

An accessory and device for turnbuckle release and tightening

FIELD OF INVENTION

[001] This invention relates to an accessory and device for turnbuckle release and tightening.

BACKGROUND TO INVENTION

[002] In the shipping industry, intermodal shipping containers are typically stacked one on top of the other and secured to one another via adjacent corner casting. Container lashings are used to secure a single container or a stack of containers to a deck of a container ship. Typically, container lashings comprise two steel rods, each steel rod has a hook or fastener connected to one end and the other end of each rod is connected to a tensioning device for tensioning the rods. In use, one hook or fastener of the lashing is connected to a corner casting of a container to be secured/ constrained and the other hook or fastener of the lashing is connected to a securing formation, lashing ring, lashing plate, or corner casting built into a deck of a container ship.

[003] The tensioning device is used to tension the rods once the hooks or fasteners of the rods are connected as described above. Typically, the tensioning device is in the form of a turnbuckle, such as, for example, a turnbuckle as illustrated in Fig. 1 of the drawings. As shown in Fig. 1 of the drawings, the turnbuckle indicated generally by the reference numeral 2 has a rigid turnable body, commonly referred to as a "bottle" 4. The bottle 4 has openings at either end thereof for threadably receiving a threaded bolt 6 having a connector 8 at the ends of the bolt 6. In use, the bottle 4 is rotated for releasing or tightening a tension in the rods connected to the connectors 8 of the bolt 4 of the turnbuckle 2. More specifically, the bottle 4 is rotated about an axis 9 of rotation of the bottle 4 of the turnbuckle 2.

[004] As such, various spanners and other manual tools are utilized when releasing and tightening the turnbuckle. This is very physically challenging work, as the forces required to release and tighten the bottle of a turnbuckle are substantial and the process must be repeated multiple times one after the other when securing or releasing multiple container lashings. Furthermore, the job is dangerous as slipping with the tool may commonly result in falling or other types of impact injury.

[005] As such, a need exists for a tool to accomplish releasing and tightening of container lashings safely and efficiently. A need further exists for an accessory which can be connected to a screw gun for releasing and tightening of container lashings.

[006] In this specification, any reference to a "screw gun" shall be interpreted broadly to mean any device which is configured for producing a rotational force, such as, for example, a powered screwdriver, drill, or the like.

SUMMARY OF INVENTION

[007] According to a first aspect of the invention, there is provided an accessory for turnbuckle release and tightening, the accessory being connectable to a screw gun, the accessory including:

a bottle spanner including a bottle engaging formation for engaging a bottle of a turnbuckle, in use, the bottle spanner having an axis of rotation about which the bottle spanner is rotated, in use, the bottle engaging formation defining a jaw for gripping the bottle of the turnbuckle and a lateral jaw opening located radially outwardly spaced from the axis of rotation of the bottle spanner and through which the bottle of the turnbuckle is introduced into the jaw, in use;

a screw gun engaging formation for engaging a screw gun and to which a chuck of the screw gun is connected, in use, in an arrangement wherein rotation forces generated by the screw gun produces rotation of the screw gun engaging formation, in use;

a force transmission mechanism for transmitting rotational forces from the screw gun engaging formation to the bottle engaging formation of the accessory for displacing the bottle, in use; when releasing or tightening the turnbuckle;

wherein the axis of rotation of the bottle spanner is aligned with an axis of rotation of the bottle of the turnbuckle; and wherein the axis of rotation of the screw gun engaging formation is perpendicular to the axis of rotation of the bottle spanner.

[008] The accessory may further include a housing.

[009] The force transmission mechanism may include a drive shaft assembly which is driven by the screw gun, in use, and a driven shaft assembly which is driven by the drive shaft assembly, in use.

[010] The drive shaft assembly may include:

(a) a worm shaft which is fixedly connected to the screw gun engaging formation, in use;

(b) a pair of spaced apart worm gears fixedly connected to the worm shaft and spaced apart from one another; and

(c) rotatable drive shaft mounting means for rotationally mounting the drive shaft to the housing.

[011] The driven shaft assembly may comprise a pair of driven shaft assemblies, each driven shaft assembly including:

- (i) a worm wheel driven shaft;
- (ii) a worm wheel mounted to the associated worm wheel driven shaft;
- (iii) a helical gear mounted to the associated worm wheel driven shaft;
- (iv) rotatable driven shaft mounting means for rotatably mounting the worm wheel driven shaft to the housing.

[012] Each worm wheel of each driven shaft assembly is configured to be driven by an associated different one of the pair of spaced apart worm gears of the drive shaft, which are rotated by the screw gun, in use.

[013] The bottle spanner may include an outer peripheral edge region which defines a helical gear thereon.

[014] The helical gear of the bottle spanner may be configured for meshing with each one of the spaced apart helical gears of the driven shaft, in use, to provide for rotation of the bottle spanner, in use, for releasing and tightening the bottle of the turnbuckle, in use.

[015] A spacing between the helical gears of the driven shaft may be greater than a length of the lateral jaw opening. As such, in use, at least one of the helical gears of the driven shaft will mesh with the helical gear of the bottle spanner, use, when the jaw opening is adjacent the other one of the helical gears of the driven shaft.

[016] The accessory may include spanner mounting means for rotatably mounting the bottle spanner to the housing. The spanner mounting means may be in the form of complementary spanner mounting formations defined on the bottle spanner

and the housing for rotatably mounting the bottle spanner to the housing. The complementary spanner mounting formations may comprise an elongate rail projecting outwardly from the bottle spanner and a complementary track within which the rail is slidingly received in use, for guiding rotation of the bottle spanner relative to the housing.

[017] The accessory may further include a handle assembly projecting outwardly from the accessory for gripping by a user for supporting the accessory, in use.

[018] The handle assembly may include:

a handle support which is mounted to the housing and to which one end of the handle rod is mounted, in use; and

a handle which may be gripped by a user, in use, the handle being mounted, in use, to the other end of the handle rod.

[019] The invention extends to a device for turnbuckle release and tightening, the device including an accessory as described and defined hereinabove and a screw gun connectable to the accessory.

BRIEF DESCRIPTION OF DRAWINGS

[020] Further features of the invention are described hereinafter by way of a non-limiting example of the invention, with reference to and as illustrated in the accompanying schematic drawings. In the drawings:

[021] Fig. 1 shows a front view of a prior art turnbuckle;

[022] Fig. 2 shows a side view of a device, in accordance with one aspect of the invention, for turnbuckle release and tightening, including an accessory for turnbuckle release and tightening;

[023] Fig. 3 shows a partially exploded perspective view of the device of Fig.2;

[024] Fig. 4 shows an exploded perspective view of the device of Fig.2;

[035] Fig. 5. shows another exploded perspective view of the device of Fig.2 as viewed from another perspective;

[036] Fig. 6. Shows an internal view of internal parts of the accessory of Figure 2 and showing the bottle spanner in a starting position; and

[027] Fig. 7. Shows a fragmentary enlarged sectional view of internal parts of a portion of the accessory of Figure 6.

DETAILED DESCRIPTION OF THE DRAWINGS

[028] With reference to the drawings, a turnbuckle loosening device, in accordance with one aspect of the invention, for turnbuckle release and tightening, is designated generally by the reference numeral 10.

[029] The turnbuckle loosening device 10 is configured for turnbuckle release and tighten, for tensioning or releasing tension in steel rods used during container lashing operations for securing intermodal shipping containers during transport thereof.

[030] The turnbuckle loosening device 10 includes a screw gun 12 and a turnbuckle loosening accessory 14, in accordance with another aspect of the invention, which is connectable to the screw gun 12.

[031] The screw gun 12 has a rotatable chuck 36 and is configured for use with the turnbuckle loosening accessory 14 and specifically has the following features:

- A directional switch to switch between clockwise rotation of the chuck, counter clockwise rotation of the chuck and a neutral position in which the chuck is not rotated by the motor of the screw gun and is disengaged from the motor of the screw gun 12.
- Cordless operation as facilitated by a rechargeable battery.
- Includes more than one removable battery and a charger for charging the removed battery and/ or the battery mounted on the screw gun.

[032] The screw gun 12 will not be explained in more detail hereinbelow and may include selected features which are common on portable screw guns/ drills.

[033] The turnbuckle loosening accessory 14 can be used with any type of screw gun, other than the screw gun 12, however, optimum and safe operations is provided by the screw gun 12, which is preferable over other types of screw guns.

[034] The turnbuckle loosening accessory 14 is configured for turnbuckle release and tightening and includes a bottle spanner 16, a screw gun engaging formation in the form of a bit 18 for connection with the screw gun 12, a force transmission mechanism, a housing 22, spanner mounting means in the form of a spanner mounting mechanism for rotatably mounting the bottle spanner 16 to the housing 22 and a handle assembly projecting outwardly from the turnbuckle loosening accessory 14 for gripping by a user for supporting the accessory 14, in use

[035] The bottle spanner 16 includes a bottle engaging formation defining a jaw 28 for engaging a bottle 4 of a turnbuckle 2, in use, and an outer peripheral edge region which defines a helical gear 30 thereon, the purpose of which will be explained in more detail hereinbelow.

[036] As shown in Figure 3 of the drawings, the bottle spanner 16 has an axis 32 of rotation about which the bottle spanner 16 is rotated, in use.

[037] The jaw 28 is configured for gripping the bottle 4 of the turnbuckle 2 and defines a lateral jaw opening 34 located radially outwardly spaced from the axis 32 of rotation of the bottle spanner 16 and through which the bottle 4 of the turnbuckle 2 is introduced into the jaw 28, in use.

[038] The bit 18 is configured for engaging the chuck 36 of the screw gun 12, in use, as shown in Figures 4 and 5 of the drawings, in an arrangement wherein rotation forces generated by the screw gun 12 produces rotation of the bit 18, in use.

[039] The force transmission mechanism is configured for transmitting rotational forces from the bit 18 to the jaw 28 of the accessory 14 for displacing the bottle 4, in use; when releasing or tightening the turnbuckle 10.

[040] The force transmission mechanism includes a drive shaft assembly 38 (see Figure 4) which is driven by the screw gun 12, in use, and two driven shaft assemblies 40 which are driven by the drive shaft assembly 38, in use.

The drive shaft assembly 38 includes:

- (a) a worm drive shaft 42 which is fixedly connected to the bit 18, in use;
- (b) a pair of spaced apart worm gears 44 fixedly connected to the worm shaft 42 and spaced apart from one another; and
- (c) rotatable drive shaft mounting means in the form of bearings 46 for rotationally mounting the worm drive shaft 42 to the housing 22.

[041] Each driven shaft assembly 40.1, 40.2 includes:

- (i) a worm wheel driven shaft 48;
- (ii) a worm wheel 50 mounted to the associated worm wheel driven shaft 48;
- (iii) a helical gear 52 mounted to the associated worm wheel driven shaft 48;
- (iv) rotatable driven shaft mounting means, in the form of bearings 54, for rotatably mounting the worm wheel driven shaft 48 to the housing 22.

[042] Each worm wheel 50 of each driven shaft assembly 40.1, 40.2 is configured to be driven by an associated different one of the pair of spaced apart worm gears 44 of the drive worm shaft 42, which are rotated by the screw gun 12, in use.

[043] The spanner mounting mechanism is in the form of complementary spanner mounting formations defined on the bottle spanner 16 and the housing 22 for rotatably mounting the bottle spanner 16 to the housing 22. As best shown in Figures 5 and 6 of the drawings, the complementary spanner mounting formations comprise an elongate rail 56 projecting outwardly from the bottle spanner 16 and a complementary track 58 within which the rail 56 is slidingly received in use, for guiding rotation of the bottle spanner 16 relative to the housing 22.

[044] The handle assembly 26 is configured to be gripped by the user for supporting the turnbuckle loosening device 10, in use.

[045] The handle assembly 26 includes a handle rod 60 (see Figure 6); a handle support 62 (see Figure 5) and a handle 64 (see Figure 6). The handle support 62 is mounted to the housing 22 and one end of the handle rod 60 is mounted, in use to the

handle support 62. The handle 64 mounted, in use, to the other end of the handle rod 60 and is configured to be gripped by a user, in use.

[046] The invention extends to the device 10 for turnbuckle release and tightening, the device 10 including the accessory 14, as described and defined hereinabove and a screw gun 12 connectable to the accessory.

[047] In use, the gear 30 of the bottle spanner 16 is configured for meshing with each one of the spaced apart helical gears 52 of the driven shaft 40.1, 40.2, in use, to provide for rotation of the bottle spanner 16, in use, for releasing and tightening the bottle 4 of the turnbuckle 2, in use.

[048] In use, with reference to Figure 6, the bottle spanner 16 is rotated to a start position, as illustrated in Figure 6 of the drawings, in which the jaw opening 34 is aligned with an opening in the housing 22, so as to permit entry of the bottle 4 into the jaw 28 of the bottle spanner 16. Once the bottle 4 is securely received within the jaw 28, rotation about the axis 32 of rotation of the spanner causes tightening or loosening of the turnbuckle 2.

[0049] When the turnbuckle 2 is sufficiently tightened or loosened, the bottle spanner 16 is again rotated to the start position, wherein the jaw opening 34 is aligned with an opening in the housing 22, to permit the bottle 4 of the turnbuckle 2 to be removed from the jaw 28 via the jaw opening 34.

[050] Advantageously, the spacing between the helical gears 52 of the driven shaft 48 are greater than a length of the lateral jaw opening 34. As such, in use, at least one of the helical gears 52 of the driven shaft 48 will mesh with the gear 30 of the bottle spanner 16, in use, when the jaw opening 34 is adjacent the other one of the helical

gears 52 of the driven shaft 48. This ensures continuous rotation of the bottle spanner 16.

[051] The inventors have found that it is highly advantageous that the axis 32 (see Figure 3) of rotation of the bottle spanner 16 is aligned with the axis 9 (see Figure 1) of rotation of the bottle 4 of the turnbuckle 2; and that the axis 67 (see Figure 3) of rotation of the screw bit 18 is perpendicular to the axis 32 of rotation of the bottle spanner, as best shown in Fig. 3 of the drawings.

[052] More specifically, this arrangement is highly advantageous due to the ergonomics and safety of the operation for the following reasons:

1. It allows the user to get a firm grip on the handle 64 and the screw gun 12 at an ergonomically optimized position relative to the in use, position of the turnbuckle 2, as it is encountered, in use, as a part of container lashings for securing intermodal shipping containers.
2. Said firm grip is highly advantageous during tightening and / or loosening of bottles 4 of turnbuckles 2 during container lashing operations, in use, so as to prevent / minimize slipping and falling, or other impact injury, during lashing operations.
3. Turnbuckles 2 can be loosened and tightened faster and will less energy.
4. Using the turnbuckle loosening device 10 for tightening and / or loosening of bottles 4 of turnbuckles 2 during container lashing operations can be faster.
5. Using the turnbuckle loosening device 10 decrease human interaction and effort needed on the vessel during the container lashing operation.
6. Work previously done entirely by manual workers and may lead to repetitive strain injuries will be less exhausting and more safe by using the turnbuckle loosening device 10.

7. In a particular embodiment (not show), the turnbuckle loosening device 10 is equipped with data logging capabilities, allowing for historical data analysis. This will help in predictive maintenance and operational optimization.
8. Using the turnbuckle loosening device 10 ensures that the turnbuckles are tightened equally, with the same torques, thus making the anchoring by the turnbuckles more secure.
9. Employing the turnbuckle loosening device 10 can give a business a competitive edge in terms of speed, quality, and cost-effectiveness, which can be crucial in industries with tight margins and high competition.

[053] This specification has been described with reference to embodiments of the invention. However, one of ordinary skill in the art appreciates that various modifications and changes can be made without departing from the scope of the invention as set forth in the claims below. Accordingly, the specification is to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of invention. For example, the configuration of the bottle spanner and the jaw may vary greatly, depending on the configuration of the bottle of the turnbuckle which it is configured to loosen/ tighten. As such, the inventors envisage bottle spanners having jaws, very different from the jaw 28 illustrated and exemplified in this specification. Similarly, the jaw opening may vary vastly from the jaw opening 34 illustrated and exemplified in this specification. The same principle applies equally to the handle assembly and the screw gun, as well as to the other components illustrated in the specification.

CLAIMS:

1. An accessory for turnbuckle release and tightening, the accessory being connectable to a screw gun, the accessory including:

a bottle spanner including a bottle engaging formation for engaging a bottle of a turnbuckle, in use, the bottle spanner having an axis of rotation about which the bottle spanner is rotated, in use, the bottle engaging formation defining a jaw for gripping the bottle of the turnbuckle and a lateral jaw opening located radially outwardly spaced from the axis of rotation of the bottle spanner and through which the bottle of the turnbuckle is introduced into the jaw, in use;

a screw gun engaging formation for engaging a screw gun and to which a chuck of the screw gun is connected, in use, in an arrangement wherein rotation forces generated by the screw gun produces rotation of the screw gun engaging formation, in use;

a force transmission mechanism for transmitting rotational forces from the screw gun engaging formation to the bottle engaging formation of the accessory for displacing the bottle, in use; when releasing or tightening the turnbuckle;

wherein the axis of rotation of the bottle spanner is aligned with an axis of rotation of the bottle of the turnbuckle; and wherein the axis of rotation of the screw gun engaging formation is perpendicular to the axis of rotation of the bottle spanner.
2. The accessory as claimed in Claim 1, wherein the accessory further includes a housing.
3. The accessory as claimed in Claim 1 or Claim 2, wherein the force transmission mechanism includes a drive shaft assembly which is driven by the screw gun, in

use, and a driven shaft assembly which is driven by the drive shaft assembly, in use.

4. The accessory as claimed in Claim 3, wherein the drive shaft assembly include:
 - (a) a worm shaft which is fixedly connected to the screw gun engaging formation, in use;
 - (b) a pair of spaced apart worm gears fixedly connected to the worm shaft and spaced apart from one another; and
 - (c) rotatable drive shaft mounting means for rotationally mounting the drive shaft to the housing.
5. The accessory as claimed in Claim 4, wherein the driven shaft assembly comprises a pair of driven shaft assemblies, each driven shaft assembly including:
 - (i) a worm wheel driven shaft;
 - (ii) a worm wheel mounted to the associated worm wheel driven shaft;
 - (iii) a helical gear mounted to the associated worm wheel driven shaft;
 - (iv) rotatable driven shaft mounting means for rotatably mounting the worm wheel driven shaft to the housing.
6. The accessory as claimed in Claim 5, wherein each worm wheel of each driven shaft assembly is configured to be driven by an associated different one of the pair of spaced apart worm gears of the drive shaft, which are rotated by the screw gun, in use.

7. The accessory as claimed in Claim 6, wherein the bottle spanner includes an outer peripheral edge region which defines a helical gear thereon.
8. The accessory as claimed in Claim 7, wherein the helical gear of the bottle spanner is configured for meshing with each one of the spaced apart helical gears of the driven shaft, in use, to provide for rotation of the bottle spanner, in use, for releasing and tightening the bottle of the turnbuckle, in use.
9. The accessory as claimed in Claim 8, wherein a spacing between the helical gears of the driven shaft is greater than a length of the lateral jaw opening.
10. The accessory as claimed in Claim 9, wherein, in use, at least one of the helical gears of the driven shaft will mesh with the helical gear of the bottle spanner, use, when the jaw opening is adjacent the other one of the helical gears of the driven shaft.
11. The accessory as claimed in Claim 1, wherein the accessory includes spanner mounting means for rotatably mounting the bottle spanner to the housing.
12. The accessory as claimed in Claim 11, wherein the spanner mounting means are in the form of complementary spanner mounting formations defined on the bottle spanner and the housing for rotatably mounting the bottle spanner to the housing.
13. The accessory as claimed in Claim 12, wherein the complementary spanner mounting formations comprise an elongate rail projecting outwardly from the bottle spanner and a complementary track within which the rail is slidingly

received in use, for guiding rotation of the bottle spanner relative to the housing.

14. The accessory as claimed in Claim 1, wherein the accessory further includes a handle assembly projecting outwardly from the accessory for gripping by a user for supporting the accessory, in use.
15. The accessory as claimed in Claim 14, wherein the handle assembly includes:

a handle support which is mounted to the housing and to which one end of the handle rod is mounted, in use; and

a handle which may be gripped by a user, in use, the handle being mounted, in use, to the other end of the handle rod.
16. A device for turnbuckle release and tightening, the device including an accessory as claimed in any one of the preceding claims; and a screw gun connectable to the accessory.