Abstract: A coupler for a railway vehicle includes a coupler anchor and a coupler centering device having a pair of arm sub-assemblies. Each arm subassembly has an upper centering arm connected to a lower centering arm via a torsion bar extending through the coupler anchor. The lower centering arms are connected by a cross link such that movement of one of the upper centering arms causes a corresponding movement of both of the lower centering arms. Each upper centering arm engages a roller that rolls along a curved surface of the centering arm when the coupler is rotated horizontally toward the upper centering arm. A centering stop element prevents the movement of the opposing upper centering arm to generate a restoring force in the torsion bars that facilitates horizontal movement of the coupler. The coupler centering device may be disengaged from an active centering position to facilitate servicing of the coupler.
COUPLER TORSION SPRING CENTERING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of United States Provisional Application No. 61/718,866, filed October 26, 2012, and entitled "Coupler Torsion Spring Centering Device", the disclosure of which is incorporated herein in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present disclosure is directed to couplers for railway cars, and, more particularly, to a device for horizontally centering a railway car coupler.

Description of Related Art

[0003] Railway vehicle cars include couplers for connecting adjacent cars to each other to form a train composition. Each coupler is adapted to swing within a predetermined angular range in a horizontal direction to facilitate car coupling and movement on a curved track. Adjoining car couplers must be aligned to be on-center with the longitudinal axis of the railway car during a car coupling procedure. Due to variations in sizes of the cars and the type of coupler installed on each car, there may exist significant horizontal offsets between adjacent couplers in the lateral direction of the railway car. Such horizontal offsets are further compounded when attempting to couple adjacent railway cars on a curved section of a railway track or while moving on the curved track. Existing couplers utilize pneumatically or hydraulically assisted coupler centering devices capable of moving the car coupler within a predetermined angular range in a horizontal direction to facilitate mating with an adjoining car coupler. These devices often require auxiliary equipment, such as pumps, hoses, and valves, that is positioned on an underside of each railway car.

[0004] Existing designs for coupler centering devices are associated with a number of disadvantages. Conventional coupler centering devices require complicated pneumatic or hydraulic equipment that increases the overall cost of the railway car and complicates car maintenance. In case of a breakdown of the pneumatic or the hydraulic mechanism, the entire coupler centering device is often rendered inoperative. Due to the complexity and weight of the components, manual movement of the coupler centering device is not possible. Additionally, because of the pumps, hoses, valves, and other auxiliary equipment, conventional coupler centering devices take up a substantial amount of space around the coupler. Such arrangements prevent the installation of other auxiliary components adjacent
to the coupler. Additionally, existing coupler centering devices may not be adjustable to control the force required to keep the coupler on center with the coupler on an adjoining railway car.

**SUMMARY OF THE INVENTION**

[0005] In view of the foregoing, a need exists for a coupler centering device that replaces complicated pneumatic or hydraulic coupler centering machinery with a mechanical centering device. An additional need exists for providing a coupler centering device having compact dimensions and reduced weight for allowing installation of auxiliary components on or near the car coupler. A further need exists for a coupler centering device adapted for manual manipulation of the coupler when aligning adjacent couplers during coupling. Yet another need exists to provide a coupler centering device that is adjustable to control the amount of force required to keep the coupler on center with the coupler of an adjoining car.

[0006] According to one embodiment, a coupler for a railway car may include a coupler anchor and a coupler mechanism pivotal relative to the coupler anchor from an on-center position to an off-center position in a substantially horizontal plane. The coupler may further include a coupler centering device for centering the coupler mechanism relative to the coupler anchor. The coupler centering device may include a first centering arm subassembly having a first centering arm and a first centering link connected to a first torsion bar extending though the coupler anchor in a substantially vertical direction and a second centering arm subassembly having a second centering arm and a second centering link connected to a second torsion bar extending through the coupler anchor in the substantially vertical direction. The coupler may further include a cross link connecting the first and second centering links. A pair of first and second rollers may be provided to be in contact with the respective first and second centering arms.

[0007] In accordance with another embodiment, the coupler may include a support bracket coupled to the coupler mechanism. The first and second rollers may be connected to the support bracket such that a first and second roller axes are oriented substantially perpendicular to a longitudinal axis of the coupler mechanism. The first and second centering arms may be preloaded against the first and second roller to generate a restoring force in the first and second torsion bar for restoring the coupler mechanism to the on-center position when the coupler mechanism is pivoted to the off-center position. In one embodiment, pivotal movement of the coupler mechanism from the on-center position may
cause one of the first and the second centering arms to roll along the one of the first and 
second rollers to generate a restoring force in the first and second torsion bars.

[0008] In a further embodiment, the restoring force in the first and second torsion bars may 
increase in proportion to the pivotal movement of the coupler mechanism from the on-center 
position. The restoring force in the first and second torsion bars may restore the coupler 
mechanism to the on-center position. In yet another embodiment, the first and second 
centering arms may be movable to a disengaged position in which the coupling mechanism is 
not urged to an on-center position. The first and second centering arms may have a curved 
shape and the first and second torsion bars may have a substantially hexagonal cross-

sectional shape.

[0009] In accordance with yet another embodiment, a railway car coupler for coupling 
railway cars may include a coupler anchor and a coupler mechanism pivotal relative to the 
coupler anchor from an on-center position to an off-center position in a substantially 
horizontal plane. The railway car coupler may further include a coupler centering device for 
centering the coupler mechanism relative to the coupler anchor. The railway car coupler 
centering device may include a first centering arm subassembly having a first centering arm 
and a first centering link connected to a first torsion bar extending through the coupler anchor 
in a substantially vertical direction and a second centering arm subassembly having a second 
centering arm and a second centering link connected to a second torsion bar extending though 
the coupler anchor in the substantially vertical direction. The railway car coupler may further 
include a cross link connecting the first and second centering links. A pair of first and second 
rollers may be provided to be in contact with the respective first and second centering arms.

[0010] In accordance with another embodiment, the railway car coupler may include a 
support bracket coupled to the coupler mechanism. The first and second rollers may be 
connected to the support bracket, such that the first and second roller axes are oriented 
substantially perpendicular to a longitudinal axis of the coupler mechanism. The first and 
second centering arms may be preloaded against the first and second roller to generate a 
restoring force in the first and second torsion bar for restoring the coupler mechanism to the 
on-center position when the coupler mechanism is pivoted to the off-center position. In one 
embodiment, pivotal movement of the coupler mechanism from the on-center position may 
cause one of the first and the second centering arms to roll along the one of the first and 
second rollers to generate a restoring force in the first and second torsion bars.

[0011] In a further embodiment, the restoring force in the first and second torsion bars may 
increase in proportion to the pivotal movement of the coupler mechanism from the on-center
position. The restoring force in the first and second torsion bars may restore the coupler mechanism to the on-center position. In yet another embodiment, the first and second centering arms may be movable to a disengaged position in which the coupling mechanism is not urged to an on-center position. The first and second centering arms may have a curved shape and the first and second torsion bars may have a substantially hexagonal cross-sectional shape.

[0012] In accordance with yet another embodiment, a coupler centering device for centering a coupler mechanism relative to a coupler anchor of a railway car may include a first centering arm subassembly having a first centering arm and a first centering link connected to a first torsion bar extending though the coupler anchor. The coupler centering device may further include a second centering arm subassembly having a second centering arm and a second centering link connected to a second torsion bar extending though the coupler anchor. A cross link may be provided for connecting the first and second centering links. Additionally, a pair of first and second rollers may be in contact with the respective first and second centering arms. In one embodiment, a support bracket may be coupled to the coupler mechanism, such that the first and second rollers are connected to the support bracket, such that the first and second roller axes are oriented substantially perpendicular to a longitudinal axis of the coupler mechanism. The first and second centering arms may have a curved shape and the first and second torsion bars may have a substantially hexagonal cross-sectional shape.

[0013] These and other features and characteristics of the coupler centering device, as well as the methods of operation and functions of the related elements of structures and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention. As used in the specification and the claims, the singular form of "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0014] **FIG. 1** is a front perspective view of a railway vehicle coupler having a coupler centering device in accordance with one embodiment.
FIG. 2 is a front view of the railway vehicle coupler of FIG. 1 showing the coupler centering device installed thereon.

FIG. 3 is a rear view of the railway vehicle coupler of FIG. 1 showing the coupler centering device installed thereon.

FIG. 4 is a top view of the railway vehicle coupler of FIG. 1 showing the coupler centering device installed thereon.

FIG. 5 is a bottom view of the railway vehicle coupler of FIG. 1 showing the coupler centering device installed thereon.

FIG. 6 is a side view of the railway vehicle coupler of FIG. 1 showing the coupler centering device installed thereon.

FIG. 7 is a partial front perspective view of an upper portion of the railway vehicle coupler illustrated in FIG. 1 showing the coupler centering device in an exploded state.

FIG. 8 is a partial perspective view of a lower portion of the railway vehicle coupler illustrated in FIG. 1 showing the coupler centering device in an exploded state.

FIG. 9 is a front perspective view of the coupler centering device of FIG. 1 without the railway vehicle coupler.

FIG. 10 is a front view of the coupler centering device shown in FIG. 9.

FIG. 11 is a rear view of the coupler centering device shown in FIG. 9.

FIG. 12 is a top view of the coupler centering device shown in FIG. 9.

FIG. 13 is a bottom view of the coupler centering device shown in FIG. 9.

FIG. 14 is a side view of the coupler centering device shown in FIG. 9.

FIG. 15 is a front perspective view of the railway vehicle coupler of FIG. 1 showing the coupler centering device in an inactive position.

FIG. 16 is a top view of the railway vehicle coupler of FIG. 1 showing the coupler centering device in one active centering position.

FIG. 17 is a top view of the railway vehicle coupler of FIG. 1 showing the coupler centering device in another active centering position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For purposes of the description hereinafter, the terms "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom", "lateral", "longitudinal", and derivatives thereof, shall relate to the embodiment as it is oriented in the drawing figures. However, it is to be understood that the invention may assume alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific
devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the invention. Hence, specific dimensions and other physical characteristics related to the embodiments disclosed herein are not to be considered as limiting.

[0032] Referring to the drawings in which like reference characters refer to like parts throughout the several views thereof, the present disclosure is generally directed to a railway car coupler having a coupler centering mechanism for adjusting the alignment of the coupler in a horizontal plane in a lateral direction of the railway car.

[0033] Referring initially to FIGS. 1-6, an embodiment of a coupler 10 is shown. Coupler 10, as described herein, is intended for connection to a frame (not shown) of a railway car (not shown), as will be readily apparent to those skilled in the rail vehicle art. Coupler 10 is adapted for use in railway vehicles used for passenger and/or cargo transit. However, this use is intended to be non-limiting and coupler 10 has applications in railway cars generally. Coupler 10 in the depicted embodiment generally includes a coupler anchor 20, a coupler mechanism 50, an energy-absorbing deformation tube 40, and an energy absorbing draft gear mechanism 30. A coupler head (not shown) is coupled to the coupler mechanism 50 for connecting a railway car to an adjacent car. Deformation tube 40 connects coupler mechanism 50 to coupler anchor 20 by connection with draft gear mechanism 30.

[0034] Coupler anchor 20 has a substantially rectangular-shaped anchor body 60 that is truncated from its lateral sides. A front face of anchor body 60 defines a plurality of anchor mounting apertures 65 which accept securing elements (not shown) for interfacing with and securing anchor body 60 to the car frame of a railway car. Anchor body 60 pivotally supports coupler mechanism 50, deformation tube 40, and draft gear mechanism 30. h1 one embodiment, coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 are aligned axially and are pivotal about a vertical axis 70 extending through a mounting portion 80 of anchor body 60. Coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 are pivotal in a horizontal plane in either direction from a longitudinal axis 90 of the railway car. Coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 may pivot through a predetermined angular range from an on-center position that is substantially parallel with longitudinal axis 90. As shown in FIGS. 16-17, coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 may pivot to a first angle a away from longitudinal axis 90 (FIG. 16) and a second angle β away from longitudinal axis 90 (FIG. 17). One of ordinary skill in the art will appreciate that first and second angles a and β are exemplary only and that coupler mechanism 50, deformation tube 40, and draft gear
mechanism 30 may be pivoted to any angular position offset from the on-center position on either lateral side of longitudinal axis 90.

[0035] With continuing reference to FIGS. 1-6, coupler 10 further includes a coupler centering device 100 for centering coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 to an on-center position that is aligned with longitudinal axis 90 of the railway car. Coupler centering device 100 is operative for centering the coupler 10 to facilitate coupling of adjacent railway cars while permitting free angular movement during car travel along a curved track.

[0036] As shown in FIGS. 1-6, coupler centering device 100 includes a pair of centering arm subassemblies 102, 104 operatively connected to anchor body 60. A first centering arm subassembly 102 includes a first centering arm 106 and a first centering link 108 connected to a first torsion bar 110 extending through one lateral side of anchor body 60. First torsion bar 110 extends in a substantially vertical direction while first centering arm 106 and first centering link 108 extend substantially perpendicular to first torsion bar 110 and substantially parallel to longitudinal axis 90 in an on-center position of coupler 10 with respect to coupler anchor 20. Similarly, a second centering arm subassembly 104 includes a second centering arm 112 and a second centering link 114 connected to a second torsion bar 116 extending through an opposite lateral side of anchor body 60 compared to first torsion bar 110. Second torsion bar 116 extends in a substantially vertical direction while second centering arm 112 and second centering link 114 extend substantially perpendicular to second torsion bar 116 and substantially parallel to longitudinal axis 90 in an on-center position of coupler 10 with respect to coupler anchor 20. First and second centering arms 106, 112 are located above an upper side of anchor body 60 while first and second centering links 108, 114 are located below a lower side of anchor body 60.

[0037] With continuing reference to FIGS. 1-6, first and second centering arms 106, 112 include a first and second proximal end 118, 120 connected to an upper end of first and second torsion bars 110, 116 and a first and second distal end 122, 124 provided opposite of first and second proximal end 118, 120. Similarly, first and second centering links 108, 114 include a first and second proximal end 126, 128 connected to a lower end of first and second torsion bars 110, 116 and a first and second distal end 130, 132 extending opposite the first and second proximal end 126, 128. First and second centering links 108, 114 are coupled to each other by a cross link 134 that connects first and second distal ends 130, 132 of first and second centering links 108, 114. Each centering arm includes a curved surface that curves inwardly toward longitudinal axis 90.
As further illustrated in FIGS. 1-6, coupler centering device 100 additionally includes a support bracket 136 mounted to an exterior portion of draft gear mechanism 30 via a plurality of support bracket fasteners 138. While FIGS. 1-6 illustrate support bracket 136 as being fastened to draft gear mechanism 30, one of ordinary skill in the art will appreciate that support bracket 136 may be secured to coupler mechanism 50 or deformation tube 40. As shown in FIGS. 1-6, support bracket 136 includes a first roller 140 and a second roller 142. First roller 140 is adapted for engaging first centering arm 106 of first centering subassembly 102 while second roller 142 is adapted for engaging second centering arm 112 of second centering subassembly 104. First and second rollers 140, 142 are rotatably secured to support bracket 136 such that first and second rollers 140, 142 may rotate about first and second roller axes 144, 146, respectively. Proximal ends of first and second centering arms 106, 112 engage a portion of first and second rollers 140, 142 when coupler 10 is in an on-center position, i.e., when coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 are arranged in a coaxial arrangement with longitudinal axis 90.

With reference to FIGS. 7-8, an exploded view of a part of first centering subassembly 102 is illustrated. FIG. 7 shows an exploded view of an upper portion of first centering subassembly 102, while FIG. 8 illustrates a lower portion of first centering subassembly 102. With reference to FIG. 7, first and second stop elements 148, 150 are provided on anchor body 60 adjacent to proximal ends 118, 120 of first and second centering arms 106, 112, respectively. First stop element 148 is secured to anchor body 60 using a plurality of fasteners 152. An adjustable stop bolt 154 is in threaded engagement with first stop element 148 to permit adjustment of stop bolt 154 in a lateral direction of anchor body 60. With continuing reference to FIG. 7, first torsion bar 110 includes an upper bushing 156 located within a cavity of anchor body 60. First torsion bar 110 is rotatably supported by upper bushing 156, which is secured within the cavity by an upper cover plate 158 that is fastened to anchor body 60 by a plurality of fasteners 152. A washer 160 is provided between upper cover plate 158 and a first securing element 162 of first centering arm 106 that is secured to an upper end 164 of first torsion bar 110. As shown in FIG. 7, first torsion bar 110 has a generally hexagonal shape with a plurality of recessed portions 166 provided at upper end 164 and lower end 168. Upper bushing 156 and first securing element 162 have a corresponding hexagonal shape adapted for receiving first torsion bar 110 therethrough. A screw 170 secures upper end 164 of first torsion bar 110 to first securing element 162 by extending into recessed portion 166.
With continuing reference to FIG. 7, first securing element 162 includes an arm securing portion 172 that secures proximal end 118 of first centering arm 106 to first securing element 162. First securing element 162 includes a first hole 174 and a second hole 176 that are in alignment with a first hole 178 and a second hole 180 on first centering arm 106. A bolt 182 passes through the first holes 174, 178 of the first securing element 162 and first centering arm 106 and is secured by a nut 184. The nut 184 and bolt 182 arrangement permits proximal end 118 of first centering arm 106 to be rotatable with respect to first securing element 162. Rotation of first centering arm 106 relative to first securing element 162 will be described hereafter with reference to FIG. 15. A removable pin 186 having a pin strap 188 extends through second holes 176, 180 of first securing element 162 and first centering arm 106, respectively. Pin 186 is removable to permit proximal end 118 of first centering arm 106 to rotate relative to first securing element 162.

Referring to FIG. 8, an exploded view of a lower portion of first centering subassembly 102 is illustrated. Lower end 168 of first torsion bar 110 (not shown in FIG. 8) includes a lower bushing 190 located within a cavity of anchor body 60. First torsion bar 110 is rotatably supported within lower bushing 190, which is secured within the cavity by a lower cover plate 192 that is fastened to anchor body 60 by a plurality of fasteners 194. One or more washers 196 are provided between lower cover plate 192 and first centering link 108 that is secured to lower end 168 of first torsion bar 110. A screw 198 secures lower end 168 of first torsion bar 110 to first centering link 108 by extending into recessed portion 166. Distal end 130, 132 of first centering link 108 is secured to cross link 134 by a bolt 200 and a nut 202. In an on-center position of the coupler 10, first and second centering links 108, 114 are substantially perpendicular to cross link 134. A complete assembly of coupler centering device 100 is illustrated in FIGS. 9-14, where coupler centering device 100 is shown without coupler 10. While the above discussion relating to FIGS. 7-8 focuses on describing the components of first subassembly 102, second subassembly 104 is arranged in an exact manner using identical components.

With reference to FIG. 15, first and second centering arms 106, 112 may be moved to a disengaged position by removing pin 186 from second holes 176, 180 on the centering arms 106, 112 and the securing elements 162. Removing pin 186 allows first and second centering arms 106, 112 to move out of contact with first and second rollers 140, 142 such that coupler 10 may be freely rotated from an on-center position to an off-center position without engaging coupler centering device 100. This is particularly advantageous during service of coupler 10 and/or coupler centering device 100.
Having described the structure of coupler centering device 100, an operating principle of the same will now be described with reference to FIGS. 1, 4, 16, and 17. Subassemblies 102, 104 are pivotally coupled to each other by cross link 134 such that movement of one subassembly causes a corresponding movement of the other subassembly. An angular displacement of first subassembly 102 in one direction away from an on-center position parallel to longitudinal axis 90 causes a corresponding angular displacement of second subassembly 104 in the same direction. In other words, pivoting angular movement of first centering arm 106 will cause a corresponding pivoting movement of first centering link 108. Because first and second centering links 108, 114 are connected by cross link 134, angular movement of first centering link 108 about a vertical axis extending through first torsion bar 110 causes a corresponding angular movement of second centering link 114 and second centering arm 112. However, as will be described hereafter, first and second centering links 108, 114 are prevented from rotating due to the presence of first and second stop elements 148, 150.

With reference to FIGS. 1 and 4, coupler 10 is in an on-center position, wherein coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 are substantially parallel and coaxial with longitudinal axis 90. In this orientation, first and second centering links 108, 114 are substantially perpendicularly oriented relative to cross link 134. First and second centering arms 106, 112 contact first and second rollers 140, 142 at outside lateral sides of the rollers with respect to longitudinal axis 90 and at a point below each roller's diameter measured perpendicular to longitudinal axis 90. In other words, first and second centering arms 106, 112 rest against an outside surface of rollers 140, 142 at a location between the roller end closest to first and second centering arms 106, 112 and first and second roller axis 144, 146. First and second centering arms 106, 112 may be preloaded against the surface of first and second rollers 140, 142 by rotating upper end 164 of first and second torsion bars 110, 116 with respect to lower end 168 thereof in order to generate a torsional force within torsion bars 110, 116. First and second torsion bars 110, 116 are desirably rotated in opposite directions in order to create a balanced force between the first and second subassemblies 102, 104. The preload force on first and second rollers 140, 142 may also be regulated by adjusting the length of stop bolt 154 on each subassembly 102, 104. Loosening stop bolt 154 of first centering arm 106 away from longitudinal axis 90 releases the preload on first roller 140, while tightening stop bolt 154 toward longitudinal axis 90 increases the preload. Similarly, loosening stop bolt 154 on second centering arm 112 away from longitudinal axis 90 releases the preload on second roller 142 in an on-center position of
coupler centering device 100, while tightening stop bolt 154 toward longitudinal axis 90 increases the preload.

[0045] With reference to FIGS. 16-17, pivoting movement of coupler 10 with respect to coupler anchor 20 causes a corresponding movement in coupler centering device 100. As shown in FIGS. 16-17, when coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 are pivoted at an angle α, β, or any other angle in a direction away from longitudinal axis 90 and toward first centering arm 106, first roller 140 also moves toward first centering arm 106. In one embodiment, coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 may be rotated up to 30° in either direction away from longitudinal axis 90. Continued rotation of coupler mechanism 50, deformation tube 40, and draft gear mechanism 30 toward first centering arm 106 causes first roller 140 to engage a curved surface 204 of first centering arm 106 and to roll along the curved surface 204. Movement of first roller 140 along curved surface 204 of first centering arm 106 causes a deflection of first centering arm 106. Because first centering arm 106 is fixed at its proximal end to first torsion bar 110, deflection of first centering arm 106 results in its rotation about a vertical axis of first torsion bar 110. This rotation of first centering arm 106 causes a twisting of upper end 164 of first torsion bar 110 relative to lower end 168 thereof. The twisting of first torsion bar 110 causes a corresponding twisting of second torsion bar 116 conveyed through movement of first and second centering links 108, 114 and cross link 134. The twisting of second torsion bar 116 results in a tendency of proximal end 120 of second centering arm 112 to rotate about a vertical axis of second torsion bar 116. However, because second stop element 150 is interposed in the movement path of second centering arm 112, second centering arm 112 engages second stop element 150 to prevent further movement thereof. Because first subassembly 102 is not similarly constrained, movement of first centering arm 106 causes a restoring force to build within first and second torsion bars 110, 116 because of relative twisting between their upper and lower ends. The restoring force is present any time coupler 10 is in an off-center position (i.e., out of alignment relative to longitudinal axis 90). The restoring force within coupler centering device 100 enables manual movement of coupler 10 back to an on-center position without the need for assistance from hydraulic or pneumatic equipment. The size and length of first and second torsion bars 110, 116 is selected such that sufficient restoring force is generated within coupler centering device 100 in any off-center position to allow a single user to manually manipulate coupler 10 back to the on-center position. For example, coupler centering device 100 may be designed such that a force input of approximately 80 pounds is sufficient to restore coupler
10 from an off-center position to the on-center position. While the present disclosure focuses on describing movement of coupler 10 in a direction toward first centering arm 106, an identical reverse movement of the components of coupler centering device 100 exists when coupler 10 is moved in a direction toward second centering arm 112.

[0046] One benefit of coupler 10 incorporating coupler centering device 100 over the existing coupler centering means is that coupler centering device 100 is adapted to enable pivotal movement of coupler 10 with respect to coupler anchor 20 for aligning coupler 10 of one railway car with the coupler of an adjacent car. Coupler centering device 100 allows for manual adjustment of coupler 10 to align it from an off-center position to an on-center position that is substantially parallel to longitudinal axis 90 of the railway car. Another benefit is that the use of torsion bars 110, 116 in coupler centering device 100 creates a mechanical system that is not dependent on secondary equipment, such as hydraulic or pneumatic pumps, hoses, and valves. Coupler centering device 100 allows for a more compact and lightweight installation which allows additional space for auxiliary equipment on or near coupler 10. Thus, coupler centering device 100 may be used to replace an existing coupler alignment system in order to provide manual adjustment, as well as to provide additional space adjacent to coupler 10 for installation of other equipment.

[0047] While various embodiments of a coupler torsion spring centering device were provided in the foregoing description, those skilled in the art may make modifications and alterations to these embodiments without departing from the scope and spirit of the invention. For example, it is to be understood that this disclosure contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment. Accordingly, the foregoing description is intended to be illustrative rather than restrictive. The invention described hereinabove is defined by the appended claims and all changes to the invention that fall within the meaning and the range of equivalency of the claims are to be embraced within their scope.
THE INVENTION CLAIMED IS:

1. A coupler for a railway car, comprising:
   a coupler anchor;
   a coupler mechanism pivotal relative to the coupler anchor from an on-center position to an off-center position in a substantially horizontal plane; and
   a coupler centering device for centering the coupler mechanism relative to the coupler anchor, the coupler centering device comprising:
      a first centering arm subassembly having a first centering arm and a first centering link connected to a first torsion bar extending through the coupler anchor in a substantially vertical direction;
      a second centering arm subassembly having a second centering arm and a second centering link connected to a second torsion bar extending through the coupler anchor in the substantially vertical direction;
      a cross link connecting the first and second centering links; and
      a pair of first and second rollers in contact with the respective first and second centering arms.

2. The coupler of claim 1, further comprising a support bracket coupled to the coupler mechanism, wherein the first and second rollers are connected to the support bracket such that a first and second roller axes are oriented substantially perpendicular to a longitudinal axis of the coupler mechanism.

3. The coupler of claim 1, wherein the first and second centering arms are preloaded against the first and second roller to generate a restoring force in the first and second torsion bar for restoring the coupler mechanism to the on-center position when the coupler mechanism is pivoted to the off-center position.

4. The coupler of claim 1, wherein pivotal movement of the coupler mechanism from the on-center position causes one of the first and the second centering arms to roll along the one of the first and second rollers to generate a restoring force in the first and second torsion bars.
5. The coupler of claim 4, wherein the restoring force in the first and second torsion bars increases in proportion to the pivotal movement of the coupler mechanism from the on-center position.

6. The coupler of claim 1, wherein the restoring force in the first and second torsion bars restores the coupler mechanism to the on-center position.

7. The coupler of claim 1, wherein the first and second centering arms are movable to a disengaged position in which the coupling mechanism is not urged to an on-center position.

8. The coupler of claim 1, wherein the first and second centering arms have a curved shape.

9. The coupler of claim 1, wherein the first and second torsion bars have a substantially hexagonal cross-sectional shape.

10. A railway car coupler for coupling railway cars, the railway car coupler comprising:
    a coupler anchor connected to a railway car body;
    a coupler mechanism pivotal relative to the coupler anchor from an on-center position to an off-center position in a substantially horizontal plane; and
    a coupler centering device for centering the coupler mechanism relative to the coupler anchor, the coupler centering device comprising:
        a first centering arm subassembly having a first centering arm and a first centering link connected to a first torsion bar extending though the coupler anchor in a substantially vertical direction;
        a second centering arm subassembly having a second centering arm and a second centering link connected to a second torsion bar extending though the coupler anchor in the substantially vertical direction;
        a cross link connecting the first and second centering links; and
        a pair of first and second rollers in contact with the respective first and second centering arms.
11. The coupler of claim 10, further comprising a support bracket coupled to the coupler mechanism, wherein the first and second rollers are connected to the support bracket such that a first and second roller axes are oriented substantially perpendicular to a longitudinal axis of the coupler mechanism.

12. The coupler of claim 10, wherein the first and second centering arms are preloaded against the first and second roller to generate a restoring force in the first and second torsion bar for restoring the coupler mechanism to the on-center position when the coupler mechanism is pivoted to the off-center position.

13. The coupler of claim 10, wherein pivotal movement of the coupler mechanism from the on-center position causes one of the first and the second centering arms to roll along the one of the first and second rollers to generate a restoring force in the first and second torsion bars.

14. The coupler of claim 13, wherein the restoring force in the first and second torsion bars increases in proportion to the pivotal movement of the coupler mechanism from the on-center position.

15. The coupler of claim 10, wherein the restoring force in the first and second torsion bars restores the coupler mechanism to the on-center position.

16. The coupler of claim 10, wherein the first and second centering amis are movable to a disengaged position in which the coupling mechanism is not urged to an on-center position.

17. The coupler of claim 10, wherein the first and second centering amis have a curved shape and wherein the first and second torsion bars have a substantially hexagonal cross-sectional shape.

18. A coupler centering device for centering a coupler mechanism relative to a coupler anchor of a railway car, the coupler centering device comprising:
a first centering am subassembly having a first centering arm and a first centering link connected to a first torsion bar extending though the coupler anchor;
a second centering arm subassembly having a second centering arm and a second centering link connected to a second torsion bar extending though the coupler anchor; a cross link connecting the first and second centering links; and a pair of first and second rollers in contact with the respective first and second centering arms.

19. The coupler of claim 18, further comprising a support bracket coupled to the coupler mechanism, wherein the first and second rollers are connected to the support bracket such that a first and second roller axes are oriented substantially perpendicular to a longitudinal axis of the coupler mechanism.

20. The coupler of claim 18, wherein the first and second centering arms have a curved shape and wherein the first and second torsion bars have a substantially hexagonal cross-sectional shape.
FIG. 13
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/067028

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B61 G 7/10 (2014.01)
USPC - 213/19
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A63H 19/18; B61G 7/10 (2014.01)
USPC - 213/7, 19, 20, 75R, 75TC, 77, 90, 104, 110

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - A63H 19/18; B61G 7/10, 7/12 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>WO 2012/026865 A1 (WESTMAN et al) 01 March 2012 (01.03.2012) entire document</td>
<td>1, 6-10, 15-18, 20</td>
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<tr>
<td>Y</td>
<td>US 3,371,802 A (DUNGAN) 05 March 1968 (05.03.1968) entire document</td>
<td>1, 6-10, 15-18, 20</td>
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<td>A</td>
<td>US 3,386,596 A (GUTRIDGE et al) 04 June 1968 (04.06.1968) entire document</td>
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Date of the actual completion of the international search
28 February 2014

Date of mailing of the international search report
20 March 2014

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