(12) STANDARD PATENT (11) Application No. **AU 2017202128 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
SHIPPING CONTAINER TWIST-LOCK

(51) International Patent Classification(s)
B65D 90/00 (2006.01) ***E05B 65/00*** (2006.01)
B65D 88/12 (2006.01)

(21) Application No: **2017202128** (22) Date of Filing: **2017.03.30**

(30) Priority Data

(31) Number	(32) Date	(33) Country
2016901179	**2016.03.30**	**AU**

(43) Publication Date: **2017.10.19**
(43) Publication Journal Date: **2017.10.19**
(44) Accepted Journal Date: **2023.02.16**

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(56) Related Art
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ABSTRACT

A twist-lock for locking a shipping container to a truck trailer or to a rail transport vehicle is disclosed. The twist-lock is mountable to a truck trailer or rail transport vehicle and includes a rotatable locking head linked to a driver that causes the locking head to rotate for locking and unlocking the twist-lock with a shipping container. The driver is configured to operate upon receiving an input signal from a location remote from the twist-lock. Also disclosed is a truck trailer including such twist-locks and a remotely actuated twist-lock system.

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FIGURE 1

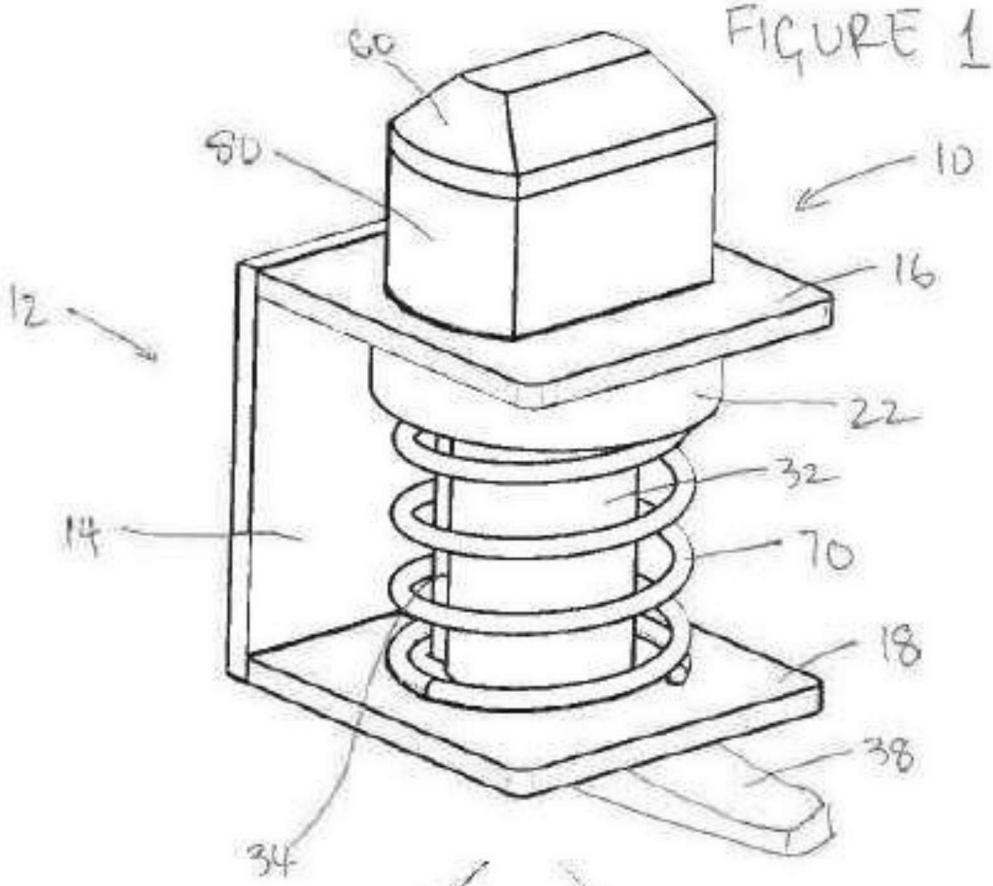
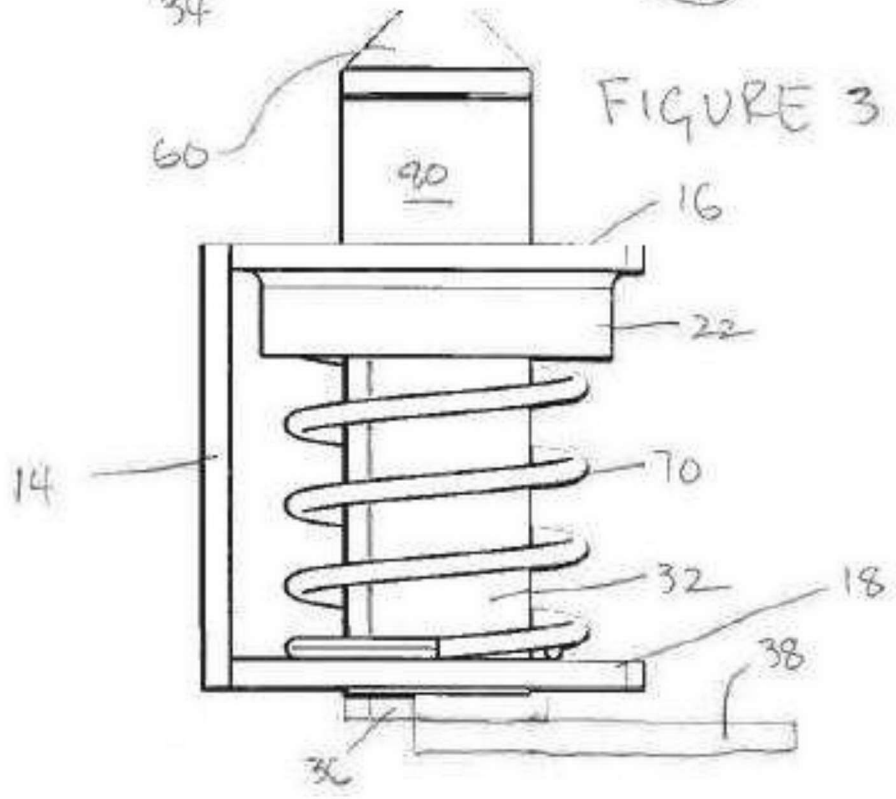


FIGURE 3



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SHIPPING CONTAINER TWIST-LOCK

TECHNICAL FIELD

The present invention relates shipping container transportation. In particular, it relates to securing a shipping container to a trailer of a truck for transporting the shipping container by road and for securing the shipping container to a railway carriage for transporting the shipping container by rail. More particularly, the invention relates to twist-locks fitted to transport vehicles and which lock the shipping container to the trailer.

The twist-lock will be described in the context of road transport by truck trailer, but it will be appreciated that the invention has broader application.

BACKGROUND

Shipping containers include a locking point at least at each lower corner and at corresponding upper corner for securing the container during shipping. The upper locking points are used to lock a shipping container to another shipping container stacked on top or to a point on a ship. The lower locking points are used for the same purpose and, additionally, for securing the shipping container to a truck trailer for transporting the shipping container by road.

The locks fitted to truck trailers for locking to a shipping container are known as twist-locks for the way they operate. Specifically, a twist-lock typically has an athletics-track shaped head on a stem that is mechanically locked within a bracket fastened to the truck trailer. The lock is operated by manually lifting the stem so that the head passes upwardly through an opening which forms part of the locking point on the shipping container. The locking point includes a cavity in communication with the opening and which defines a shoulder surrounding the opening. Rotating the stem so that the head overlaps the shoulder causes the twist-lock to mechanically lock with the locking point of the shipping container.

The twist- lock is formed so that the twisting action causes frictional locking of

the stem in the rotated position i.e. with the head overlapping the shoulder. This prevents the twist-lock from releasing during transport of the container.

The manual process of locking each twist-lock ensures that the truck driver checks that each twist-lock is secured properly. Spending time at each twist-lock, however, exposes the truck driver to the risk of injury or death as a result of traffic, i.e. other trucks or container-loading vehicles such as cranes and container lift vehicles. The risks are ever-present and each year at container wharves around the world, truck drivers are injured and some are killed by traffic while securing a shipping container to a trailer.

It is an object of the invention to reduce the extent to which truck drivers are exposed to risk while operating twist-locks.

The above description is not to be taken as an admission of the common general knowledge in Australia or elsewhere.

SUMMARY OF THE DISCLOSURE

There are a number of aspects to the invention that separately and in combination contribute to reducing the extent to which truck drivers are exposed to risk while operating twist-locks.

One aspect (a first aspect) relates to providing a twist lock with a driver, i.e. an electric motor, that causes a locking head to rotate for locking and unlocking the twist-lock, wherein the electric motor is configured to operate upon receiving an input signal from a location remote from the twist-lock.

Another aspect (a second aspect) relates to a twist lock having a locking lug, comprising a collar and locking head, that is biased upwardly relative to a structure to cause the collar and locking head to project into a locking recess of a shipping container when the locking recess is aligned with the locking head and the collar and depressed by the shipping container when the locking recess is misaligned with the locking head and collar.

Another aspect (a third aspect) relates to a twist-lock system for locking a shipping container to a truck trailer, the system comprising a plurality of twist-locks that provide a status feedback signal to an input terminal that is remote from the twist-

locks, for example in a truck cabin, to indicate a status condition of the twist-lock, e.g. whether the twist-lock is locked or unlocked.

The present invention provides in one aspect a twist-lock for locking a shipping container to a truck trailer, the twist-lock being mountable to a truck trailer and including a rotatable locking head, the twist-lock housing an electric motor linked to the locking head so as to cause the locking head to rotate for locking and unlocking the twist-lock with a shipping container and wherein the electric motor is configured to operate upon receiving an input signal from a location remote from the twist-lock.

The remote location may be a cabin of a truck coupled to the trailer.

Remote operation of the twist-lock removes safety concerns associated with a truck driver visiting each twist-lock around a trailer and manually operating each twist lock. Given that there may be 4 or 8 twist-locks that require operation to secure a container (and in some cases, two shipping containers on a trailer), the truck driver is exposed to traffic, such as other trucks, forklifts or transporters carrying containers to a truck. Such exposure places the truck driver at risk of injury and death. Those risks are reduced by enabling the shipping container to be locked to the truck trailer without the driver leaving the cabin.

Remote operation of the twist-lock reduces the time required to lock a container to the truck trailer because all relevant twist-locks can be operated simultaneously. This results in a faster turn-around time for truck drivers in terms of loading and unloading shipping containers.

The twist-lock may include a locking lug which includes a collar to which the driver is connected such that the locking head is rotatable relative to the collar and the locking head and collar have the same profile of a locking recess on a shipping container so that the collar and the locking head a receivable in the locking recess.

The twist-lock may include a bracket in which the locking lug is mechanically locked and wherein the locking head and at least a portion of the collar project above a top platform of the bracket.

The locking lug may be able to move generally vertically relative to the bracket and wherein the vertical movement is limited by the mechanical locking of the locking lug to the bracket and wherein the locking lug is biased upwardly relative to the bracket

to cause the collar and locking head to project into the locking recess of a shipping container when the locking recess is aligned with the locking head and collar.

The upward bias may be provided by a coil spring surrounding the locking lug.

Alternatively, the upward bias may be provided hydraulically.

Alternatively, the upward bias may be provided pneumatically.

The upper platform may include a downwardly depending sleeve having an inner profile that guides generally vertical movement of the collar within the sleeve, and therefore guides generally vertical movement of the locking lug within the bracket.

The driver may be configured to cause rotation of the locking head between an unlocked position in which its profile is aligned with the profile of the collar to an unlocked position in which the profiles of the collar and the locking head are generally perpendicular

The driver may include a pair of limit switches that limit rotation of the locking head to the locked and unlocked positions.

The twist-lock may include an arm linked to the driver to rotate in unison with the locking head and wherein the arm is configured to provide a visual indication of the position of the locking head.

The arm may be configured to be visible from the cabin of a truck linked to a truck trailer when the locking head is in an unlocked position.

The present invention further provides in a second aspect a truck trailer including a plurality of twist-locks according to the aspect described above and wherein the twist-locks are configured to receive an input signal from a remote location to operate the respective drivers to lock or unlock a shipping container with the truck trailer.

The truck trailer may include an actuator that sends the input signal to one or more groups of the twist-locks and wherein the groups are selected to coincide with the configuration of locking recesses in different shipping containers.

A twist-lock system for locking a shipping container to a truck trailer, the system including a plurality of twist-locks according to the aspect described above, the twist-locks are configured to receive an input signal from a remote location to operate the respective drivers to lock or unlock a shipping container with the truck trailer and an input terminal remote from the twist-locks and which receives inputs from a truck

driver and which causes the twist-locks to receive an input signal to operate the respective drivers to lock or unlock a shipping container with the truck trailer.

The input terminal may be located in the cabin of a truck and is in communication with the twist-locks.

The system may include an actuator on the truck trailer that receives a signal from the input terminal and sends input signals to the twist-locks to operate the respective drivers.

The twist-locks may provide a status feedback signal to the input terminal, optionally via the actuator, to indicate a status condition of a twist-lock.

The status condition may be whether the locking head is in the locked or unlocked position.

The twist-lock described above is also applicable to locking a shipping container to rail transport vehicles.

In a second aspect, the invention provides a twist-lock that can be fitted to a trailer or other structure for locking a shipping container to the structure, the twist-lock comprising a locking lug which includes a collar and a locking head, the locking lug having the same profile of a locking recess on the shipping container so that the collar and the locking head are receivable in the locking recess, the twist-lock comprising an electric motor linked to the locking head so as to cause the locking head to rotate for locking and unlocking the twist-lock with the shipping container, the locking head being rotatable relative to the collar between a locked position and an unlocked position to respectively lock and unlock the shipping container to the structure, wherein the locking lug is biased upwardly relative to the structure, when in use the twist-lock is fitted to the structure, to cause the collar and locking head to project into the locking recess of the shipping container when the locking recess is aligned with the locking head and the collar and depressed by the shipping container so as to be withdrawn into the structure or flush with an outer surface of the structure when the locking recess is misaligned with the locking head and collar.

In a third aspect, the invention provides a twist-lock system for locking a shipping container to a truck trailer, the system including a plurality of twist-locks, and an input terminal that is remote from the twist-locks and wherein the twist-locks

provide a status feedback signal to the input terminal to indicate a status condition of a twist-lock.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described further, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is an isometric view of a twist-lock according to an embodiment of the invention in an unlocked position.

Figure 2 is an exploded view of the twist-lock in Figure 1.

Figure 3 is a side elevation of the twist-lock in Figure 1.

Figure 4 is an isometric view of the twist-lock in Figure 1 in a locked position.

Figure 5 is an isometric view of the twist-lock in Figure 1 in a depressed position, such as when a shipping container is placed over the twist-lock and the position of the twist-lock on the trailer does not coincide with a locking recess on the shipping container.

Figure 6 is a flow chart of a twist-lock system incorporated into a truck and truck trailer.

DESCRIPTION OF EMBODIMENT

A twist lock (10) according to an embodiment of the invention is shown in Figures 1 to 5. The twist-lock (10) is mountable to a truck trailer via a bracket (12) and includes a locking mechanism that includes a rotatable locking head, in the form of a cap (60). The twist lock 10 further includes a driver, in the form of an electric motor

(40), it causes the cap (60) to rotate to lock and unlock the twist-lock (10) with a shipping container. The electric motor (40) operates upon receiving an input signal from a location remote from the twist-lock (10).

More specifically, and having regard to figures 1 and 2, the bracket includes a mounting panel (14) which is secured to a chassis or other structural part of a truck trailer whereby to secure the twist-lock (10) to the truck trailer. The bracket (12) includes an upper platform, in the form of upper panel (16) and a lower panel (18). A hole passes through the upper panel (16) and is shaped with arcuate ends and parallel sides connecting the ends. The arcuate ends have a curvature which corresponds to the curvature of a sleeve (22) that extends downwardly from an underside of the upper platform (16) so that parts of the sleeve (22) are aligned with the arcuate ends of the opening.

The lower platform (18) is generally parallel to the upper platform (16) and includes an opening (26) that is aligned with the opening and the upper platform (16). The opening (26) includes a cut out section which acts as a guide channel (28).

The electric motor (40) forms part of a locking lug which comprises a housing (32) that is formed as a generally hollow cylinder for receiving the electric motor (40). The housing (32) includes an upper flange (24) that is shaped to fit through the opening in the upper panel (16). The flange (24) includes downwardly extending side wings that define a seat (20) for an upper end of a coil spring (70). When the twist-lock (10) is assembled, an upper part of the coil spring (70) is located within the sleeve (22) and abuts the underside of the upper panel (16) so that it is compressed slightly between the upper panel (16) and the lower panel (18). The seat (20) rests on the top of the coil spring (70) so that the housing (32) is suspended within the coil spring (70) and extends downwardly through the opening (26) in the lower panel (18). A guide ridge (34) on the housing locates in the guide channel (28) to ensure that the housing (32) remains aligned with the guide ridge (34) facing the mounting panel (14) during operation of the twist-lock (10). In this position, the cap (60) projects above the upper panel (16) by a distance slightly greater than the depth of a locking point of a shipping container so that the cap (60) can be actuated to lock with the locking point. Additionally, the cap (60) is biased into that position by the coil spring (70). However, the coil spring (70) allows the cap (60) to be depressed flush with the upper panel (16) by a shipping container

when it is misaligned during loading. In this way, the twist-lock 10 is protected from damage during loading, but re-arranges itself for locking when the shipping container is properly aligned.

Although this embodiment utilises the coil spring (70) to provide the upward biasing force on the cap (60), it will be appreciated that other embodiments may use other means for upwardly biasing the cap (60). For example, the cap (60) may be biased upwardly pneumatically or hydraulically. In one embodiment, the coil spring (70) may be replaced by a compressible gas strut that links the housing (32) to the lower panel (18).

A printed circuit board (44) is accommodated within the housing (32) and is electrically connected to the electric motor (40) for controlling operation of the electric motor (40).

A drive spindle (42) extends upwardly from an upper end of the electric motor (40). The drive spindle (42) passes through a motor mount bracket (46) and into a locking ring (62) to which the motor mount bracket (46) is fastened by screws. The drive spindle (42) has a D-shaped profile which corresponds with the profile of a central hole passing through the locking ring (62) such that operation of the electric motor (40) causes the motor mount bracket (46) and the locking ring (62) to rotate with the motor. Limit switches 50 are fastened to respective stubs of (48) which project from the motor mount bracket (46) at approximately 90° to each other.

When assembled, the spindle (42), motor mount bracket (46) and locking ring (62) are housed within the collar (80) which is fixed to an upper side of the flange (24). The collar (80) includes an aperture (82) aligned with the drive spindle (42) so that the locking ring (62) can be fastened to the cap (60) and, therefore, operation of the electric motor (40) causes the cap (60) to rotate. The limits switches (50) are configured on the motor mount bracket to contact an interior surface of the collar (80) so as to discontinue rotation of the cap (60) relative to the collar (80). As the limit switches (50) are aligned roughly perpendicularly to each other, rotation of the cap (60) is limited to the same extent. For example, Figure 1 shows the cap (60) aligned with the collar so that both the cap (60) and the collar (80) are able to pass through an opening in a locking point of a shipping container. Figure 4, however, shows the locking cap (60) rotated through approximately 90° so that the cap (60) overlaps a shoulder of a locking point on the

shipping container. When the cap (60) overlaps a shoulder, the twist-lock mechanically locks with the shipping container and, therefore, it is considered to be in a locked position. By way of contrast, Figure 1 shows the twist-lock (10) in the unlocked position.

The twist lock (10) further includes a flange (36) (Figures 3 and 5) that extends radially outwardly from the housing (32) so that the flange (36) is unable to fit through the aperture (26) in the lower platform (18). In this way, the housing (32) is mechanically locked with the bracket (12). The mechanical locking is completed by the fact that the flange (24) on the top of the housing is unable to pass through the opening (26) even if the spring (70) could be compressed to that extent.

Additionally, the twist-lock (10) includes an arm in the form of a handle (38) (Figures 1, 3, 4 and 5). The handle (38) is linked to the electric motor and rotates in unison with the cap (60). However, the handle (38) is aligned generally perpendicularly to the cap (60) so that in the unlock position (Figure 1), the handle (38) extends away from the mounting panel (14). This places the handle (38) outside the width extremity of the trailer and therefore becomes visible to a truck driver from the cabin of a truck. When the twist-lock is in the locked position (Figure 4), the handle (38) extends parallel to the mounting panel (14) and is contained within the width extremity of the truck trailer. As a result, the handle (38) is not visible to the truck driver from the cabin of the truck and therefore provides visual indication of the locking status of the twist-lock (10).

A truck trailer will include a number of twist-locks (10) to coincide with the different configurations of locking points that are associated with shipping containers of different sizes. For example, a truck trailer may have 14 or more twist-locks (10) to accommodate shipping containers that have 4 or 8 locking points. As a result, some twist-locks (10) when fitted to a truck trailer will not coincide with a locking point on a shipping container. To account for this, the housing (32), collar (80) and cap (60) are all formed to move generally vertically within the bracket and yet remain generally vertically aligned. Specifically, the coil spring (70) is compressed (Figure 5) by the weight of a shipping container bearing on the cap (60) which is depressed to be generally level with the upper panel (16). As a result, the collar (60) is pushed downwardly within the sleeve (22). The curvature of the sleeve (22) is generally

consistent with the curvature of the arcuate ends of the collar (80) so that the collar remains generally vertically aligned within the sleeve (22). Furthermore, the housing (32) extends downwardly through the opening (26) in the lower panel (18). The twist-lock (10) remains in this position until the shipping container is removed from the truck trailer. At that time the upward biasing force provided by the coil spring (70) causes the collar (80) and cap (60) to project once more above the level of the upper panel (16).

Similar action occurs when a shipping container is lowered onto the truck trailer and when the locking points are not properly aligned with the twist-locks (10). When the locking points are ultimately aligned, the coil spring (70) pushes the collar (80) and the cap (60) upwardly into the locking points so the twist-lock (10) can be operated to lock the truck trailer to the shipping container.

As shown in Figure 6, each twist-lock (10) is connected by electrical cable to an input terminal (90) located remotely from the twist-locks (10). Specifically, the input terminal (90) may be located in the cabin of a truck so that the truck driver can operate the twist-locks remotely from the cabin of the truck. There is considerable convenience associated with operating the twist-locks (10) from the cabin because it reduces the overall time to secure the shipping container to the truck trailer.

According to one embodiment, the twist-locks (10) can be operated simultaneously in groups. For example, groups contained within respective dashed lines marked A, B and C in Figure 6 may be operated independently of each other, but with the twist-locks (10) in each group being operated simultaneously.

Although the twist-locks (10) are shown in Figure 6 as being connected to the terminal input (90) by wire, i.e. electrical cable, it will be appreciated that the connection may be instead by wireless communication means, such as Wi-Fi, Bluetooth or other wireless communications.

In an alternative form, the twist-locks (10) may be connected by wire to an actuator terminal fitted to a truck trailer and communication of the signal from the terminal input (90) to the twist-locks (10) may be via wireless communication means from the input terminal (90) to the actuator and then by wire to the twist-locks (10).

In a further alternative, the twist-locks (10) may be fitted with sensors to indicate a status condition of the twist-locks and that information may be communicated

to the terminal input (90) via the wired or wireless communication means. In this way, the truck driver can monitor the status of the twist-locks (10) to ensure that they are locked or unlocked, as required.

In yet another alternative, the electric motors (32) may be substituted for pneumatic or hydraulic drivers for causing rotation of the cap (60).

In the event that the power supply to the electric motors (40) fails so that the twist-locks (10) cannot be moved to a locked or unlocked position, the twist-locks (10) include a trigger that releases the drive spindle (42) from the locking ring (62). However, the handle (38) remains mechanically linked to the cap (60) so that operation of the handle (32) manually operates the cap (60) to lock or unlock from a shipping container.

Many modifications may be made to the preferred embodiment of the present invention as described above without departing from the spirit and scope of the present invention.

For example, the electric motor (40) may be substituted for pneumatic or hydraulic drivers for causing rotation of the cap (60).

In the claims which follow, and in the preceding description, except where the context requires otherwise due to express language or necessary implication, the word “comprise” and variations such as “comprises” or “comprising” are used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the apparatus and method as disclosed herein.

In the foregoing description of preferred embodiments, specific terminology has been resorted to for the sake of clarity. However, the invention is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar technical purpose.

Terms such as "front" and "rear", "inner" and "outer", "above", "below", "upper" and "lower" and the like are used as words of convenience to provide reference points and are not to be construed as limiting terms. The terms “vertical” and “horizontal” when used in reference to the twist-lock throughout the specification, including the claims, refer to orientations relative to the normal operating orientation of a twist-lock.

Furthermore, invention(s) have been described in connection with what are presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the invention(s).

Also, the various embodiments described above may be implemented in conjunction with other embodiments, for example, aspects of one embodiment may be combined with aspects of another embodiment to realize yet other embodiments. Further, each independent feature or component of any given assembly may constitute an additional embodiment.

CLAIMS

1. A twist-lock that can be fitted to a trailer or other structure for locking a shipping container to the structure, the twist-lock comprising a locking lug which includes a collar and a locking head, the locking lug having the same profile of a locking recess on the shipping container so that the collar and the locking head are receivable in the locking recess, the twist-lock comprising an electric motor linked to the locking head so as to cause the locking head to rotate for locking and unlocking the twist-lock with the shipping container, the locking head being rotatable relative to the collar between a locked position and an unlocked position to respectively lock and unlock the shipping container to the structure, wherein the locking lug is biased upwardly relative to the structure, when in use the twist-lock is fitted to the structure, to cause the collar and locking head to project into the locking recess of the shipping container when the locking recess is aligned with the locking head and the collar and depressed by the shipping container so as to be withdrawn into the structure or flush with an outer surface of the structure when the locking recess is misaligned with the locking head and collar.

2. The twist-lock defined in claim 1, wherein the upward bias is provided pneumatically, hydraulically or by a coil spring surrounding the locking lug.

3. The twist-lock defined in claim 1 or claim 2, wherein the twist-lock includes an arm linked to rotate in unison with the locking head and wherein the arm is configured to provide a visual indication of the position of the locking head.

4. The twist-lock defined in claim 3, wherein the arm is configured to be visible from the cabin of a truck linked to a truck trailer when the locking head is in an unlocked position.

5. A twist-lock system for locking a shipping container to a truck trailer, the system including a plurality of twist-locks as defined in any one of claims 1-4, and an

input terminal that is remote from the twist-locks and wherein the twist-locks provide a status feedback signal to the input terminal to indicate a status condition of a twist-lock.

6. The twist-lock system defined in claim 5, wherein the input terminal is located in the cabin of a truck and is in communication with the twist-locks.

7. The twist-lock system defined in claim 5 or claim 6, wherein the system includes an actuator on the truck trailer, the actuator receives a signal from the input terminal and sends input signals to the electric motor to rotate the locking head relative to the collar between the locked position and the unlocked position.

8. The twist-lock system defined in claim 7, wherein the status feedback signal is provided to the input terminal via the actuator.

9. The twist-lock system defined in claim 7 or claim 8, wherein the status condition indicates whether the locking head is in the locked or unlocked position.

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FIGURE 1

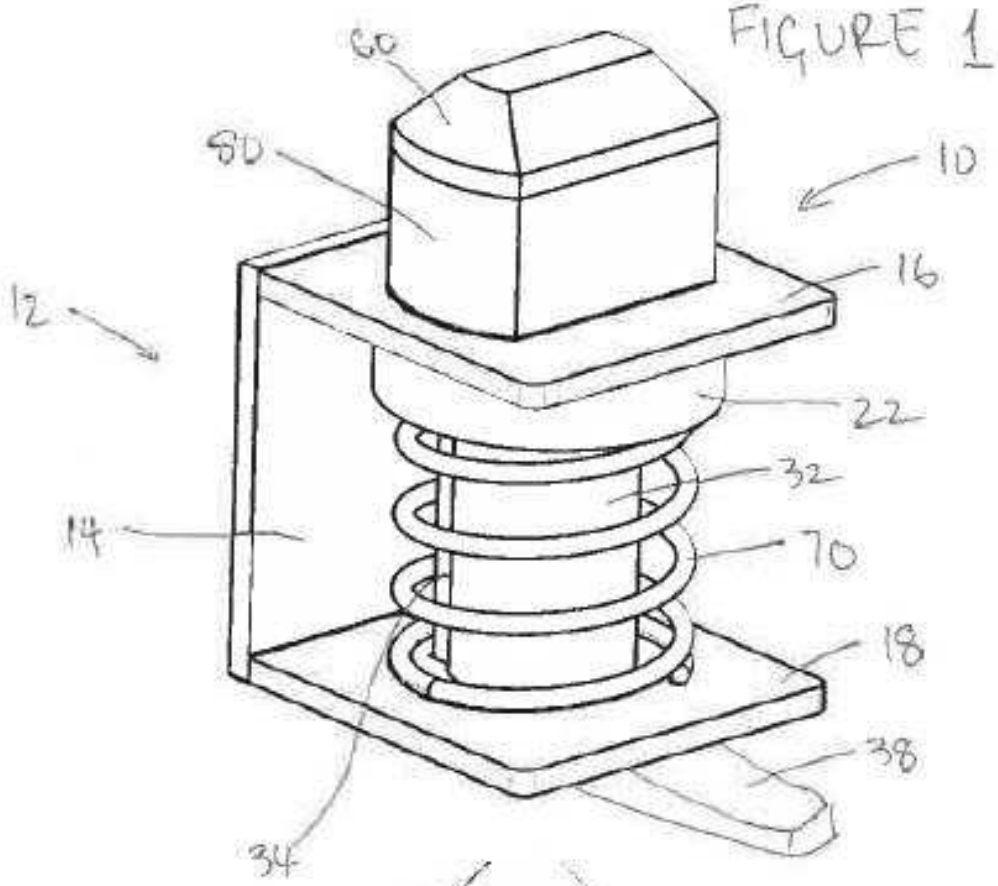

FIGURE 3

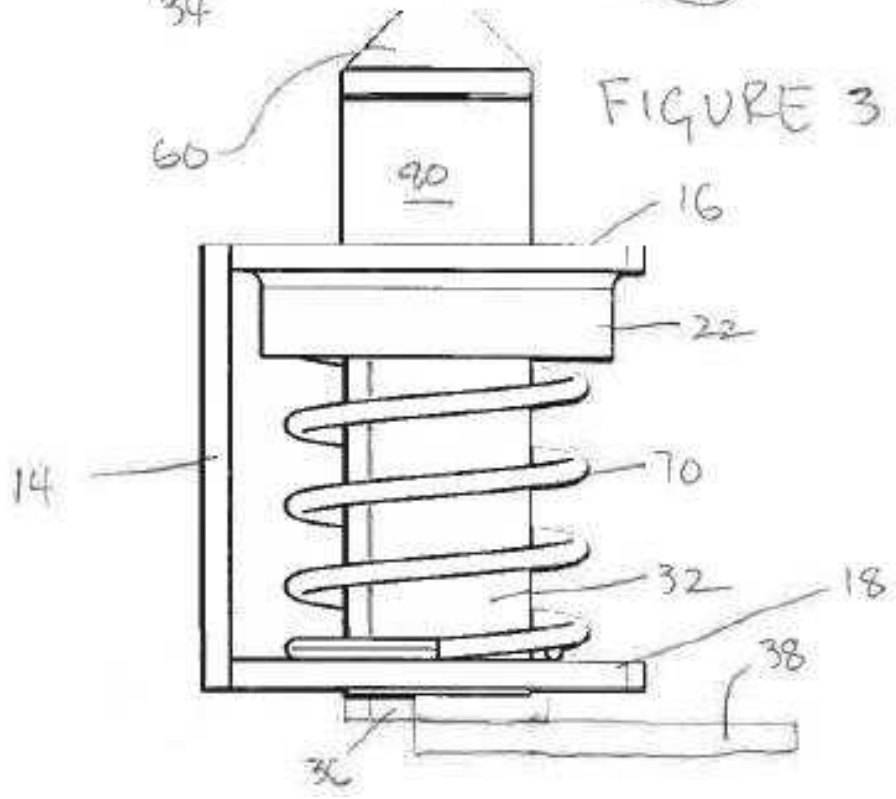

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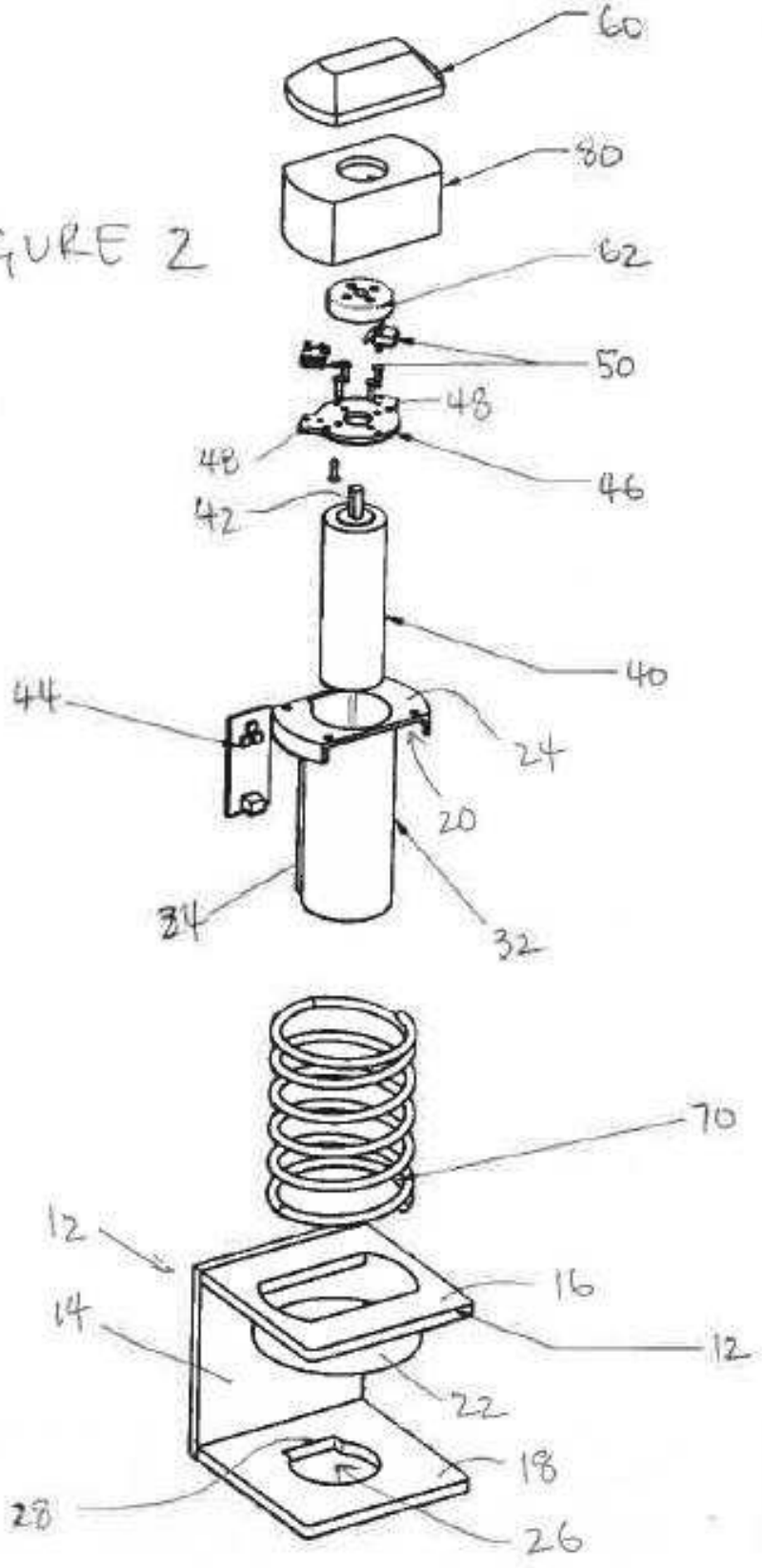
FIGURE 2



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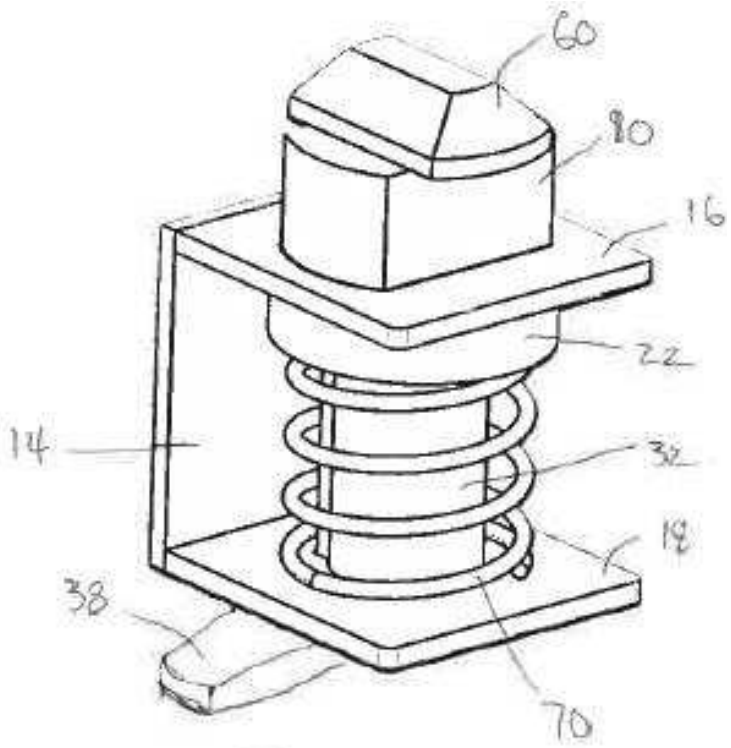

FIGURE 4

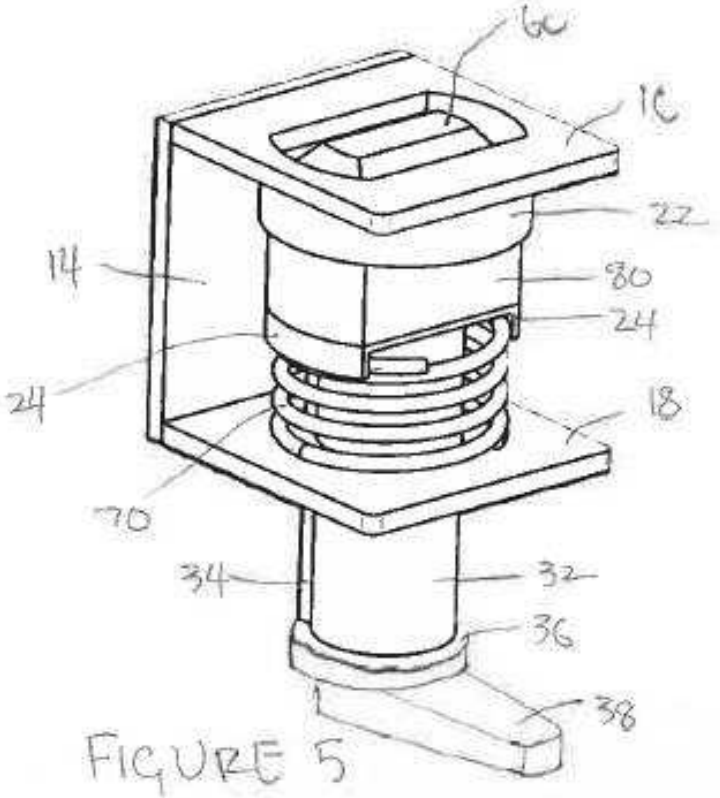

FIGURE 5

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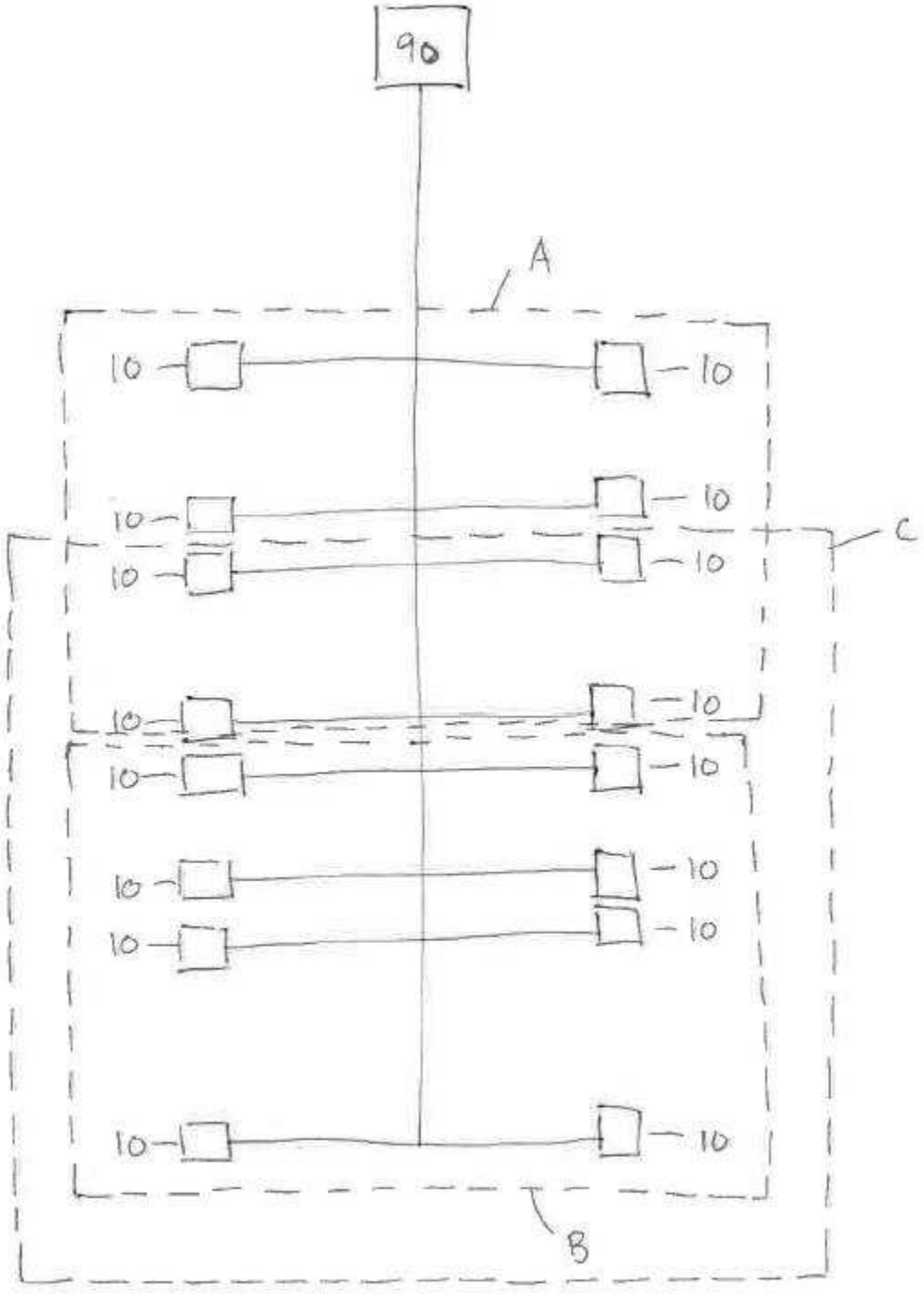

FIGURE 6