Title
A coupling assembly for connecting articles

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1. A coupling assembly for connecting two articles, including a pair of coupling members for respectively engaging each article, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and its respective article for resisting torsional or rotational forces on the coupling member.

2. The coupling assembly according to claim 1, wherein said one coupling member is a nut and the other coupling member is a pin, said nut having an internal bore for threadably connecting said nut to said pin, said force resisting member being resiliently compressible and being located in a groove around said bore.
A COUPLING ASSEMBLY FOR CONNECTING ARTICLES

The invention relates to a coupling assembly for connecting articles. In particular, the invention relates to a coupling assembly for connecting a hitch bar to a hitch receiver in a tow bar assembly.

Coupling devices are widely used to connect or secure articles together. One proposed coupling device includes two jaws, one jaw being movable relative to the other jaw. This device joins articles by placing the articles between the jaws and bringing the moveable jaw into engagement against one of the articles so that the jaws apply a force against each article, thus connecting the articles.

One particular application of coupling devices is to connect a hitch bar to a hitch receiver in a tow bar assembly. Another coupling device which has been proposed uses a slot cut into the hitch receiver with a corresponding slot in the hitch bar. The respective slots of the hitch bar and hitch receiver are aligned. A threaded pin is then inserted into the slots and a nut is screwed onto the pin to secure the hitch bar to the hitch receiver.

A disadvantage of both coupling devices is that the articles are always not rigidly secured against lateral forces, such as torsional or rotational forces. This means that the articles may become loose from the coupling device under action of those forces. In the case of the hitch bar and hitch receiver, the coupling device is often subject to vibrations during use, especially when the towing vehicle travels over rough surfaces. These vibrations often cause the nut and pin to rotate relative to each other causing the nut to loosen from the pin. This may result in the towed vehicle coming loose from the towing vehicle. In addition, once the nut has loosened from the pin, the coupling device begins to rattle from the vibrations causing wear on the pin and nut.
Accordingly, one aspect of the invention provides a coupling assembly for connecting two articles, including a pair of coupling members for respectively engaging each article, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and its respective article for resisting torsional or rotational forces on the coupling member.

Another aspect of the invention provides a coupling assembly for connecting a hitch bar to a hitch receiver, including a pair of coupling members for respectively engaging the hitch bar and the hitch receiver, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and the hitch bar or hitch receiver for resisting torsional or rotational forces on the coupling member.

A further aspect of the invention provides a coupling assembly for connecting a hitch bar to a hitch receiver, including a pair of coupling members for respectively engaging the hitch bar and the hitch receiver, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and the hitch bar or hitch receiver for resisting torsional or rotational forces on the coupling member;

said one coupling member is a nut and the other coupling member is a pin,
said nut having an internal bore for threadably connecting said nut to said pin, said force resisting member being resiliently compressible and being located in a groove around said bore; and

said coupling assembly including a tool which can engage said nut and facilitate rotation of said nut on said pin, said nut having radially extending slots for receipt of said tool.
The provision of a force resisting member promotes a pre-loaded resilient connection between the coupling assembly and the connected articles. Thus, the risk of loosening of the coupling assembly by twisting or rotational forces on the coupling assembly is reduced. In the case of a hitch bar and hitch receiver, the invention also inhibits vibrations being generated between the coupling members and so reduces rattling.

Preferably, the member is resiliently compressible. In one preferred embodiment the coupling member is a knob or nut. The knob or nut may have an internal threaded bore to connect itself to the other coupling member. The force resisting member can be located in a circular groove concentric to the bore. The resiliently compressible member is preferably an O-ring.

It is preferred that the other coupling member is a threaded pin. The pin preferably has a head with a flat. The flat may be received in a complementary shaped hole in the hitch bar or hitch receiver in order to prevent rotation of the pin relative to the hitch bar or the hitch receiver.

Preferably, the knob or nut has a land surrounding the bore for engaging the pin. The land is preferably metal. The knob or nut can have circumferential chamfered edges to provide gripping surfaces on the knob or nut for the hands of a user.

A tool is preferably engageable with one coupling member for moving the coupling member relative to the other coupling member. The tool is preferably engageable with the knob or nut. The knob or nut preferably has radially extending slots for engaging the tool.

The tool may also engage one coupling member to secure the coupling assembly. The tool preferably engages the pin. The pin may have a spigot at its end for engaging the tool. The spigot preferably has a recess for receiving the tool.
In a preferred embodiment the tool is an R-clip.

A preferred embodiment will now be described by way of example only, with reference to the drawings of which:

Figure 1 is a perspective view of a coupling assembly according to a preferred embodiment of the invention when used to connect a hitch bar to a hitch receiver;

Figure 2 is an underside perspective view of the coupling assembly of Figure 1;

Figures 3A and 3B are top and underside perspective views of the coupling assembly of Figure 1;

Figures 4A and 4B are exploded perspective views of individual components of the coupling assembly of Figure 1;

Figure 5 is a top view of the coupling assembly of Figure 1;

Figure 6 is a cross-sectional side view of the coupling assembly taken along A-A in Figure 5;

Figure 7 is a close-up sectional view of the coupling assembly taken from B in Figure 6;

Figure 8 is a top view of one coupling member of the coupling assembly of Figure 1;

Figure 9 is a side view of the coupling member of Figure 8; and

Figures 10-14 are respectively, perspective, side, plan, underside perspective and additional side views of one coupling member of the coupling assembly of Figure 1 being tightened by a tool.

Figures 1 and 2 illustrate a coupling assembly 1 for connecting a hitch bar 3 and a hitch receiver 5 in a tow bar assembly 100, according to a preferred embodiment of the invention.

Referring to Figures 3 and 4, the coupling assembly 1 has a first coupling member 7, a second coupling member 9, tool 11 and force resisting member 13. In the
illustrated embodiment, the first coupling member 7 is a threaded pin while second coupling member 9 is a knob, which in effect functions as a nut. Tool 11 is engageable with pin 7 to secure the coupling assembly 1. Tool 11 is in the form of an R-clip while force resisting member 13 is a resiliently compressible O-ring.

Tow bar assembly 100 consists of hitch receiver 5 which is mounted on a tow bar (not shown), hitch bar 3 and tow ball 111. Hitch receiver 5 has two components; a mounting plate 110 and a hitch box 112. Holes 6, 8 are provided in hitch box 112 and mounting plate 110, respectively. Holes 6 and 8 are aligned with respect to each other and are designed for receiving pin 7. Hole 6 is formed to match the profile of head 10 of pin 7 while hole 8 matches the profile of the shaft 12 of pin 7. Hitch bar 3 has a bore 4 for receiving pin 7 and hitch receiver 5 also has a bore 6 for receiving pin 7.

Head 10 is at one end of pin 7, while at the opposite end a non-threaded spigot 15 is provided. Head 10 is formed so as to have a flat 14. As best shown in Figure 2, flat 14 of head 10 fits into complementarily shaped hole 6. When coupling assembly 1 is used to connect hitch bar 3 and hitch receiver 5, the neat fit between head 10, a flat 14 and hole 6 prevents rotation of pin 7 while knob 9 is tightened to connect hitch 3 and hitch receiver 5.

The spigot 15 of pin 7 has a lateral bore 17 to receive shaft 12 of R-clip 11. This allows R-clip 11 to secure the pin 7 and knob 9 to form coupling assembly 1. By locating R-clip 11 in spigot 15, the user has ready access for the R-clip 11 for connecting or disconnecting the coupling assembly 1 from the hitch bar 3 and hitch receiver 5.

Knob 9 has a threaded internal bore 21 defined by metal land 19 for mating with the complementary thread of pin 7. Referring to Figure 4A, knob 9 has on its underside a circular groove 27 that is concentric to threaded bore 21. O-ring 13 is
inserted into groove 27 for resisting torsional or rotational forces applied to knob 9. When the knob 9 is tightened against hitch mounting 110 of hitch 5, O-ring 13 is compressed into groove 27. This pre-loads the O-ring 13 to increase its resistance to torsional or rotational forces. The O-ring 13 is usually compressed in groove 27 about 20% to 30% of its diameter to provide the pre-load. In the preferred embodiment, the O-ring 13 has a diameter in the range of 34-35mm and a thickness in the range of 2-5mm.

As best seen in Figures 8 and 9, knob 9 also has a series of radially extending slots 23. The slots 23 provide a surface for R-clip 11 to engage knob 9, so that a user has a means for tightening and loosening knob 9 using R-clip 11. Slots 23 alternate with circumferential chamfered edges 25 of knob 9. The chamfered edges 25 provide finger grips for the user to manually tighten or loosen knob 9.

Figure 3 illustrates the coupling assembly 1 when assembled. The coupling assembly 1 works as follows. The hitch bar 3 is inserted into hitch box 112 of hitch receiver 5 so that bore 4 of hitch bar 3 is aligned with holes 6, 8. Pin 7 is then inserted through bore 4 and mounting plate 110 via holes 6, 8. Pin 7 is inserted so that head 10 and flat 14 fit within hole 6 of hitch box 112. As shown in Figures 6 and 7, in this position head 10 is located next to hitch bar 3. Knob 9 is then threaded onto pin 7. The user then tightens knob 9 onto mounting plate 110 of hitch receiver 5 by hand using chamfered edges 25.

As shown in Figures 10-14, R-clip 11 is then used in conjunction with slots 23 to further tighten knob 9. The shaft 12 of R-clip 11 is inserted into one of the slots 23 of knob 9. The user then applies a force against R-clip 11, which is transmitted to knob 9 via engagement of shaft 12 and slot 23. This causes knob 9 to rotate, thereby increasing its tightness against mounting plate 110. Thus, R-clip 11 is used as a large lever arm to increase the mechanical advantage, allowing for further tightening of knob 9.
Tightening of knob 9 by R-clip 11 forces head 10 into tight engagement with hitch bar 3 while O-ring 13 is compressed into groove 27 against mounting plate 110 of hitch receiver 5. This creates a pre-loaded resilient connection between the pin 7, hitch bar 3, hitch receiver 5 (being mounting plate 110 and hitch box 112) and knob 9. Due to flat 14 on the head 10, the head 10 locks against hitch bar 3 to inhibit any rotation or torsion of pin 7 as knob 9 is tightened.

The O-ring 13, now compressed between knob 9 and hitch receiver 5, resists any torsional or rotational forces on knob 9 that may loosen the pre-loaded resilient connection between the coupling assembly 1, hitch bar 3 and hitch receiver 5. That is, when knob 9 is tightened by R-clip 11, the O-ring 13 is compressed into the groove 27 against mounting plate 110 of hitch receiver 5, thus creating a load to resist subsequent torsional or rotational forces on knob 9.

Finally, R-clip 11 is inserted through bore 17 of pin 7 to ensure retention of hitch bar 3 and hitch receiver 5.

Thus, it can be seen that the coupling assembly 1 provides a resistance against any torsional or rotational forces that may be applied to the coupling assembly 1 during use. This inhibits loosening of the components of the coupling assembly 1, and promotes a pre-loaded resilient connection between hitch bar 3 and hitch receiver 5. The R-clip 11 and slots 23 also provide a means of tightening the knob 9 without the need for any extra tools.

In the preferred embodiment, the hitch bar 3 is a ShadowMount Tongue, mounting plate 110 is a ShadowMount Fishplate and the hitch box 112 is a ShadowMount Channel. All these ShadowMount components are manufactured by Trimas Pty Ltd.
The pin 7 and land 19 of knob 9 is made of metal to provide maximum strength. The body of knob 9 can be made of plastic.

The foregoing describes only one embodiment of the invention and modifications can be made without departing from the scope of the invention.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A coupling assembly for connecting two articles, including a pair of coupling members for respectively engaging each article, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and its respective article for resisting torsional or rotational forces on the coupling member.

2. The coupling assembly according to claim 1, wherein said one coupling member is a nut and the other coupling member is a pin, said nut having an internal bore for threadably connecting said nut to said pin, said force resisting member being resiliently compressible and being located in a groove around said bore.

3. The coupling assembly according to claim 3 wherein said coupling assembly includes a tool which can engage said nut and facilitate rotation of said nut on said pin, said nut having radially extending slots for receipt of said tool.

4. A coupling assembly for connecting a hitch bar to a hitch receiver, including a pair of coupling members for respectively engaging the hitch bar and the hitch receiver, the coupling members being connected in use so that one coupling member is moveable relative to the other coupling member, wherein one coupling member has a member interposed between the coupling member and the hitch bar or hitch receiver for resisting torsional or rotational forces on the coupling member; said one coupling member is a nut and the other coupling member is a pin, said nut having an internal bore for threadably connecting said nut to said pin, said force resisting member being resiliently compressible and being located in a groove around said bore; and said coupling assembly including a tool which can engage said nut and
facilitate rotation of said nut on said pin, said nut having radially extending slots for receipt of said tool.

5. A coupling assembly for connecting a hitch bar to a hitch receiver, substantially as described with reference to the drawings and/or the example.

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