

TORQUE WRENCHTECHNICAL FIELD

This invention relates to torque wrenches, and more particularly to torque wrenches that are bi-directional in operation.

BACKGROUND ART

Torque wrenches, and in particular hydraulic torque wrenches, are well established for use in tightening bolted joints. Such wrenches usually include a hydraulically-operated ram reciprocation of the piston of which causes rotation of an associated crank lever. A ratchet mechanism incorporating means for co-operation with the nut or bolt to be tightened is, in turn, rotated by the lever through drive means reacting between the lever and the ratchet mechanism whereby the nut or bolt is itself rotated.

The application of such a torque wrench to the nut or bolt provides for rotation of the nut or bolt in one direction.

In order to rotate the nut or bolt in the opposite direction, the wrench must be removed from the nut or bolt, turned over, and re-applied to the nut or bolt.

There are situations, for example in the subsea and nuclear industries, where torque wrenches have to be operated remotely, and, in such circumstances, it is not feasible to remove, turn over and reapply the torque wrench to enable the nuts or bolts to be rotated in different directions.

Additionally, torque wrenches are finding uses in many industries as valve actuators where rotation of the valve spindle in both directions must be readily available.

It has therefore been proposed to provide torque wrenches incorporating bi-directional mechanisms whereby rotation in both directions can be achieved without removing the wrench from the component to be rotated.

Such bi-directional torque wrenches commonly incorporate a pair of drive shoes each reacting between the crank lever and the ratchet mechanism, one shoe associated with clockwise rotation of the ratchet mechanism and the other shoe associated with anticlockwise rotation of said mechanism.

More particularly, the two drive shoes are interconnected with one another, each shoe being movable between an operative drive position engaging with the ratchet mechanism and an inoperative position disengaged from said mechanism. The interconnection of the two shoes is such that, when one of the drive shoes is in its operative drive position, the other drive shoe is completely disengaged from the ratchet mechanism.

A switching mechanism, which may be manually operated or powered, is provided to alter the relative positions of the drive shoes to achieve either clockwise or anticlockwise rotation. Failure to



disengage one of the drive shoes when engaging the other shoe will result in the wrench locking up and preventing rotation of the ratchet mechanism in either direction - the drive shoes will work against one another when both engage the ratchet mechanism.

In the aforementioned subsea and nuclear industries, it is clearly not possible to switch the torque wrench manually, and a remote control arrangement is therefore required.

However, remote switching mechanisms are both expensive and complex to install. For example the wrench may incorporate a hydraulically-operated ram to effect the switching which must be provided with a receiver and a power supply actuated by a remote signal.

Such additional equipment clearly increases the risk of a failure occurring, while the remote nature of the switching operation leads to questions as to whether or not switching has in fact occurred. A sensor could be provided to detect the appropriate movement, but this adds still further to the cost.

DISCLOSURE OF THE INVENTION

It would be desirable to be able to provide a torque wrench capable of providing both clockwise and anticlockwise rotation of a component without the necessity of removing the wrench from the component and without the requirement for a manually-operated or powered switching mechanism within the wrench.

According to the present invention there is provided a torque wrench comprising a housing in which is mounted a rotatable ratchet mechanism adapted to co-operate with a component to be rotated by the wrench, a first drive lever extending radially of said ratchet mechanism and pivotal about one end thereof coaxial with the ratchet mechanism on the application to the other end thereof of a driving force, first drive means reacting between the first lever and the ratchet mechanism whereby, on movement of the first lever from a rest position towards a fully displaced position, the ratchet mechanism is rotated in one direction, a second drive lever extending radially of said ratchet mechanism and pivotal about one end thereof coaxial with the ratchet mechanism on the application to the other end thereof of a driving force, and second drive means reacting between the second lever and the ratchet mechanism whereby, on movement of the second lever from a rest position towards a fully displaced position, the ratchet mechanism is rotated in the other direction, the wrench further comprising control means reacting between the housing and the first and second drive means in such a manner that, with a lever in its rest position, the associated drive means is disengaged from the ratchet mechanism.

It will thus be appreciated that, with such an arrangement, rotation of the component to be tightened or loosened can be achieved in either direction by



appropriate pivoting movement of the associated drive lever, there being no need to actuate any switching means, disengagement of the non-active drive means occurring automatically when in its rest position by virtue of said control means.

In a preferred embodiment of the invention, the control means are such that, on movement of a drive lever from its rest position towards its fully displaced position, the associated drive means are brought into engagement with the ratchet mechanism while the other drive lever is held in its rest position with its associated drive means disengaged from the ratchet mechanism.

In one embodiment of the invention, each drive means is mounted on a lever arm pivotal on the associated drive lever, abutment means being provided on the housing whereby, with the drive lever in its rest position, the lever arm engages the associated abutment means to pivot the drive means out of engagement with the ratchet mechanism, and, on movement of the drive lever to a displaced position, the lever arm disengages from said abutment whereby the drive means move into driving engagement with the ratchet mechanism.

In an alternative embodiment of the invention, the torque wrench includes, for each drive lever, a lever arm pivotal on the housing, one end of the lever arm being adapted for engagement with the associated drive



means and the other end of the lever arm being adapted for engagement by abutment means on the associated drive lever, the arrangement being such that, with the drive lever in its rest position, the abutment means on the drive lever engage the other end of the lever arm to pivot said lever arm whereby the one end thereof disengages the drive means from the ratchet mechanism, and, on movement of the drive lever to a displaced position, the other end of the lever arm disengages from the abutment means and the drive means move into driving engagement with the ratchet mechanism.

Preferably the torque wrench includes, for each drive lever, a fluid-operated piston-cylinder assembly interconnected with the other end of the associated drive lever, extension of the piston of the assembly causing pivotal movement of the associated drive lever about the one end thereof from its rest position towards its fully displaced position.

The fluid supply to said piston-cylinder assemblies is preferably such that, prior to extension of the piston of one assembly to move the associated drive lever from its rest position, the piston of the other assembly is fully retracted to hold the associated drive lever in its rest position.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 and 2 show parts of two alternative torque wrenches according to the invention.



DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Fig. 1, there is illustrated part of a bi-directional torque wrench including a housing part of which is shown at 2. The housing 2 contains a ratchet mechanism 4 rotatable within the housing about point P and provided with a hexagonal recess 6 therein for co-operation with a nut, bolt or socket to be rotated.

A first drive lever or crank 8 for the mechanism 4 has one end pivotal about the point P, the piston rod 10 of a first hydraulic piston-cylinder assembly 12 being pivotally attached at 14 to the other end of said lever 8.

The lever 8 is shown in its rest position with the piston rod 10 of the assembly 12 fully retracted. On extension of the rod 10, the lever 8 is pivoted about the point P in an anticlockwise direction towards a fully displaced position as will be detailed below.

A second drive lever or crank 16 for the mechanism 4 has one end pivotal about the point P, the piston rod 18 of a second hydraulic piston-cylinder assembly 20 being pivotally attached at 22 to the other end of the lever 16. The assemblies 12,20 work in opposite directions to one another.

The lever 16 is shown in a displaced position with the piston rod 18 of the assembly 20 partly extended and having pivoted the lever 16 in a clockwise direction from its rest position.

Drive means react between the levers 8,16 and the ratchet mechanism 4 to enable appropriate rotation of said mechanism on pivotal movement of the levers 8,16 about the point P.

More particularly, a carrier arm 24 is pivotally mounted at 26 on the lever 8, one end of said arm 24, with the lever 8 in its illustrated rest position, engaging an abutment 28 within the housing 2 whereby the arm 24 is held in the inoperative position shown in the drawing.

A toothed drive shoe 30 is carried on the other end of said arm 24, said shoe 30, with the arm 24 in its inoperative position, being held out of engagement with the teeth of the ratchet mechanism 4.

The arrangement is such that, on extension of the piston rod 10 of the assembly 12 from its fully retracted position, the lever 8 is pivoted in an anticlockwise direction from its illustrated rest position. The one end of the carrier arm 24 is thereby disengaged from the abutment 28 and pivots in an anticlockwise direction about the point 26 whereby the teeth of the drive shoe 30 are moved into meshing engagement with the teeth of the ratchet mechanism 4, continued pivotal movement of the lever 8 resulting in corresponding anticlockwise rotation of the mechanism 4.

A corresponding drive arrangement is provided between the lever 16 and the mechanism 4, with

components equivalent to those of the arrangement between the lever 8 and the mechanism 4 being similarly referenced but with a dash added.

As the lever 16 is displaced from its rest position, the carrier arm 24¹ has disengaged from the abutment 28¹ and the drive shoe 30¹ has moved into driving engagement with the ratchet mechanism 4.

With both the clockwise and anticlockwise drive arrangements, movement of the piston rod 10,18 to its fully retracted position brings the one end of the associated lever arm 24,24¹ into engagement with the abutment 28,28¹ on the housing to pivot said lever arm 24,24¹ about the point 26,26¹ into its inoperative position and to disengage the drive shoe 30,30¹ from the ratchet mechanism 4.

The hydraulic supply to the assemblies 12,20 is such that, on demand to one of said assemblies for extension purposes, the fluid is first of all fed to the other assembly to ensure that the associated piston rod is fully retracted and thereby that the associated drive shoe is disengaged from the ratchet mechanism 4.

So, on driving of the ratchet mechanism 4 in one direction by the shoe 30,30¹, the other shoe 30¹,30 is totally disengaged from the mechanism, thereby avoiding any locking up of said mechanism.

Fig. 2 illustrates an alternative arrangement for engaging and disengaging the drive shoes with and from the ratchet mechanism. Components equivalent to those

of Fig. 1 are similarly referenced.

Effectively, the locations of the lever arms 24,24¹ are pivotally mounted on the housing 2. With the lever 8,16 in its rest position, the one end of the lever arm 24,24¹ engages the associated abutment 28,28¹ whereby the other end of the lever arm 24,24¹ is pivoted upwardly to engage the drive shoe 30,30¹ and lift it out of engagement with the ratchet mechanism 4 (as shown for shoe 30 in Fig. 2).

Pivoting movement of the lever 8,16 from its rest position towards a displaced position results in disengagement of the one end of the lever arm 24,24¹ from the abutment 28,28¹ and downward pivoting movement of the other end of the lever arm 24,24¹ out of contact with the drive shoe 30,30¹ whereby said shoe 30,30¹ moves into meshing engagement with the ratchet mechanism 4 (as is shown for shoe 30¹ in Fig. 2).

Thus there is provided a bi-directional torque wrench which is particularly suited to remote operation, for example in subsea and nuclear applications, in that there is no need to provide separate switching of the drive means when moving from clockwise to anticlockwise rotation and vice versa. Location of a drive lever 8,16 in its rest position ensures that the associated drive shoe is totally disengaged from the ratchet mechanism, and thereby enables rotation of the mechanism 4 by the other drive lever 16,8 without the possibility of malfunctioning of

the wrench.

Clearly the precise means by which a drive shoe is disengaged from the ratchet mechanism 4 can vary from those illustrated, providing said disengagement is achieved when the lever is in its rest position.

CLAIMS

1. A torque wrench comprising a housing (2) in which is mounted a rotatable ratchet mechanism (4) adapted to co-operate with a component to be rotated by the wrench, a first drive lever (8) extending radially of said ratchet mechanism (4) and pivotal about one end thereof coaxial with the ratchet mechanism (4) on the application to the other end thereof of a driving force, first drive means (3) reacting between the first lever (8) and the ratchet mechanism (4) whereby, on movement of the first lever (8) from a rest position towards a fully displaced position, the ratchet mechanism (4) is rotated in one direction, a second drive lever (16) extending radially of said ratchet mechanism (4) and pivotal about one end thereof coaxial with the ratchet mechanism (4) on the application to the other end thereof of a driving force, and second drive means (30¹) reacting between the second lever (16) and the ratchet mechanism (4) whereby, on movement of the second lever (16) from a rest position towards a fully displaced position, the ratchet mechanism (4) is rotated in the other direction, characterised by control means (24, 26, 28; 24¹, 26¹, 28¹) reacting between the housing (2) and the first and second drive means (30, 30¹) in such a manner that, with a lever (8, 16) in its rest position, the associated drive means (30, 30¹) is disengaged from the ratchet mechanism (4).

2. A torque wrench as claimed in claim 1 in





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which the control means (28, 28¹) are such that, on movement of a drive lever (8, 16) from its rest position towards its fully displaced position, the associated drive means (30, 30¹) are brought into engagement with the ratchet mechanism (4) while the other drive lever (16, 8) is held in its rest position with its associated drive means (30¹, 30) disengaged from the ratchet mechanism (4).

3. A torque wrench as claimed in claim 1 or claim 2 in which each drive means (30, 30¹) is mounted on a lever arm (24, 24¹) pivotal on the associated drive lever (8, 16), abutment means (28, 28¹) being provided on the housing (2) whereby, with the drive lever (8, 16) in its rest position, the lever arm (24, 24¹) engages the associated abutment means (28, 28¹) to pivot the drive means (30, 30¹) out of engagement with the ratchet mechanism (4), and, on movement of the drive lever (8, 16) to a displaced position, the lever arm (24, 24¹) disengages from said abutment (28, 28¹) whereby the drive means (30, 30¹) move into driving engagement with the ratchet mechanism (4).

4. A torque wrench as claimed in claim 1 or claim 2 and including, for each drive lever (8, 16), a lever arm (24, 24¹) pivotal on the housing (2), one end of the lever arm (24, 24¹) being adapted for engagement with the associated drive means (30, 30¹) and the other end of the lever arm (24, 24¹) being adapted for engagement by abutment means (28, 28¹) on the associated

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drive lever (8, 16), the arrangement being such that, with the drive lever (8, 16) in its rest position, the abutment means (28, 28¹) on the drive lever (8, 16) engage the other end of the lever arm (24, 24¹) to pivot said lever arm (24, 24¹) whereby the one end thereof disengages the drive means (30, 30¹) from the ratchet mechanism (4), and, on movement of the drive lever (8, 16) to a displaced position, the other end of the lever arm (24, 24¹) disengages from the abutment means (28, 28¹) and the drive means (30, 30¹) move into driving engagement with the ratchet mechanism (4).

5. A torque wrench as claimed in any one of claims 1 to 4 and including, for each drive member (8, 16), a fluid-operated piston-cylinder assembly (12, 20) interconnected with the other end of the associated drive lever (8, 16), extension of the piston (10, 18) of the assembly (12, 20) causing pivotal movement of the associated drive lever (8, 16) about the one end thereof from its rest position towards its fully displaced position.

6. A torque wrench as claimed in claim 5 in which the fluid supply to the piston-cylinder assemblies (12, 20) is such that, prior to the extension of the piston (10, 18) of one assembly (12, 20) to move the associated drive lever (8, 16) from its rest position, the piston (18, 10) of the other assembly (20, 12) is fully retracted to hold the associated drive lever (16, 8) in its rest position.

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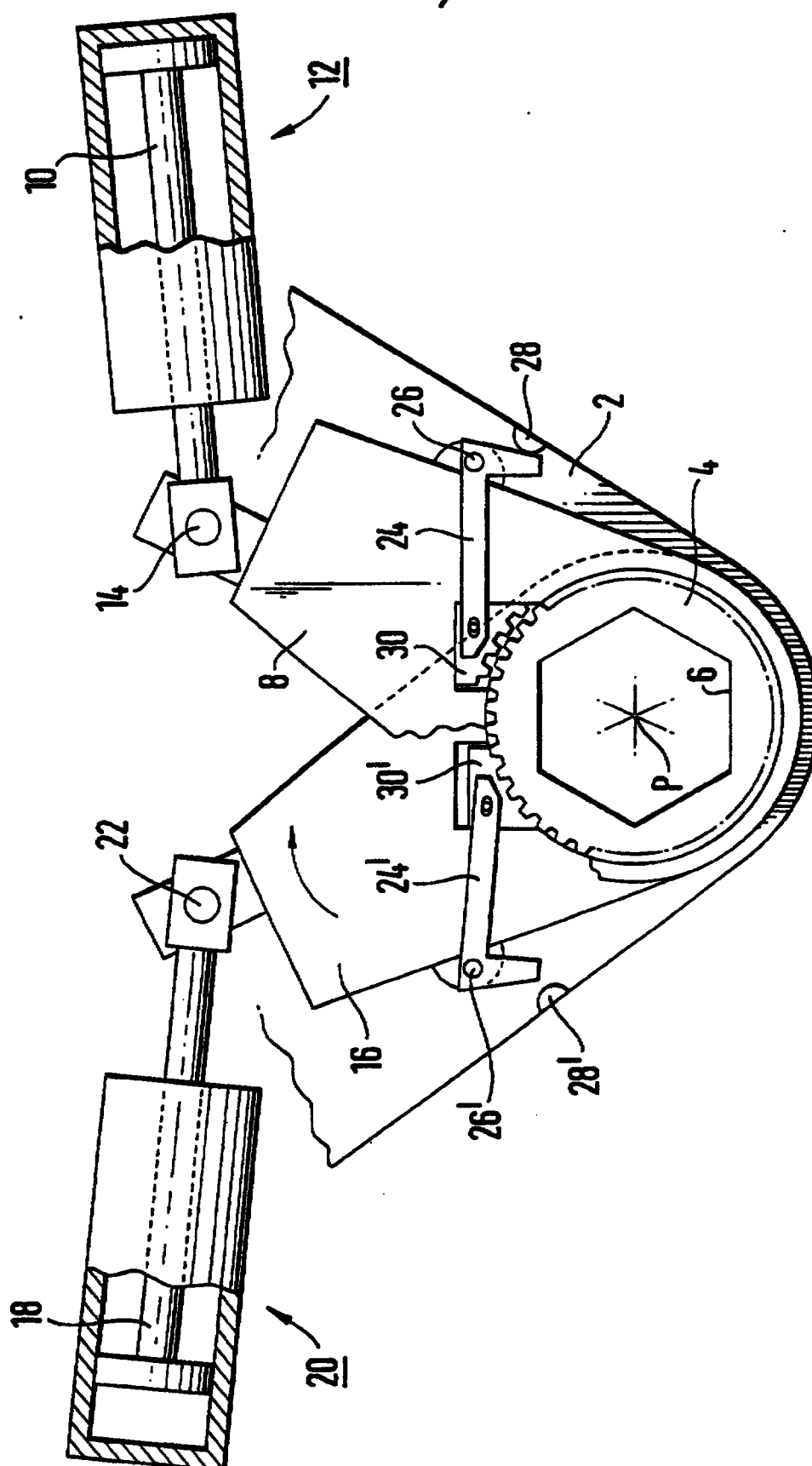
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Fig. 1

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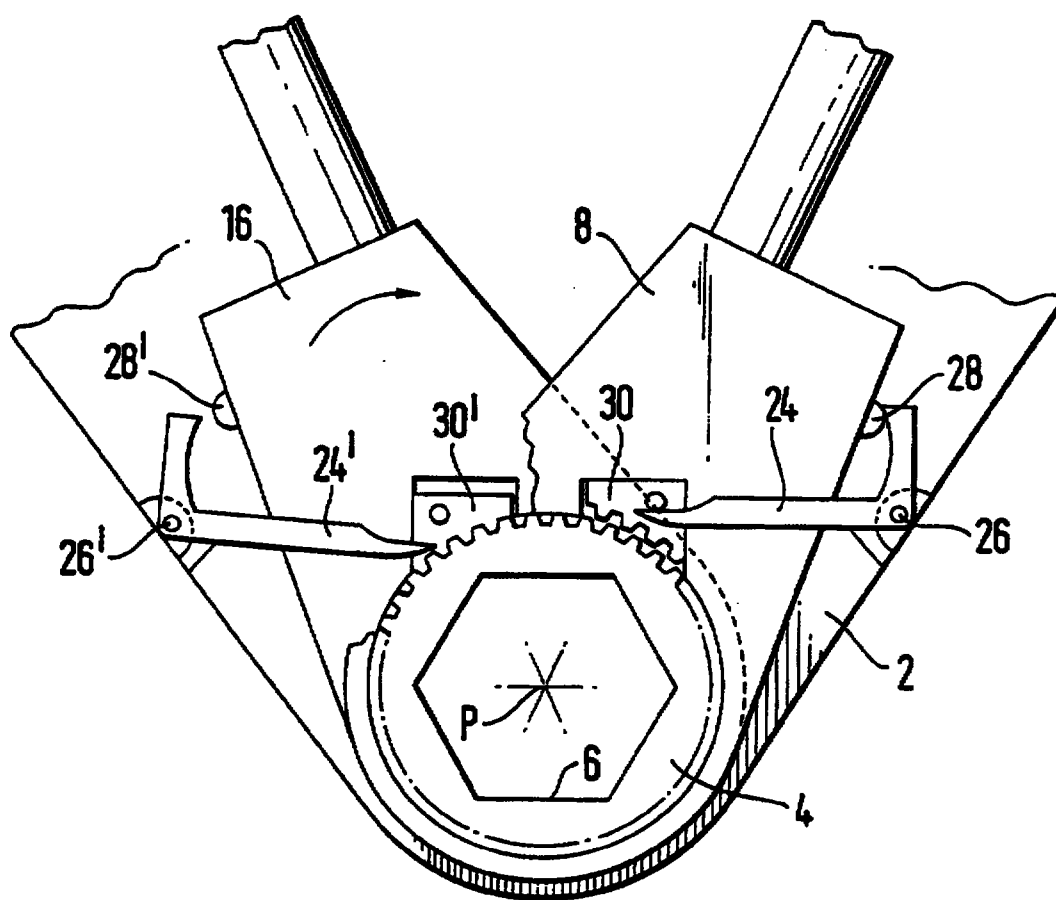


Fig. 2

Additionally, torque wrenches are finding uses in many industries as valve actuators where rotation of the valve spindle in both directions must be readily available.

It has therefore been proposed, for example as disclosed in US-A-2729997, to provide torque wrenches incorporating bi-directional mechanisms whereby rotation in both directions can be achieved without removing the wrench from the component to be rotated.

Such bi-directional torque wrenches commonly incorporate a pair of drive shoes each reacting between the crank lever and the ratchet mechanism, one shoe associated with clockwise rotation of the ratchet mechanism and the other shoe associated with anticlockwise rotation of said mechanism.

More particularly, the two drive shoes are interconnected with one another, each shoe being movable between an operative drive position engaging with the ratchet mechanism and an inoperative position disengaged from said mechanism. The interconnection of the two shoes is such that, when one of the drive shoes is in its operative drive position, the other drive shoe is completely disengaged from the ratchet mechanism.

A switching mechanism, which may be manually operated or powered, is provided to alter the relative positions of the drive shoes to achieve either clockwise or anticlockwise rotation. Failure to

According to the present invention there is provided a torque wrench comprising a housing in which is mounted a rotatable ratchet mechanism adapted to co-operate with a component to be rotated by the wrench, a first drive lever extending radially of said ratchet mechanism and pivotal about one end thereof coaxial with the ratchet mechanism, first lever drive means for applying a driving force to the other end of the first lever to pivot said first lever about the one end thereof reciprocatingly between a rest position and a fully displaced position, first drive means reacting between the first lever and the ratchet mechanism whereby, on movement of the first lever from the rest position towards the fully displaced position, the ratchet mechanism is rotated in one direction, a second drive lever extending radially of said ratchet mechanism and pivotal about one end thereof coaxial with the ratchet mechanism, second lever drive means for applying a driving force to the other end of the second lever to pivot said second lever about the one end thereof reciprocatingly between a rest position and a fully displaced position, and second drive means reacting between the second lever and the ratchet mechanism whereby, on movement of the second lever from the rest position towards the fully displaced position, the ratchet mechanism is rotated in the other direction, the wrench further comprising control means reacting between the housing and the first and second drive means such that, with a lever in its rest

position, the associated drive means is disengaged from the ratchet mechanism, and such that, on movement of a drive lever from its rest position towards its fully displaced position, the associated drive means are brought into engagement with the ratchet mechanism while the other drive lever is held in its rest position with its associated drive means disengaged from the ratchet mechanism.

It will thus be appreciated that, with such an arrangement, rotation of the component to be tightened or loosened can be achieved in either direction by appropriate pivoting movement of the associated drive lever, there being no need to actuate any switching means, disengagement of the non-active drive means occurring automatically when in its rest position by virtue of said control means.

In one embodiment of the invention, each drive means is mounted on a lever arm pivotal on the associated drive lever, abutment means being provided on the housing whereby, with the drive lever in its rest position, the lever arm engages the associated abutment means to pivot the drive means out of engagement with the ratchet mechanism, and, on movement of the drive lever to a displaced position, the lever arm disengages from said abutment means whereby the drive means move into driving engagement with the ratchet mechanism.

In an alternative embodiment of the invention, the torque wrench includes, for each drive lever, a lever

arm pivotal on the housing, one end of the lever arm being adapted for engagement with the associated drive means and the other end of the lever arm being adapted for engagement by abutment means on the associated drive lever, the arrangement being such that, with the drive lever in its rest position, the abutment means on the drive lever engage the other end of the lever arm to pivot said lever arm whereby the one end thereof disengages the drive means from the ratchet mechanism, and, on movement of the drive lever to a displaced position, the other end of the lever arm disengages from the abutment means and the drive means move into driving engagement with the ratchet mechanism.

Preferably the lever drive means each comprise a fluid-operated piston-cylinder assembly interconnected with the other end of the associated drive lever, extension of the piston of the assembly causing pivotal movement of the associated drive lever about the one end thereof from its rest position towards its fully displaced position.

The fluid supply to said piston-cylinder assemblies is preferably such that, prior to extension of the piston of one assembly to move the associated drive lever from its rest position, the piston of the other assembly is fully retracted to hold the associated drive lever in its rest position.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 and 2 show parts of two alternative torque wrenches according to the invention.

CLAIMS

1. A torque wrench comprising a housing (2) in which is mounted a rotatable ratchet mechanism (4) adapted to co-operate with a component to be rotated by the wrench, a first drive lever (8) extending radially of said ratchet mechanism and pivotal about one end thereof coaxial with the ratchet mechanism (4), first lever drive means (12) for applying a driving force to the other end of the first lever (8) to pivot said first lever (8) about the one end thereof reciprocatingly between a rest position and a fully displaced position, first drive means (30) reacting between the first lever (8) and the ratchet mechanism (4) whereby, on movement of the first lever (8) from the rest position towards the fully displaced position, the ratchet mechanism (4) is rotated in one direction, a second drive lever (16) extending radially of said ratchet mechanism (4) and pivotal about one end thereof coaxial with the ratchet mechanism (4), second lever drive means (20) for applying a driving force to the other end of the second lever (16) to pivot said second lever (16) about the one end thereof reciprocatingly between a rest position and a fully displaced position, and second drive means (30¹) reacting between the second lever (16) and the ratchet mechanism (4) whereby, on movement of the second lever (16) from the rest position towards the fully displaced position, the ratchet mechanism (4) is rotated in the other



direction, characterised by control means (24, 26, 28; 24¹, 26¹, 28¹) reacting between the housing (2) and the first and second drive means (30, 30¹) such that, with a lever (8, 16) in its rest position, the associated drive means (30, 30¹) is disengaged from the ratchet mechanism (4), and such that, on movement of a drive lever (8, 16) from its rest position towards its fully displaced position, the associated drive means (30, 30¹) is brought into engagement with the ratchet mechanism (4) while the other drive lever (16, 8) is held in its rest position with its associated drive means (30¹, 30) disengaged from the ratchet mechanism (4).

2. A torque wrench as claimed in claim 1 in which each drive means (30, 30¹) is mounted on a lever arm (24, 24¹) pivotal on the associated drive lever (8, 16), abutment means (28, 28¹) being provided on the housing (2) whereby, with the drive lever (8, 16) in its rest position, the lever arm (24, 24¹) engages the associated abutment means (28, 28¹) to pivot the drive means (30, 30¹) out of engagement with the ratchet mechanism (4), and, on movement of the drive lever (8, 16) to a displaced position, the lever arm (24, 24¹) disengages from said abutment means (28, 28¹) whereby the drive means (30, 30¹) move into driving engagement with the ratchet mechanism (4).

3. A torque wrench as claimed in claim 1 and including, for each drive lever (8, 16), a lever arm (24, 24¹) pivotal on the housing (2), one end of the



lever arm (24, 24¹) being adapted for engagement with the associated drive means (30, 30¹) and the other end of the lever arm (24, 24¹) being adapted for engagement by abutment means (28, 28¹) on the associated drive lever (8, 16), the arrangement being such that, with the drive lever (8, 16) in its rest position, the abutment means (28, 28¹) on the drive lever (8, 16) engage the other end of the lever arm (24, 24¹) to pivot said lever arm (24, 24¹) whereby the one end thereof disengages the drive means (30, 30¹) from the ratchet mechanism (4), and, on movement of the drive lever (8, 16) to a displaced position, the other end of the lever arm (24, 24¹) disengages from the abutment means (28, 28¹) and the drive means (30, 30¹) move into driving engagement with the ratchet mechanism (4).

4. A torque wrench as claimed in any one of claims 1 to 3 in which the lever drive means each comprise a fluid-operated piston-cylinder assembly (12, 20) interconnected with the other end of the associated drive lever (8, 16), extension of the piston (10, 18) of the assembly (12, 20) causing pivotal movement of the associated drive lever (8, 16) about the one end thereof from its rest position towards its fully displaced position.

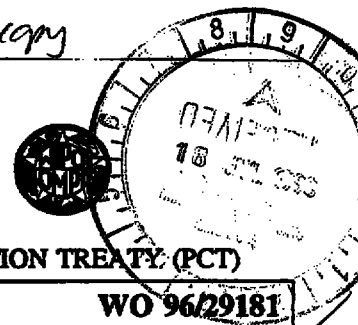
5. A torque wrench as claimed in claim 4 in which the fluid supply to the piston-cylinder assemblies (12, 20) is such that, prior to the extension of the piston (10, 18) of one assembly (12,



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20) to move the associated drive lever (8, 16) from its rest position, the piston (18, 10) of the other assembly (20, 12) is fully retracted to hold the associated drive lever (16, 8) in its rest position.

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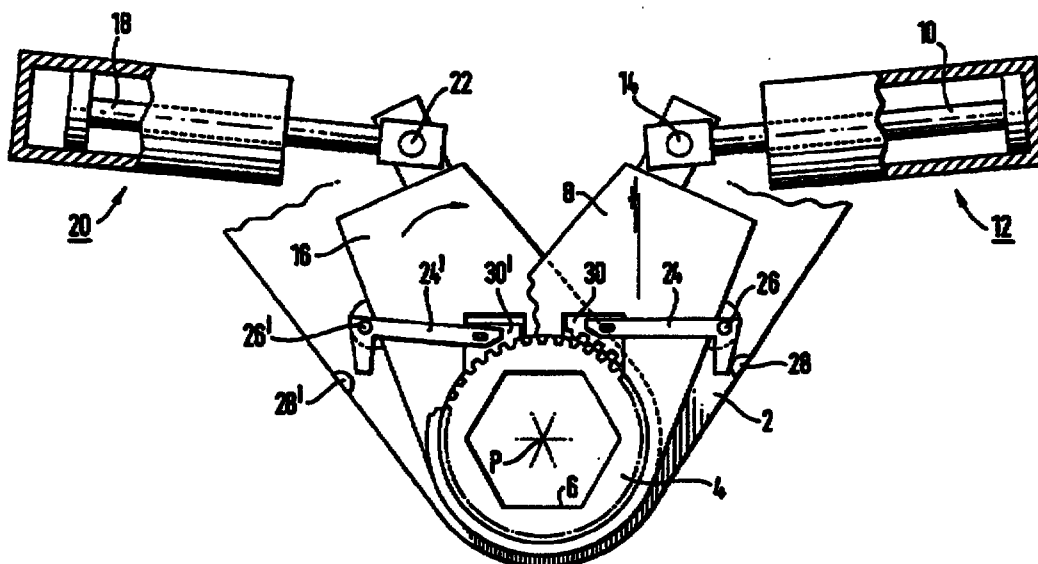
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B25B 21/00	A1	(11) International Publication Number: WO 96/29181 (43) International Publication Date: 26 September 1996 (26.09.96)
(21) International Application Number: PCT/GB96/00637 (22) International Filing Date: 18 March 1996 (18.03.96) (30) Priority Data: 9505545.5 20 March 1995 (20.03.95) GB (71) Applicant (for all designated States except US): HEDLEY PURVIS LIMITED [GB/GB]; Coopies Lane Industrial Estate, Morpeth, Northumberland NE61 6JU (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): WALTON, John, Nigel [GB/GB]; 29 The Villas, Stannington, Morpeth, Northumberland NE61 6AT (GB). (74) Agent: SANDERSON, Michael, John; Mewburn Ellis, York House, 23 Kingsway, London WC2B 6HP (GB).	(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published With international search report.	

(54) Title: **TORQUE WRENCH**



(57) Abstract

A bi-directional torque wrench comprises a housing (2) in which is mounted a ratchet mechanism (4) for rotating an associated nut or bolt, first and second drive levers (8, 16) each movable in opposite directions between rest and displaced positions to rotate the ratchet mechanism (4) in said opposite directions through drive means (30, 30') reacting between the associated lever (8, 16) and the ratchet mechanism (4). Control means (24, 26, 28; 24', 26', 28') react between the housing (2) and the drive means (30, 30') in such a manner that, with a lever (8, 16) in its rest position, the associated drive means (30, 30') is disengaged from the ratchet mechanism (4).