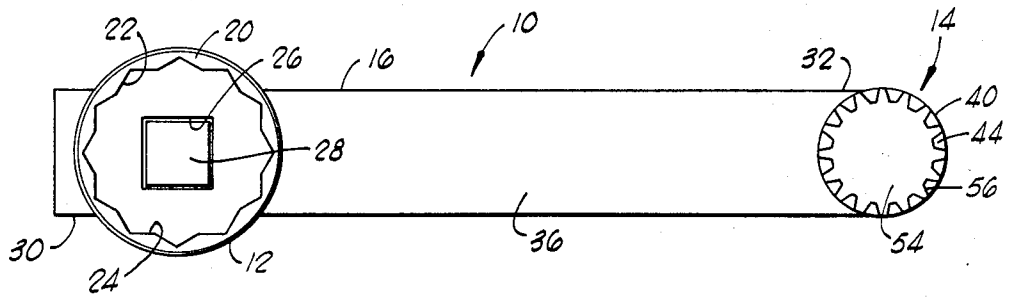


FIG. 3

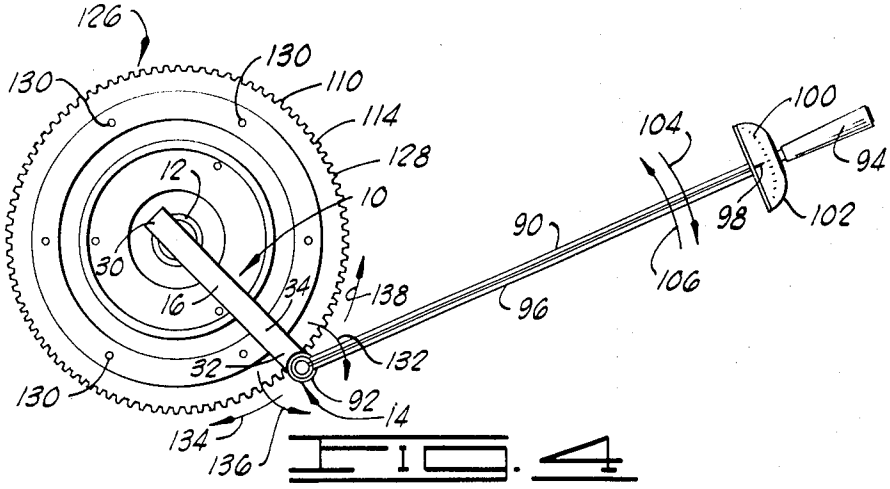


FIG. 4

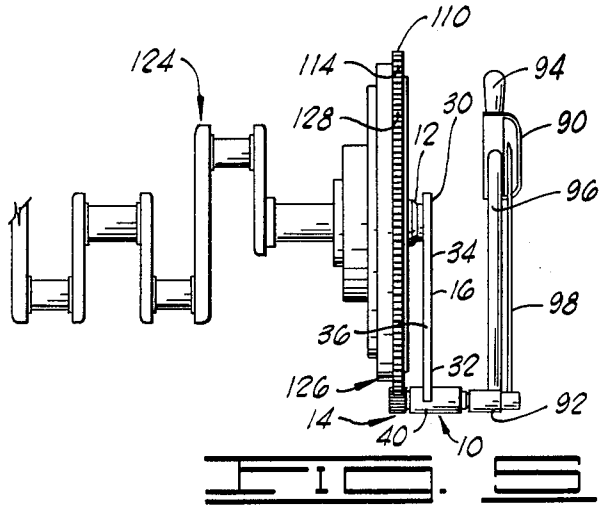


FIG. 5

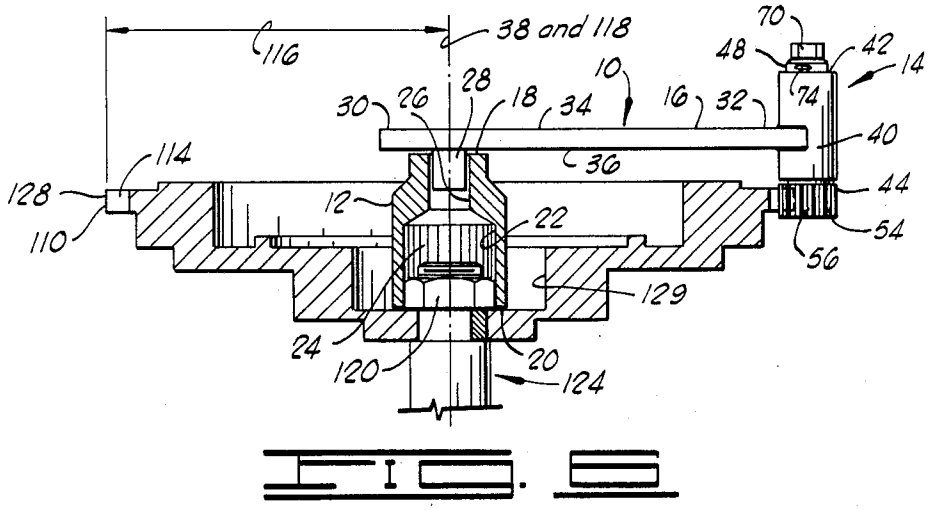


FIG. 6

METHOD AND APPARATUS FOR REMOVING AND TIGHTENING NUT-TYPE FASTENERS OR THE LIKE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to improvements in methods and apparatus for removing and tightening fasteners and, more particularly, to methods and apparatus for removing and tightening fasteners such as nuts or the like wherein the socket head is rotatingly driven via geared elements.

2. Brief Description of the Prior Art

In the past there have been various wrenches and torque wrenches constructed for removing nut-like fastener elements and some of the fastener removing apparatus of the past have included gear-operated elements. The U.S. Pat., No. 2,478,935, issued to Moritz, disclosed a gear-operated wrench having an arm which was held secure while a second arm was utilized to drive gear elements connected to a socket for loosening and tightening a nut via turning the socket. The U.S. Pat. Nos. 456,830, issued to Martin; 545,969, issued to McCoy; 641,782, issued to Costlan; 754,831, issued to Abolt; and 2,630,731, issued to Imboden, each disclosed a type of gear-operated socket wrench wherein the gears were an integral part of the wrench and functioned primarily to translate the motion applied to a part of the wrench for driving a socket head.

The U.S. Pat. No. 2,243,948, issued to Eyrick, disclosed a wrench for removing nut-like fasteners from a dual wheel type of structure wherein a portion of the wrench engaged and secured some of the nuts for turning while another portion of the wrench unscrewed a second set of nuts. The U.S. Pat. Nos. 611,540 and 766,273, issued to Whitaker and Lorang, respectively, each disclosed a tire nut tightening machine and the U.S. Pat. No. 616,272, issued to Stigen, disclosed a gear-wrench for tightening and removing the nuts from a thrashing-machine-cylinder teeth. One other related device was disclosed in the U.S. Pat. No. 620,657, issued to Kernek.

SUMMARY OF THE INVENTION

An object of the invention is to provide an improved apparatus for removing and tightening fasteners such as nuts or the like in a faster, more efficient and more economical manner.

One other object of the invention is to provide an apparatus for removing and tightening fasteners such as nuts or the like which is economical in construction and operation.

A still further object of the invention is to provide an improved apparatus for removing and tightening the gland nut connecting a flywheel to a crankshaft in a faster, more economical, more efficient and safer manner.

Another object of the invention is to provide an improved method for removing and tightening fasteners such as nuts or the like which is more efficient and more economical.

Yet another object of the invention is to provide an improved method for tightening and removing gland nuts connecting a flywheel to a crankshaft in a faster, more efficient and more economical manner.

Other objects and advantages of the present invention will be evident from the following detailed description when read in conjunction with the accompanying drawings which illustrate a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a torque wrench apparatus constructed in accordance with the present invention.

FIG. **2** is a partial sectional, partial elevational view of the torque wrench apparatus of FIG. **1.**

FIG. **3** is a bottom elevational view of the torque wrench apparatus of FIGS. **1** and **2.**

FIG. **4** is a front elevational view of the torque wrench apparatus of FIGS. **1, 2** and **3** connected in an assembled position for removing and tightening the gland nut of a flywheel, showing the drive assembly connected to the drive member of the torque wrench apparatus for rotatingly driving the drive member of the torque wrench apparatus in a manner tightening and removing the gland nut.

FIG. **5** is a diagrammatical, side elevational view showing the apparatus of the present invention connected in an assembled position to a flywheel secured to a crankshaft (partially shown) via a gland nut, the apparatus of the present invention being connected for removing and tightening the gland nut.

FIG. **6** is a partial sectional, partial elevational view of the flywheel connected to a crankshaft (partially shown) via a gland nut, the torque wrench apparatus being connected to the flywheel and the gland nut for removing and tightening the gland nut.

BRIEF DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawings in general, and to FIGS. **1, 2** and **3** in particular, shown therein and designated by the general reference numeral **10,** is a torque wrench apparatus for tightening and removing fasteners, such as nuts or the like, for example, constructed in accordance with the present invention. The torque wrench apparatus **10** basically includes: a socket head **12** removably engageable with a fastener; a drive member **14** for rotatingly driving the socket head **12** to remove and tighten the fastener; and a connecting bar **16** interconnecting the drive member **14** and the socket head **12,** in a manner to be described in greater detail below.

The socket head **12** has an upper end **18** and a lower end **20.** An opening **22,** as shown more clearly in FIG. **3,** is formed through a central portion of the lower end **20** and extends a distance axially upwardly through the socket head **22** (shown more clearly in FIG. **6**). A fastener engaging surface **24** is formed about the inner peripheral surface formed by the opening **22** for lockingly engaging the outer peripheral surface of a fastener such as a nut or the like, in a manner well-known in the art.

As shown more clearly in FIGS. **2** and **6,** an opening **26** is formed through a central portion of the upper end **18** of the socket head **12,** the opening **26** also intersecting the opening **22,** in one form, as shown in FIG. **6.** The opening **26** is square-shaped and constructed to lockingly receive a portion of a square-shaped protrusion **28** formed on the connecting bar **16,** the connecting bar **16** being lockingly and removably connectable to the socket head **12** via the protrusion **28** extending

through a portion of the opening **26** in the socket head **12**, in an assembled position of the torque wrench apparatus **10**.

The connecting bar **16** has opposite end portions **30** and **32** and an upper surface **34** and a lower surface **36**. The protrusion **28** is, more particularly, formed on the lower surface **36** of the connecting bar **16**, generally near the end portion **30** thereof, the protrusion **28** extending a distance generally perpendicularly from the lower surface **36**, as shown more clearly in FIGS. **2** and **6**. The opening **26** in the socket head **12** and the protrusion **28** formed on the connecting bar **16** each cooperate to define a socket head turning axis **38** in a connected position of the socket head **12** and the connecting bar **16**, as shown more clearly in FIG. **2**.

A housing **40** is secured to the end portion **32** of the connecting bar **16**, the housing **40** forming an integral part of the connecting bar **16**, in one embodiment of the invention. The housing **40** is basically tubular shaped and extends transversely to the connecting bar **16**, the connecting bar **16** being, more particularly, secured to a central portion of one side of the housing **40**.

The housing **40** has an upper end **42** and a lower end **44**, an opening **46** being formed through the housing **40**, intersecting the upper and the lower ends **42** and **44** thereof, as shown more clearly in FIG. **2**. The opening **46** through the housing **40** is sized to journally receive a portion of the drive member **14** and to journally and rotatingly support the drive member **14** in an assembled position of the torque wrench apparatus **10**, in a manner to be described in greater detail below.

The drive member **14** includes a cylindrically shaped shaft **48**, having an upper end portion **50** and a lower end portion **52**, a portion of the shaft **48** generally between the upper and the lower end portions **50** and **52** being rotatingly and journally disposed through the opening **46** of the housing **40**.

A gear member **54** is secured to the lower end portion **52** of the shaft **48**, a plurality of gear teeth **56** being formed on and extending about the outer periphery of the gear member **54**. The gear member **54**, including the gear teeth **56** formed thereon, has a diameter **58** which is larger than a diameter **60** formed by the opening **46** through the housing **40**, the gear member diameter **58** being also larger than a diameter **62** formed by the outer periphery of the shaft **48**. The gear teeth **56** of the gear member **54** thus extend a distance radially outwardly beyond the outer peripheral surface formed by the shaft member **48** forming an upwardly facing ledge **64** extending a distance radially outwardly from the shaft **48** generally near the lower end **52** thereof.

In an assembled position of the drive member **14** and the housing **40** to the connecting bar **16**, the shaft **48** is journally disposed in the opening **46** and positioned therein such that the gear member **54** is disposed generally below the lower end **44** of the housing **40**. Since the gear member diameter **58** is larger than the diameters **60** and **62** and since the gear member **54** is positioned below the lower end **44** of the housing **40**, the lower end **44** of the housing **40** engages the upwardly facing ledge **64** formed by the gear member **54** thereby limiting the movement of the drive member **14** in an axially upwardly direction **66** through the opening **46** of the housing **40** and positioning the drive member **14** in the housing **40** in a predetermined assembled position in one direction, for reasons which will be made more apparent below.

As shown more clearly in FIGS. **1** and **2**, a tapered surface **68** is formed on the upper end portion **50** of the drive member **14**, the tapered surface **68** being tapered inwardly and forming a smaller diameter head portion generally at the uppermost end of the shaft **48**. A drive head **70** is securedly connected to the uppermost end portion formed by the tapered surface **68** at the upper end portion **50** of the shaft **48**, the drive head **70** having a plurality of engaging surfaces **72** formed about the outer periphery thereof forming a nut-like shaped element removably engageable with a drive assembly for drivingly rotating the drive member **14** within the housing **40**, in a manner and for reasons which will be described in greater detail below.

The shaft **48** has a sufficient axial length such that, in an assembled position of the drive member **14** in the housing **40**, the upper end portion **50** and the drive head **70** of the drive member **14** each extend a distance axially upwardly beyond the upper end **42** of the housing **40**. A portion of a lock member **74** is disposed through an aperture **76** of the shaft **48**, the aperture **76** extending transversely through the shaft **48** generally near the upper end portion **50** thereof and being positioned above the upper end **42** of the housing **40** in an assembled position of the drive member **14** in the housing **40**. A portion of the lock member **74** extends radially outwardly from the outer peripheral surface of the shaft **48** from each end of the aperture **76**, each portion of the lock member **74** extending from the shaft **48** providing an engaging surface **78** engageable with portions of the upper end **42** of the housing **40** limiting the movement of the drive member **14** in an axially downwardly direction **80** positioning the drive member **14** in an assembled position in the housing **40** in one direction (only one of the engaging surfaces **78** being shown in FIG. **1**).

The lock member **74** is, more particularly, removably disposable through the aperture **76** such that the drive member can be quickly and easily inserted in an assembled position through the aperture **76**, the lock member **74** being of a cotter pin type of construction, for example. The drive head **70** has a diameter **81** formed via the outer periphery thereof and sized to be smaller than the gear member diameter **58**, the housing opening diameter **60** and the shaft diameter **62**. More particularly, the diameter **81** of the drive head **70** is sized such that the drive head **70** is insertable through the opening **46** formed through the housing **40**. In this manner, the drive member **14** can be removed and replaced or repaired by simply removing the lock member **74** and sliding the shaft **48** in an axially downwardly direction **80**, the shaft **48** and the gear member **54** and the drive head **70** being removably disengaged from the connecting bar **16**.

The drive member **14** is thus journally and rotatingly supported within the opening **46** of the housing **40**, the lock member **74** positioning the drive member **14** in one direction and the gear member **54** positioning the drive member **14** in an opposite direction. The housing **40** is positioned on the connecting bar **16** and the opening **46** through the housing **40** is positioned such that the drive member **14** is rotatable within the opening **46** of the housing **40** about a drive member turning axis **82**. The drive member turning axis **82** is substantially parallel with the socket head turning axis **38** and

spaced a predetermined distance **84** therefrom via the rigid interconnection therebetween provided via the connecting bar **16.**

As shown more clearly in FIGS. **2** and **6,** the lower end **20** of the socket head **12** is disposed in a plane spaced a distance **86** below the planar disposition of the lowermost end portion of the drive member **14** formed via the lower end of the gear member **54.** In this manner, the torque wrench apparatus **10** can be utilized for removing and tightening fasteners disposed in a plane generally below the planar disposition of the geared surface meshingly engaging the gear teeth **56** of the gear member **54,** which is particularly useful in removing the gland nut securing a flywheel to a gear shaft, in a manner to be described in greater detail below. It should also be noted that, since the socket head **12** is removably connected to the connecting bar **16,** various socket heads are connectable to the connecting bar **16** and useable in cooperation with the drive member **14** for removing fasteners wherein the connected socket head has various predetermined openings **26** and disposed in various predetermined planar dispositions with respect to the lowermost end portion of the drive member **14** formed via the gear member **54,** thereby positioning the apparatus of the present invention to be used in various operations.

In one assembled, operational embodiment of the present invention, the apparatus includes a torque indicating wrench **90,** shown in FIGS. **4** and **5.** The torque indicating wrench **90** includes one end portion **92** which is removably and drivingly connectable to the drive head **70** of the drive member **14** and, in one form, can be of the ratchet-type of construction. A handle **94** is formed on the end of the torque indicating wrench **90,** opposite the end portion **92** drivingly connectable to the drive head **70,** the end portion **92** and the handle **94** being interconnected via an elongated rod **96** extending therebetween. The torque indicating wrench **90** also includes a pointer rod **98** connected on one end thereof to the end portion **92,** the opposite end of the pointer rod **98** being disposed in indicating proximity with respect to a plurality of torque indicating indicia **100** inscribed on a plate **102** secured to the rod **96,** generally near the handle **94.**

During the operation of the apparatus of the present invention, the end portion **92** of the torque indicating wrench **90** is drivingly and removably connected to the drive head **70** of the drive member **14** and the operator rotates the torque indicating wrench **90** in rotating directions **104** or **106** to drivingly rotate the drive member **14** about the drive member turning axis **82,** the torque indicating wrench **90** being rotated in one direction **104** or **106** to tighten the fastener and rotated in the opposite direction **104** or **106** to remove the fastener. As the torque indicating wrench **90** drivingly rotates the drive member **14,** the pointer rod **98** is moved into indicating proximity with predetermined torque indicating indicia **100** to indicate the torque (expressed in foot-pounds) required to rotate the drive member **14,** thereby indicating the torque required to rotate the fastener to be tightened or removed. Torque indicating wrenches having end portions removably connectable to nut-shaped members and pointer rods moving into indicating proximity with respect to torque indicating indicia to indicate the torque required to rotate the member engaged via the torque indicating wrench such as the torque indicating wrench **90** are well-known in the art and commercially available, a detailed description of the construction and operation thereof not being required herein.

The apparatus of the present invention, in one aspect, includes a geared surface **110,** as shown in FIGS. **4, 5** and **6,** disposed about the fastener to be tightened or removed, the geared surface **110** having a plurality of gear teeth **114** formed thereon. The gear teeth **114** of the geared surface **110** are meshingly engageable with the gear teeth **56** of the gear member **54** and cooperate therewith to form a guide surface guiding the moement of the drive member **14** generally along the geared surface **110** in a predetermined path about the fastener to be tightened or removed, for reasons and in a manner to be made more apparent below.

The geared surface **110** is formed about the fastener to be tightened or removed, as generally mentioned before, and, in a preferred form, is spaced a radial distance **116** from a fastener turning axis **118,** the geared surface **110** extending circularly about the fastener, as shown more clearly in FIGS. **4** and **6.** In an assembled position of the apparatus of the present invention, the torque wrench apparatus **10** is positioned such that the gear teeth **56** of the gear member **54** meshingly engage the gear teeth **114** of the geared surface **110** and the socket head **12** is positioned such that the fastener engaging surface **24** formed in the opening **22** thereof drivingly and lockingly engages the fastener to be removed or tightened such as the gastener **120,** shown in FIG. **6,** for example. In this operative position of the apparatus of the present invention, the fastener turning axis **118** is substantially aligned with the socket head turning axis **38** so that the rotation of the socket head **12** about the socket head turning axis **38** rotatingly drives the fastener **120** to remove or tighten the fastener **120** depending on the direction of rotational movement of the socket head **12** about the socket head turning axis **38.**

In one preferred application, the apparatus of the present invention is utilized to remove a particular fastener **120;** that is, the gland nut **120** which is threadedly secured to one end of a crankshaft **124,** the gland nut **120** securing a flywheel **126** to the threaded end of the crankshaft **124,** as shown more clearly in FIG. **4.** In this embodiment of the invention, the geared surface **110** is formed about the outer periphery **128** of the flywheel **126.** More particularly, the crankshaft **124** and the flywheel **126,** shown in FIGS. **4, 5** and **6,** constitute the arrangement and interconnection of the automobile crankshaft and flywheel presently utilized in the construction of a Volkswagen type of automobile, for example, the gland nut **120** being disposed in a recess **129** formed in the flywheel **126.** Although the present invention has been found particularly useful in tightening and removing gland nuts utilized in a Volkswagen engine construction to secure the flywheel to the crankshaft, it is to be expressly understood that the invention as described and claimed herein is not limited to this particular application, this particular application of the present invention being illustrated in the drawings and described in the specification for the purpose of clarity of description and to describe one preferred operational embodiment of the apparatus of the present invention.

In the past, to remove the gland nut securing the flywheel to the crankshaft of a Volkswagen engine construction or the like, it has been necessary to first re-

move the clutch pressure plate and clutch disc, the operator preferably marking the relationship between the flywheel and the crankshaft during the removal operation. A spacial retainer has then been required to hold the flywheel in position while the gland nut and spring washer were removed. In this particular application the gland nut was generally torqued to 217 foot-pounds and a breaker bar type of torque wrench was required for removing and tightening the gland nut. In those instances where a special flywheel retainer was not obtainable, an angle iron type of breaker bar was bolted between two of the clutch bolt holes, such as the clutch bolt holes **130** (only some of the clutch bolt holes **130** being shown in FIG. **4**, for example), the angle iron being 4 feet long and 2 by 4 inches in cross-section, in one recommended operational form.

To tighten the gland nut, the breaker bar was utilized in cooperation with a conventional socket wrench, the breaker bar being held to securedly position the flywheel while the socket wrench was rotated to removingly turn the gland nut. A range extender was also utilized in cooperation with the torque wrench and angle bar for tightening the gland nut to a predetermined torque. The range extender was then secured about the gland nut and included a bar extending radially from the gland nut having one end adapted for connection to a conventional, commercially available 150 foot-pound torque wrench, such as the torque indicating wrench **90**, shown in FIGS. **4** and **5** of the drawings. This operation generally required special tooling and, in most instances, required two operators, one holding the breaker bar while the other rotated the socket wrench or torque wrench during the removal or tightening, respectively, of the flywheel gland nut. Further, in those instances when the crankshaft and flywheel were removed from the automobile engine and placed upon a work bench or the like, the removing or tightening of the gland nut utilizing the breaker bar and socket wrench or torque wrench combinations was even more unmanageable. The apparatus of the present invention and particularly the torque wrench apparatus **10** are constructed such that the gland nut **120** can be quickly, easily and efficiently removed or tightened by a single operator in an assembled position of the crankshaft and flywheel in the automobile engine or in a removed position of the crankshaft and flywheel, thereby providing a safer, more economical, more efficient and faster method for removing and tightening the gland nut securing the flywheel to one end of the crankshaft.

In utilizing the apparatus of the present invention to remove the gland nut **120** securing the flywheel **126** to one end of the crankshaft **124** (the crankshaft **124** being partially shown in FIGS. **5** and **6**), the socket head **12** is first positioned over the gland nut **120** such that the gland nut **120** is disposed within the opening **22** and lockingly engaged via the fastener engaging surface **24** formed therein, as shown more clearly in FIG. **6**. The protrusion **28** formed on the connecting bar **16** is then lockingly disposed within the opening **26** formed in the upper end **18** of the socket head **12**, thereby positioning the gear teeth **56** of the gear member **54** in meshing engagement with the gear teeth **114** of the geared surface **110**.

In this position of the torque wrench apparatus **10**, as shown in FIGS. **4**, **5** and **6**, the end portion **92** of the torque indicating wrench **90** is lockingly disposed or connected to the drive head **70** of the drive member **14** and the torque indicating wrench **90** is rotated in a direction **104** or **106** to remove or tighten the gland nut **120**. More particularly, when the torque indicating wrench **90** is moved in the direction **104**, the drive member **14** is rotated in a direction **132**, thereby drivingly rotating the gear member **54** connected thereto in a rotating direction **132** about the drive member turning axis **52**. As the gear member **54** is rotated in the direction **132**, the gear teeth **56** of the gear member **54** drivingly and meshingly engage the gear teeth **114** of the geared surface **110** moving the gear member **56** and drive member **14** along the path defined via the geared surface **110** in a general direction **134**. As the gear member **134** is moved along the geared surface **110** in the general direction **134**, the connecting bar **34** is also driven in a general direction **134**, thereby drivingly rotating the socket head **12** in a general direction **134** about the socket head turning axis **38** and rotating the fastener or gland nut **120** in the general direction **134** via the engagement between the socket head **12** and the fastener **120**.

By the same token, when the torque indicating wrench **90** is rotated in the general direction **106**, the drive member **14** is rotated in a general direction **136**, opposite the direction **132**, about the drive member turning axis **82**. As the drive member **14** is rotated in a general direction **136** about the drive member turning axis **82**, the drive member **14** is moved in a general direction **138**, generally opposite the direction **134**, along the geared surface **110** via the meshing engagement between the gear teeth **56** of the gear member **54** and the gear teeth **114** of the geared surface **110**. As the drive member **14** is driven in a general direction **138**, the socket head **12** is rotated in a general direction **138** via the interconnection between the socket head **12** and the drive member **14** via the connecting bar **16**, thereby drivingly rotating the fastener or gland nut **120** in a general direction **138** about the fastener turning axis **118**.

The torque required to turn the drive member **14** is determined via the pointer rod **98** in cooperation with the torque indicating indicia **100**. The torque required to rotate the drive member **14** about the drive member turning axis **82** is less than and related to the torque required to turn the gland nut or fastener **120**.

Utilizing the apparatus of the present invention for removing the gland nut **120** connecting the flywheel **126** to the crankshaft **124**, as generally mentioned before with respect to a Volkswagen type of engine construction, it has been found that a torque of 14 foot-pounds required to turn the drive member **14** about the drive member turning axis **82** corresponds to a torque of 217 foot-pounds required to turn the gland nut **120**, and a torque of **34** foot-pounds required to turn the drive member **14** about the drive member turning axis **82** corresponds to a torque of 500 foot-pounds required to turn the gland nut or fastener **120** about the fastener turning axis **118**. The present invention thus not only provides a faster, more economical and safer manner for removing the gland nut **120**; but, also permits the gland nut to be torqued utilizing a relatively inexpensive torque indicating wrench construction, such as the torque indicating wrench **90** shown in FIGS. **4** and **5**, since the actual torque required to be applied and indicated by the torque indicating wrench is in the range of 14 foot-pounds to 34 foot-pounds, for example.

Changes may be made in the construction and the operation of the various components and assemblies of the present invention without departing from the spirit and scope of the present invention as defined in the following claims.

I claim:

1. A torque wrench apparatus for tightening and removing fasteners such as nuts or the like by rotating the fasteners to be removed about a fastener turning axis, wherein a geared surface is disposed about the fastener and spaced a predetermined distance therefrom, the torque wrench apparatus comprising:

a socket head, having an upper and a lower end, a fastener engaging surface formed in the lower end thereof removably and securedly engageable with a fastener in one position of the socket head;

a connecting bar, having opposite end portions, the socket head connectable to one end portion of the connecting bar for turning about a socket head turning axis;

a drive member, having an upper and a lower end portion and a plurality of gear teeth formed on the lower end portion of the drive member meshingly engageable with the geared surface in one position, a portion of the drive member journally connected to the end portion of the connecting bar, opposite the end portion connected to the socket head, for rotation about a drive member turning axis; and

means connectable with a portion of the drive member rotating the drive member in a connected position and in a driving position thereof, the drive member moving along the gear surface via the meshing engagement therebetween and rotating the socket head via the interconnecting connecting bar connected to the socket head and the drive member.

2. The apparatus of claim **1** wherein the socket head and the drive member are each connected to the connecting bar in one position for turning the socket head about the socket head turning axis substantially aligned with the fastener turning axis of the fastener to be removed.

3. The apparatus of claim **2** wherein the socket head and the drive member are each connected to the connecting bar in one position for turning the socket head about the socket head turning axis substantially parallel with the drive member turning axis, the connecting bar spacing the socket head turning axis a predetermined distance from the drive member turning axis substantially corresponding to the predetermined distance between the fastener and the geared surface.

4. The apparatus of claim **1** wherein the socket head includes an opening formed through a portion of the upper end thereof; and wherein the connecting bar includes a protrusion formed on the end thereof connectable to the socket head, the protrusion extending a distance from the connecting bar and being insertable through a portion of the opening formed in the upper end of the socket head removably and lockingly interconnecting the socket head and the connecting bar.

5. The apparatus of claim **1** defined further to include: a housing, having an upper end and a lower end and an opening extending therethrough intersecting the upper and the lower ends thereof, secured to the end portion of the connecting bar opposite the end portion connectable to the socket head; and wherein the drive member is defined further to include: a shaft, having an upper end portion and a lower end portion, journally disposed through the opening in the housing; a gear member connected to the lower end portion of the shaft forming the drive member gear teeth; and a drive head connected to the upper end portion of the shaft; and wherein the means rotating the drive member is defined further as being connectable to the drive head.

6. The apparatus of claim **5** wherein the gear member forms an engaging surface engaging the lower end of the housing limiting the movement of the drive member in an upwardly axial direction in the housing; and wherein the drive member is defined further to include: locking member means removably connectable to the upper end portion of the shaft forming an engaging surface engaging the upper end of the housing limiting the movement of the drive member in a downwardly axial direction in the housing.

7. The apparatus of claim **6** wherein the drive head is defined further as being insertable through the opening in the housing in a removed position of the locking member means.

8. The apparatus of claim **1** wherein the lower end of the socket head is disposed in a plane spaced a distance below the planar disposition of the lowermost end portion of the drive member in a connected position of the socket head, the drive member and the connecting bar.

9. A torque wrench apparatus for tightening and removing fasteners such as nuts or the like by rotating the fasteners to be removed about a fastener turning axis, wherein a geared surface is disposed about the fastener and spaced a predetermined distance therefrom, the torque wrench apparatus comprising:

a socket head, having an upper and a lower end, a fastener engaging surface formed in the lower end thereof removably and securedly engageable with a fastener in one position of the socket head;

a connecting bar, having opposite end portions, the socket head connectable to one end portion of the connecting bar for turning about a socket head turning axis; and

a drive member, having an upper and a lower end portion and a plurality of gear teeth formed on the lower end portion of the drive member meshingly engageable with the geared surface in one position, a portion of the drive member journally connected to the end portion of the connecting bar, opposite the end portion connected to the socket head, for rotation about a drive member turning axis, the drive member moving along the geared surface via the meshing engagement therebetween and rotating the socket head via the interconnecting connecting bar connected to the socket head and the drive member.

10. A method for tightening and removing the gland nut securing a flywheel, having a geared surface formed about the outer periphery thereof, to one end of a crankshaft or the like, the method comprising the steps of:

securing a socket head to the gland nut;

engaging the geared surface of the flywheel via a gear member connected to the socket head, the gear member meshingly engaging the geared surface; and

rotating the gear member to drive the gear member along the geared surface of the flywheel for rotating the socket head via the connection between the

socket head and the gear member in one direction tightening the gland nut and in one other direction removing the gland nut.

11. The method of claim **10** defined further to include the steps of:

rotating the gear member via a torque indicating wrench, having torque indicating indicia thereon; and

determining the torque on the gland nut via the torque indication indicia of the torque indicating wrench.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,815,211 Dated June 11, 1974

Inventor(s) John C. Acord IV

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

In the address of the inventor, "706 N. Elbson" should be --706 N. Ellison--.

Column 6, line 12, "moement" should be --movement--.

Signed and sealed this 17th day of September 1974.

(SEL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents