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LOW PROFILE RAIL CLAMP ASSEMBLY

Abstract

A clamp assembly including a clamp base, a clamping member carriage, and a clamp member. The clamp base includes a clamping end and a release end with an elongate member support section extending therebetween, the clamping member carriage slidably connected to and positioned below the clamp base. The clamping member carriage includes first and second ends, the first end extending toward the clamping end of the clamp base and the second end extending toward the release end of the clamp base. The clamp member is pivotally mounted to a guide rod mounted below the clamp base, the clamp member engageable by the clamping member carriage, the clamp member advanceable between a clamp position and an open position upon sliding advancement of the clamping member carriage toward the clamping or release end of the clamp base, and such sliding advancement may be accomplished by a spring and/or an actuator.

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Background/Summary

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 63/555,637, filed Feb. 20, 2024, the disclosure of which is hereby incorporated herein in its entirety by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] This invention relates to improved clamp assemblies for securing long lengths of ribbon rail to a rail train car.

Description of the Related Art

[0003] Devices and methods for securing long lengths of rails for train tracks to rail cars for transport have been described and claimed in Applicant's prior patents U.S. Pat. Nos. 8,181,577 and 8,590,454. In brief, railroad tracks are constructed using long sections of ribbon rail which may be up to 1600 feet in length. These sections of ribbon rail are formed by butt welding multiple sticks of rail, which traditionally come from the steel mill in thirty-nine foot or seventy-eight foot lengths. The welding of the ribbon rails is done at a welding plant and the welded ribbon rails are transported to their installation site on a specially constructed rail train. The rail train includes a plurality of rail rack cars, each typically having one or two racks of shelves per car.

[0004] One car in each rail train is a tie-down car including specialized stands which include means for fixing the rails to racks on the stands to prevent longitudinal movement of the rails relative to the tie-down car. The fixing means generally includes a plurality of clamping blocks which are bolted to the stand on opposite sides of each rail so as to bear against the foot or base flange of the rail and clamp it against the stand. Historically, each clamping block is held down by three or four large bolts which must be installed or removed using an impact wrench or the like. Recent improvements, such as those in the previously referenced patents, utilize a mechanical clamping assembly with hydraulically actuated clamps or hooks which selectively capture and retain the rail without the need of a worker manually clamping and unclamping the rails. It has been learned, however, that the overall configuration of the clamping members which endure repetitive rotation of an actuator system as the clamp moves results in rapid wearing of components with excessive maintenance and repair costs. An improved clamping assembly which significantly reduces wear, increases maintenance intervals and limits repairs is needed.

SUMMARY OF THE INVENTION

[0005] The present invention is an improved clamping assembly for clamping elongate members in place, such as rails to be secured in place on a rail train. The clamping assemblies are mounted on shelves on one or more tie-down cars. Clamp members of each clamping assembly are normally urged to a clamping position by one or more springs to secure the rail in place to the clamping assembly and to the rail car. Linear actuators, such as hydraulic cylinders are utilized to move the clamp members out of clamping engagement with the rails.

[0006] Each clamp assembly includes a base plate fastened to the stand of the tie-down car. The base plate has at least two openings formed therethrough, one on each longitudinal side of a rail support section of the base plate on which the rail is supported. Respective clamping members extend upwardly through the openings. Each clamping member has a clamping flange which

selectively engages a lower flange or foot of the rail, and a clamp hub slidably mounted on a guide rod mounted to and below the base plate. A slidable clamping member carriage includes tubular spring bores in which springs are positioned, with the springs positioned between the carriage and an abutting feature on the base plate to normally bias a respective clamping member in a first direction relative to the guide rod on which the respective clamping member is mounted. The guide rods extend at an angle relative to the base plate such that each clamping member moves generally upward or downward relative to the base plate as the hubs of the clamping members ride along their respective guide rods.

[0007] The springs normally urge the clamping members toward the lower ends of the guide rods, drawing the clamping flange of each clamping member downward onto the foot of a rail positioned between opposed clamping members. Inline hydraulic actuators are connected to the slidable clamping member carriage which moves independently from the fixed guide rods, with the hydraulic actuators selectively acting on the clamping members to urge the clamping members in opposition to the spring and out of clamping engagement with the rail, or in harmony with the spring and into clamping engagement with the rail. In normal or resting orientation, the springs act on the clamping members to urge and hold the clamping members in clamping engagement with the rail when hydraulic pressure to the actuators is released, such as during transport of the rails.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a perspective view of a rail tie-down car.

[0009] FIG. **2** is a perspective view of a rail clamp assembly in a clamped position and viewed from an end opposite a pair of actuators operable to move clamps of the clamp assembly between clamped and unclamped positions.

[0010] FIG. **3** a perspective view of the rail clamp assembly as in FIG. **2** in the clamped position and viewed from an end from which the actuators extend.

[0011] FIG. **4** is a partially exploded perspective view of the rail clamp assembly as in FIG. **2** with the clamps in the clamped position.

[0012] FIG. **5** is a top, plan view of the rail clamp assembly as in FIG. **3** with the clamps in an unclamped position.

[0013] FIG. **6** is a cross-sectional view of the rail clamp assembly taken along line **6**-**6** of FIG. **5**.

[0014] FIG. **7** is a bottom, perspective view of the rail clamp assembly with the clamps in the clamped position and with springs removed to show detail.

[0015] FIG. **8** is a bottom, plan view of the rail clamp assembly with the clamps in the clamped position.

[0016] FIG. **9** is a bottom, plan view of the rail clamp assembly with the clamps in the unclamped position.

[0017] FIG. **10** is a cross-section view of the rail clamp assembly taken along line **10**-**10** of FIG. **8**

[0018] FIG. **11** is a cross-section view of the rail clamp assembly taken along line **11**-**11** of FIG. **9**.

[0019] FIG. **12** is a top, perspective view of a clamping member carriage of the rail clamp assembly.

[0020] FIG. **13** is a top, plan view of the clamping member carriage as shown in FIG. **12**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in

virtually any appropriately detailed structure. The drawings constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

[0022] Certain terminology will be used in the following description for convenience in reference only and will not be limiting. For example, the words “upwardly,” “downwardly,” “rightwardly,” and “leftwardly” will refer to directions in the drawings to which reference is made. The words “inwardly” and “outwardly” will refer to directions toward and away from, respectively, the geometric center of the embodiment being described and designated parts thereof. Said terminology will include the words specifically mentioned, derivatives thereof and words of a similar import.

[0023] Referring to the drawings and as shown in FIG. **1**, the reference number **1** generally designates a clamp car or tie-down car **1** which may be incorporated into a rail train for transporting a plurality of ribbon rails **3** along a railroad track. The rail train may be constructed or assembled similar to the rail train as shown and described in U.S. Pat. No. 8,590,454 of Ivan E. Bounds and assigned to Herzog Contracting Corp. of St. Joseph, Missouri, the disclosure of which is incorporated herein by reference.

[0024] As shown in FIGS. **3**, **10** and **11**, each rail **3** is of fixed length and includes a head **5**, a base flange **6**, and a web **7** connecting the base flange **6** to the head **5**. The base flange **6** may be described as including opposingly directed feet **8** and **9**. The rail train is made up of a plurality of cars, including front- and rear-end cars or tunnel cars, the tie-down car **1**, and a plurality of rail support cars. In the embodiment shown, the tie-down car **1** is preferably positioned near the center of the train to accommodate the greatest amount of expansion of the outer periphery of the train as it rounds corners without pulling the rails **3** off of rail support shelves on the front and rear end cars.

[0025] Referring to FIG. **1**, the tie-down car **1** includes a plurality of clamp assemblies **100** which are mounted on clamp stands **31** and **32** and clamp the ribbon rails **3** to the clamp stands **31** and **32** and to the train. The clamp stands **31** and **32** are generally mirror images of each other, with clamping assemblies **100** on the first clamp stand **31** connecting a first half of the rails **3** to the tie-down car **1** and clamping assemblies **100** on the second clamp stand **32** connecting a second half of the rails **3** to the tie-down car **1**. As discussed in more detail hereafter, the clamp assemblies **100** are preferably hydraulically and remotely operated for clamping the ribbon rails **3** to the clamp stands **31** and **32**. As mentioned elsewhere, it is to be understood that the clamp assemblies **100** could be actuated pneumatically, electrically, or mechanically.

[0026] Each clamp stand **31** and **32** is formed from a framework **34** forming a plurality of clamp stand shelves **35**, respectively, with the number of clamp stand shelves **35** corresponding to the number of layers or rows of rail to be supported. First and second end roller rack stands (not shown) may be positioned adjacent and outwardly from the clamp stands **31** and **32**, respectively, on the ends of the tie-down car **1**. Each clamp stand shelf **35** is provided with multiple clamp assembly frameworks **34**, two of which are included in the embodiment shown. The clamp frameworks **34** support opposingly oriented clamping assemblies **100**, with each opposingly oriented pair of such clamp assemblies configured to secure a rail **3**.

[0027] Referring to FIGS. **2** and **3**, each clamp assembly **100** of clamp stands **31** and **32** includes a clamp plate **102** to which the rest of the components are attached. Each clamp plate or base plate **102** has a pair of opposed clamping members **103** and **104** extending through slots **105** and **106** formed in the base plate **102**. As shown in FIG. **1**, the clamp plate **102** of each clamp assembly **100** includes means for connecting it to the framework **34** of the shelf **35** on which it is supported which, in the embodiment shown, comprise bolt holes **107** formed in each clamp plate **102**. Bolts (not shown) are threaded through the bolt holes **107** and into the framework **34** to secure the base plate **102** of each clamp assembly **100** thereto.

[0028] The base plate **102** of each clamp assembly **100** includes a driving or actuating end **108** and

an opposing second or spring end **109**, with at least one longitudinal receiving section **110** positioned between the ends **108** and **109** on which the base flange **6** of a respective rail **3** rests. The actuating end **108** may also be referred to as a clamping end **108** and the spring end **109** may also be referred to as the release end **109** of the base plate **102**. As best shown in FIG. **4**, two elongate clamp slots **105** and **106** are formed through the base plate **102** adjacent to and on opposite sides of the receiving section **110**. Each clamp slot **105** and **106** is defined by inner and outer edges **113** and **114** relative to a longitudinal axis extending through the receiving section **110**, and by inner and outer end walls **115** and **116** extending transverse to the longitudinal axis extending through the receiving section **110**. The inner end wall **115** may be referred to as a clamping end or clamping end wall **115** and the outer end wall **116** may be referred to as a release end or release end wall **116**. As best seen in FIGS. **2**, **3**, **10** and **11**, each clamping member **103** and **104** includes a clamp hook or holding hook **117** and **118** for grasping the base flange **6** of a rail **3**. As best seen in FIGS. **4** and **9**, the clamping members **103** and **104** are slidably mounted on guide rods or shafts **119** and **120**, respectively, that are mounted to bosses or other structures formed on the underside of the base plate **102**. The guide rods **119** and **120** extend below the base plate **102** with each hook **117** and **118** extending upward through a respective one of the clamp slots **105** and **106**. Each clamping member **103** and **104** is supported within a clamping member carriage **121** and **122**, each of which is slidably connected to and positioned below the clamp base **102** and slidable between the clamping end **108** and release end **109** thereof. Longitudinal movement of the clamping member carriages **121** and **122** moves the clamping members **103** and **104** longitudinally along the respective guide rods **119** and **120** to advance the clamping members **103** and **104** into and out of engagement with the base flange **6** of a rail **3** on the base plate **102**.

[0029] Referring to FIG. **7**, the base plate **102** has a depending box-shaped flange assembly **124** positioned near the periphery thereof. This flange assembly **124** includes a first end or actuator end **125**, an opposed second end **126**, and opposing sides **127**, **128**, with the ends and the sides having inner surfaces **130** and outer surfaces **132**. The flange assembly **124** substantially houses the clamping member carriages **121** and **122** as described herein. Outer guide rails or tracks **135** and **136** are provided along the inner surfaces **130** of the opposing flange assembly sides **127**, **128** with the guide rails **135** and **136** spanning substantially between the flange assembly opposing ends **125** and **126**. A central guide rail **138** similarly extends between the flange assembly opposing ends **125** and **126** medially between the flange assembly sides **127** and **128**. Clamping member carriage **121** is slidably mounted on and between outer guide rail **135** and central guide rail **138**, and clamping member carriage **122** is slidably mounted on and between outer guide rail **136** and central guide rail **138**.

[0030] Hydraulic actuators **141** and **142** are mounted below the plane in which the base plate **102** extends, near the driving end **125** and in-line with a respective carriage **121** and **122**. Each actuator **141**, **142** includes a respective piston **143**, **144** which is fastened to a respective clamping member carriage **121**, **122** and extends through openings provided through the actuator end **125** of flange assembly **124**. The actuators **141** and **142** are operable to act on the respective clamping member carriages **121** and **122** which carry the clamping members **103** and **104**, with operation of the actuators **141** and **142** drawing the hooks **117** and **118** against the biasing force of springs **145** and **146** from a clamping position wherein the hooks **117** and **118** are oriented proximate the clamping end walls **115** of the respective slots **105** and **106** to an unclamped or open position wherein the hooks **117** and **118** are oriented proximate to the release end walls **116** of the respective slots **105** and **106**. The actuators **141** and **142** are also operable to advance or drive the clamp hooks **117** and **118** from the open position back to the clamping position.

[0031] Referring to FIGS. **8** and **9**, each clamping member carriage **121** and **122** includes a push end **148** and an opposite compression end **149** and is provided with connection means, such as a mounting tab **151** on the push end **148** for attachment to a fork or clevis **152** extending from an end of the respective piston **143**, **144** of each respective hydraulic actuator **141**, **142**. The push end **148**

of each carriage **121**, **122** may be referred to as the clamping end **148** and the compression end **149** of each carriage **121**, **122** may be referred to as the compression end **149**. Each clamping member carriage **121** and **122** has carriage rails **155** projecting from sides thereof (see FIG. **10**) which are aligned with and moveable upon the guide tracks **135** and **136** and the central guide rail **138** of the base plate flange assembly **124**, allowing the clamping member carriages **121** and **122** to move linearly. As best shown in FIG. **7**, two spring bores **161** and **162** are provided in each clamping member carriage **121** and **122** for housing the compression springs **145** and **146**. The compression springs **145** and **146** extend between inner ends of the bores **161** and **162** and the inner surface **130** of the compression end **126** of the flange assembly **124**, with the spring bores **161** and **162** surrounding the springs **145** and **146** during compression to limit spring deflection.

[0032] The compression springs **145** and **146** are sized to normally urge the carriages **121** and **122** toward the clamping end **108** of the base plate **102**, which advances the associated clamp members **103** and **104** toward an inner end or clamping end **169** of each guide rod **119** and **120** such that the clamp members **103** and **104** slide downward on the respective guide rods **119** and **120** and toward the clamping end **108** of the base plate **102**. As the carriages **121** and **122** advance toward the clamping end **108**, the clamp hooks **117** and **118** are drawn downward into the clamping position and the pistons **143** and **144** of the actuators **141** and **142** are urged outward.

[0033] Each guide rod **119** and **120** extends from its clamping end **169** to an outer end or release end **171** and is connected to the underside of the base plate **102**, such that the guide rods **119** and **120** slope downward from the release ends **171** to the clamping ends **169**. The clamping end **169** of each guide rod **119**, **120** is connected to the underside of the base plate **102** proximate to the actuator end **125** thereof, and the release end **171** of each guide rod **119**, **120** is connected to the underside of the base plate **102** closer to the opposing end **126** of the flange assembly **124** and proximate to the release end **116** of each guide slot **105**, **106**. The guide rods **119** and **120** may also be described as sloping downward from the release end **116** to the clamping end **115** of each clamp slot **105**, **106**. The guide rods **119** and **120** generally extend along the full length of the respective clamp slots **105** and **106** and are positioned parallel to and below the inner edges **113** thereof.

[0034] As shown in FIGS. **4**, **8**, and **9**, the pistons **143** and **144** of the actuators **141** and **142** are axially connected to the clamping member carriages **121** and **122**, respectively. The clamp members **103** and **104** are slidably and rotatably mounted on respective guide rods **119** and **120** and lie within openings or recesses **175** (see FIGS. **12** and **13**) extending into the respective carriages **121** and **122** from upper surfaces thereof. The clamping member carriages **121** and **122** are configured to slide longitudinally relative to the clamp base **102** and the guide rods **119** and **120**, thereby advancing the respective clamp members **103** and **104** longitudinally relative to the guide rods **119** and **120** while allowing the clamp members **103** and **104** to rotate relative to the guide rods **119** and **120**. By positioning the actuators **141** and **142** and the springs **145** and **146** to extend along the longitudinal axis of or in line with the respective carriages **121** and **122**, the overall height of the clamp assembly **100** is reduced. The springs **145** and **146** function to normally bias and advance the clamping carriages **121** and **122** and the clamping members **103** and **104** carried thereby toward the clamping end **108** of the base plate **102**, drawing the clamping members **103** and **104** downward on guide rods **119** and **120** until the holding hooks **117** and **118** extend in the clamping position. The springs **145** and **146** thereby force the holding hooks **117** and **118** to the clamping position when the supply of pressurized hydraulic fluid to actuators **141** and **142** is withdrawn, as may occur during transport of the rails **3** on the rail train, which may take days or weeks, or if a hydraulic line supplying pressurized fluid to either actuator **141** or **142** is severed. It is to be understood that different types of actuators other than hydraulic actuators might be utilized, including pneumatic actuators or solenoids. The actuators shown are linear actuators, but it is foreseen that other types of actuators, mechanisms or linkages may be used for remotely acting on and moving the hooks **117** and **118**.

[0035] Referring to FIGS. **10** and **11**, each clamping member **103** and **104** includes a generally

tubular guide sleeve or hook hub **176**, a shank **177** projecting outward from and generally tangential to the hook hub **176** and a clamping flange **178** which is positioned at an upper end of the shank **177**. The clamping flange **178** extends perpendicularly inward from the shank **177** and over the hook hub **176** in spaced relation thereto, such that the shank **177** and clamping flange **178** form the hook **117** and **118** of each clamping member **103** and **104**. The guide rods **119** and **120** extend along axes which pass through guide bores formed in each hook hub **176** at acute angles relative to the clamping flanges **178**, with the angles between the hook hubs **176** and clamping flanges **178** corresponding to the angled or downward slope of the guide rods **119** and **120** toward their respective clamping ends **169**. As best seen in FIGS. **8** and **9**, a first end or clamping end face **179** of the hook hub **176** is lower or spaced further away from the clamping flange **178** than a second end or release end face **180** of the hook hub **176**. The clamping end faces **179** are formed on the ends of the hook hubs **176** opposite the respective compression springs **145**, **146**, and the release end faces **180** are formed on the ends of the hook hubs **176** closer to the respective compression springs **145**, **146**.

[0036] As best seen in FIG. **4**, a sloping gap **181** which is formed between the hook hub **176** and the clamping flange **178** of each clamping member **103** and **104** opens inward toward the longitudinal receiving section **110** of the base plate **102** and is wider at the first end **179** than the second end **180** of the hook hub **176**. The gap **181** between the hook hub **176** and clamping flange **178** allows the hooks **117** and **118** to move downward and rotate inward as the springs **145** and **146** urge the respective hooks **117** or **118** toward the clamping end **115** of each slot **105** and **106** and into the clamping position, with the clamping flange **178** of each hook **117**, **118** down downwardly against the rail flange foot **8** or **9**.

[0037] The inner edges **113** of the clamp slots **105** and **106** generally define the outer edges of the receiving section **110**, and the outer edges **114** of each clamp slot **105** and **106** are contoured inward from the release ends **116** to the clamping ends **115**, such that the clamp slots **105** and **106** are narrower proximate to their respective clamping ends **115** than proximate to their respective release ends **116**. The edges of the base plate **102** form the outer edge **114** of each slot **105** and **106**, with the narrower spacing of the clamp slots **105**, **106** near the clamping ends **115** thereof allowing the edges of the base plate **102** to function as guides which engage the hooks **117** and **118**, forcing the hooks **117** and **118** to pivot inward about the respective guide rods **119** and **120** as the springs **145** and **146** urge the hooks **117** and **118** to the clamped position. Similarly, the wider spacing of the clamp slots **105**, **106** near the release ends **116** thereof allows the hooks **117** and **118** and clamping flanges **178** thereof to pivot outward to the open position, spaced away from a rail **3** supported on the receiving section **110** of the clamp base plate **102**, with the inner edges **113** of the clamp slots **105** and **106** guiding the hooks **117** and **118** sufficiently outward such that when the hooks **117** and **118** are in the open position, the hooks **117** and **118** are spaced apart from and do not overlie the feet **8** and **9** of the rail base flange **6**.

[0038] Referring to FIG. **4**, each clamp slot **105** and **106** includes a relatively wide distal portion or release portion **182** proximate to the respective release end **116**, a tapering intermediate portion **183**, and a relatively narrow clamping portion **184** proximate to the respective clamping end **115**. First and second inwardly sloping transition sections **185** and **186** extend between the distal portion **182** and the intermediate portion **183** and between the narrow portion **184** and the intermediate portion **183**, respectively, of each clamp slot **105** and **106**. The narrow clamping portions **184** of the clamp slots **105** and **106** are sized slightly wider than the width of the hook shanks **177** extending therethrough, such that when the clamping members **103** and **104** are drawn to the clamping position, the hook shanks **177** are maintained in a perpendicular or vertical alignment relative to the base plate **102** and the clamping flanges **178** project over the receiving section **110** and over the feet **8** and **9** of the rail base flange **6**. A clamping wall **190** is formed along the outer edge **114** of each slot **105** and **106** along the narrow portion **184** thereof, with the clamping walls **190** and the second transition sections **186** cooperating to urge or hold the clamp hooks **117** and **118** in the

clamping position. As the hooks **117** and **118** advance from the clamping position to the open position, the hooks **117** and **118** are drawn outward toward respective release ends **171** of the slots **105** and **106**. As the hooks **117** and **118** move from the intermediate portions **183** to the distal portions **182** of the slots **105** and **106**, the second ends of the hooks **117** and **118** engage the associated first transition sections **185** of the slots **105** and **106** such that the hooks **117** and **118** pivot outward and their associated clamping flanges **178** pivot away from the receiving section **110** and into an open alignment.

[0039] As best shown in FIG. **5**, when the hooks **117** and **118** are in the open position discussed above, a first end of each hook **117** and **118** which is oriented closer to the respective slot clamping end **115** is positioned in the intermediate portion **183** of the respective slots **105** and **106**, and an opposing second end of each hook **117** and **118** which is oriented closer to the respective slot release end **116** is positioned in the distal portion **182** of the respective slots **105** and **106**. As the hooks **117** and **118** are driven toward the respective clamping ends **115** of the slots **105** and **106**, the first ends of the hooks **117** and **118** engage the associated inner or second transition sections **186** of the slots **105** and **106** such that the hooks **117** and **118** pivot inward, with the hook shanks **177** pivoting upward into alignment with the intermediate portions **183** of the clamp slots **105** and **106** as the hooks **117** and **118** are driven toward the respective clamping ends **115** of each slot **105** and **106**. As the first ends of the hooks **117** and **118** advance into the narrow portions **184** of the respective slots **105** and **106**, the second ends of the hooks **117** and **118** extend adjacent to the portions of the base plate **102** which form the intermediate portions **183** of the slots **105** and **106**, such that the second ends of the hooks **117** and **118** are urged toward the inner edges **113** of the respective slots **105** and **106** until the entire length of each hook clamping flange **178** engages with and clamps against the respective foot **8** or **9** of the rail base flange **6**.

[0040] Referring to FIGS. **10** and **11**, it is seen that as the hooks **117** and **118** are drawn inward and downward from the distal portions **182** of the respective clamp slots **105** and **106** toward the clamping ends **115** thereof for engagement of inner surfaces of the clamping flanges **178** with upper surfaces of the respective rail feet **8** and **9** of a rail **3** positioned on the rail receiving section **110** of the base plate **102**, the hook hubs **176** advance downward on their respective downwardly sloping guide rods **119** and **120** such that the hooks **117**, **118** and the associated clamping flanges **178** are forced downward.

[0041] As best seen in FIG. **7**, the clamping member carriages **121** and **122** are configured to engage and move the clamping members **103** and **104** longitudinally along the shafts **119** and **120** in response to the biasing force of the springs **145**, **146** and the extension of the pistons **143**, **144** of actuators **141**, **142**. The carriages **121** and **122** are slidably mounted below the base plate **102**, such that the clamping end **148** of each carriage **121** and **122** extends toward or faces the clamping end **108** of the base plate **102** and the release end **149** of each carriage **121** and **122** extends toward or faces the release end **109** of the base plate **102**. As best seen in FIGS. **12** and **13**, the recesses or cavities **175** of the carriages **121** and **122**, which may be referred to as clamping member recesses **175**, are formed between first and second abutments **205** and **206** mounted on each carriage **121** and **122**. The first abutments **205** are mounted on the respective carriages **121** and **122** closer to the clamping ends **148** thereof and extend in closely spaced relation to the clamping end faces **179** of the respective hook hubs **176**, and the second abutments **206** are mounted on the respective carriages **121** and **122** closer to the release ends **149** thereof and extend in closely spaced relation to the release end faces **180** of the respective hook hubs **176**. As the carriages **121** and **122** advance toward the clamping end **108** of the base plate **102**, the second abutments **206** mounted thereon extend in engaging or abutting relationship with the release end faces **180** of the hook hubs **176** of the clamping members **103** and **104**, pushing each clamping member **103** and **104** toward the clamping end **108** of the base **102** such that each hook hub **176** slides downward on the respective guide rod or shaft **119** and **120** and into the clamping position as discussed previously. Similarly, as the carriages **121** and **122** advance toward the release end **109** of the base plate **102**, the first

abutments **205** mounted thereon extend in engaging or abutting relationship with the clamping end faces **179** of the hook hubs **176** of the clamping members **103** and **104**, pushing each clamping member **103** and **104** toward the release end **109** of the base **102** such that each hook hub **176** slides upward on the respective guide rod or shaft **119** and **120** and into the open or released position as discussed previously.

[0042] In the embodiment shown in FIGS. **12** and **13**, the release end **149** of each carriage **121** and **122** is formed as a spring housing generally in the form of a rectangular block or spring support block **211**, with the spring receiving bores **161** and **162** extending into the spring support blocks **211** from the release ends **149** of the carriages **121** and **122**. An outer side wall **213** extends along an outer side of each carriage **121** and **122** from the spring support block **211** toward the clamping end **148**, with an end wall **215** projecting laterally inward from the outer side wall **213** of each carriage **121** and **122** at the clamping end **148** thereof and toward the respective guide rod **119** or **120**. The first abutment **205** of each carriage **121**, **122** is mounted on the respective end wall **215** outward of the respective guide rod **119** or **120**, and the first abutments **205** extend back toward the respective release ends **149** of the carriages **121** and **122**. The first abutments **205** may be described as oriented generally vertically and may be formed from a comparatively soft metal, relative to the carriages **121** and **122**, such as brass or bronze to reduce wear on clamping end face **179** of the hook hub **176** as the clamping members **103** and **104** are repeatedly advanced between the clamping position and the open position. The mounting tabs **151**, which connect the pistons **143** and **144** of the actuators **141** and **142** to respective carriages **121** and **122**, are formed on the end wall **215** of each carriage **121** and **122**.

[0043] In the embodiment shown, a carriage floor **217** extends forward from the spring support block **211** of each carriage **121** and **122** and toward the clamping member recess **175** thereof. The second abutments **206** are secured to or formed on an end of the respective carriage floors **217** adjacent to the clamping member recess **175**, with each second abutment **206** extending laterally in a plane oriented below the release ends **171** of the respective guide rods **119** and **120**. The second abutments **206** may be described as oriented generally horizontally and may be formed from a comparatively soft metal, relative to the carriages **121** and **122**, such as brass or bronze to reduce wear on the release end face **180** of the hook hub **176** as the clamping members **103** and **104** are repeatedly advanced between the clamping position and the open position.

[0044] In the embodiment shown, each clamping member recess **175** extends from an upper surface of the respective carriage **121**, **122** through a lower surface thereof, such that the clamping member recesses **175** extend completely through the respective carriages **121** and **122** and the respective carriage floors **217** do not extend below the hook hubs **176** of the clamping members **103** and **104**. A shaft accommodating recess **225** is formed above the carriage floor **217** of each carriage **121** and **122** and opens upward, extending through the upper surface thereof to allow each carriage floor **217** and second abutment **206** formed thereon to slide below the release end **171** of each guide rod **119**, **120** and a portion of the respective guide rod **119**, **120** positioned proximate thereto as the carriages **121** and **122** are advanced toward the clamping end **108** of the base plate **102**. In an embodiment, the carriage floor **217** may include a sidewall portion **227** which extends along the outer side wall **213** of each carriage **121** and **122** from a position proximate to the second abutment **206** thereof to the end wall **215** thereof. The sidewall portion **227** may extend inward from the outer side wall **213** of each carriage **121**, **122** into the respective recesses **175** such that an inner edge of the sidewall portion **227** may define an outer edge of the recess **175** of each clamping member **103**, **104**.

[0045] With reference to FIGS. **1-3**, a mounting plate **231** is secured to each actuator **141** and **142** and is configured to allow mounting the actuators **141** and **142** to the framework **34** of the respective clamp stands **31** and **32** on which the clamp assembly **100** is secured. In the embodiment shown, the mounting plates **231** are secured to the actuators **141** and **142** such that the pistons **143** and **144** thereof extend through openings formed in the respective mounting plates **231**, before

extending through openings formed in the actuator end **125** of the base plate flange assembly **124** to allow extension and retraction of each piston **143** and **144** therethrough in association with longitudinal movement of the carriages **121** and **122**. The actuators **141**, **142** and pistons **143**, **144** may be described as being connected in-line with the respective carriages **121**, **122**, such that application of pressurized hydraulic fluid to the actuators **141** and **142** drives movement of the carriages **121** and **122** along only their longitudinal axes. Similarly, the compression springs **145** and **146** may be described as extending in-line with the respective carriages **121** and **122**, such that the biasing force of the springs **145** and **146** drives movement of the carriages **121** and **122** along only their longitudinal axes. The pistons **143** and **144** are connected to the carriages **121** and **122**, respectively, rather than to the clamping members **103** and **104**, allowing the pistons **143** and **144** to remain in a fixed rotational position as the clamping members **103** and **104** are advanced between the clamping position and the release position. Similarly, the springs **145** and **146** act on the carriages **121** and **122**, respectively, rather than acting directly on the clamping members **103** and **104**, thereby preventing impartment of rotational torque on the springs **145** and **146** as the clamping members **103** and **104** rotate relative to the shafts **119** and **120**, respectively, while advancing between the clamping position and the release position. In addition, because the actuators **141** and **142** and springs **145** and **146** can be mounted in-line with the carriages **121** and **122**, respectively, the overall height of the clamping assembly **100** is reduced.

[0046] It is to be understood that compression or tension springs could foreseeably be used to bias the clamp hooks into or out of clamping engagement with a rail supported on the rail base, such that springs could function as either clamping means or release means acting on the clamp hooks. It should be further understood that actuators of the type disclosed herein can be used as either clamping or release means, or both, which act on the clamp hooks to advance the clamp hooks into and out of clamping engagement with a rail supported on the rail base. Actuators other than hydraulic actuators, including pneumatic actuators, solenoids or mechanical linkages could be used to move the clamp hooks into and/or out of clamping engagement with a rail supported on the rail base to permit remote engagement and disengagement of the clamp hooks with a rail supported on the clamp base.

[0047] It is to be understood that while certain forms of the present invention have been illustrated and described herein, it is not to be limited to the specific forms or arrangement of parts described and shown. As used in the claims, identification of an element with an indefinite article “a” or “an” or the phrase “at least one” is intended to cover any device assembly including one or more of the elements at issue. Similarly, references to first and second elements, or to a pair of elements, is not intended to limit the claims to such assemblies including only two of the elements, but rather is intended to cover two or more of the elements at issue. Only where limiting language such as “a single” or “only one” with reference to an element, is the language intended to be limited to one of the elements specified, or any other similarly limited number of elements.

Claims

1. A clamp assembly for securing an elongate member thereto, comprising: a clamp base having an elongate member support section extending from a clamping end to a release end of said clamp base; a clamping member carriage slidably connected to the clamp base and slidable between the clamping end and the release end of the clamp base; the clamping member carriage having first and second ends, the first end extending toward the clamping end of the clamp base and the second end extending toward the release end of the clamp base; an actuator connected to the clamping member carriage and operable to selectively move the clamping member carriage between the clamping end and the release end of the clamp base; a spring acting on and normally urging the clamping member carriage toward the clamping end of the clamp base; and a clamping member engaged by the clamping member carriage, the clamping member advanceable into clamping engagement with

an elongate member supported on the elongate member support section of the clamp base upon movement of the clamping member carriage toward the clamping end of the clamp base by the actuator, and the clamping member advanceable out of clamping engagement with the elongate member supported on the elongate member support section of the clamp base upon movement of the clamping member carriage toward the release end of the clamp base.

2. The clamp assembly as in claim 1, wherein the spring comprises at least one compression spring.

3. The clamp assembly as in claim 1, wherein the actuator comprises a linear actuator.

4. The clamp assembly as in claim 1, wherein the clamping member carriage is slidably connected to the clamp base therebelow and the spring comprises at least one compression spring extending between the release end of the clamping member carriage and an abutment depending from the clamp base.

5. The clamp assembly as in claim 4, wherein the actuator comprises a linear actuator connected at a first end to the clamp base and at a second end to a clamping end of the clamp member carriage.

6. The clamp assembly as in claim 1, further comprising a shaft on which the clamping member is pivotally mounted, the shaft mounted below the clamp base and having an upper end and a lower end, the upper end of the shaft extending closer to the release end of the clamp base than the lower end of the shaft.

7. The clamp assembly as in claim 1, wherein the clamping member includes a hook configured to move downward and pivot inward upon advancement of the clamping member into clamping engagement with the elongate member supported on the elongate member support section of the clamp base.

8. A clamp assembly for securing an elongate member thereto, comprising: a) a clamp base having an elongate member support section extending from a clamping end to a release end of said clamp base; b) a shaft having an upper end and a lower end mounted below said clamp base; said lower end of said shaft supported below said upper end of said shaft and said lower end of said shaft extending closer to the clamping end of said clamp base than said upper end of said shaft; c) a clamping member having a hub pivotally mounted on said shaft; a shank projecting outward from said hub and a clamping flange projecting inward from a distal end of said shank over and in spaced relation to said hub; and d) a clamping member carriage slidably connected to and below said clamp base and slidable between the clamping end and the release end of the clamp base; the clamping member carriage having first and second ends, the first end extending toward the clamping end of the clamp base and the second end extending toward the release end of the clamp base; the clamping member carriage having a clamping member cavity extending into the clamping member carriage from an upper surface thereof, the clamping member carriage having a first abutment extending adjacent the clamping member cavity from the first end of the clamping member carriage and having a second abutment extending adjacent the clamping member cavity from the second end of the clamping member carriage, the clamping member positioned within the clamping member cavity with the first abutment extending in closely spaced relation to a clamping end face of the clamping member and the second abutment extending in closely spaced relation to a release end face of the clamping member such that sliding advancement of the clamping member carriage toward the clamping end of the clamp base advances the clamping member on the shaft toward the lower end thereof and sliding advancement of the clamping member carriage toward the release end of the clamp base advances the clamping member on the shaft toward the upper end thereof.

9. The clamp assembly as in claim 8, further comprising at least one compression spring acting on a second end of the clamping member carriage and normally biasing the clamping member carriage toward the clamping end of the clamp base.

10. The clamp assembly as in claim 9, further comprising a linear actuator acting on a first end of the clamping member carriage for selectively advancing the clamping member carriage toward the release end of the clamp base against the biasing force of the at least one compression spring.

11. The clamp assembly as in claim 8, wherein the shank of the clamping member extends through a clamp slot formed in the clamp base, the clamp slot defined by a clamping end wall, a release end wall, and inner and outer edge walls extending therebetween; the clamping end of the clamp base extending closer to the clamping end wall than the release end wall.

12. The clamp assembly as in claim 11, further comprising a first sloped transition section extending between the release end wall and the inner edge wall and a second sloped transition section extending between the clamping end wall and the outer edge wall.

13. The clamping assembly as in claim 12, wherein the clamping member pivots inward upon engaging the first sloped transition section as the clamping member advances toward the lower end of the shaft; and the clamping member pivots outward upon engaging the second sloped transition section as the clamping member advances toward the upper end of the shaft.

14. A clamp assembly for securing an elongate member thereto, comprising: a clamp base having an elongate member support section extending from a clamping end to a release end of said clamp base, an elongate clamp slot formed in said clamp base, said elongate clamp slot including a clamping portion proximate to an inner end wall of said elongate clamp slot and a release portion proximate to an outer end wall of said elongate clamp slot; a clamp member carriage slidably connected to said clamp base and slidably advanceable between the clamping end and the release end of said clamp base; said clamp member carriage having first and second ends, the first end extending toward the clamping end of said clamp base and the second end extending toward the release end of the clamp base a guide rod mounted to an underside of said clamp base, said guide rod extending between a first end mounted proximate to the outer end wall of said elongate clamp slot and a second end mounted proximate to the inner end wall of said elongate clamp slot, said guide rod sloping downward from said first end thereof to said second end thereof; and a clamp member comprising a hub pivotally mounted to said guide rod and a hook extending outward therefrom, the hook extending through said elongate clamp slot, said clamp member advanceable between a clamping position and an open position upon sliding advancement of the clamp member carriage between the clamping end and the release end of said clamp base.

15. The clamp assembly as in claim 14, further comprising a linear actuator attached to the first end of the clamp member carriage, the linear actuator operable to slidably advance the clamp member carriage between the clamping end and the release end of said clamp base.

16. The clamp assembly as in claim 15, further comprising at least one compression spring acting on the second end of the clamp member carriage, the at least one compression spring normally biasing the clamp member carriage toward the clamping end of the clamp base.

17. The clamp assembly as in claim 14, wherein the hook comprises a shank projecting outward from said hub and a clamping flange projecting inward from a distal end of said shank, said clamping flange projecting over and in spaced relation to said hub to form a gap extending between said clamping flange and said hub.

18. The clamp assembly as in claim 14, wherein said hook moves downward and rotates inward upon advancement of said clamp member to the clamping position, and said hook moves upward and rotates outward upon advancement of said clamp member to the open position.

19. The clamp assembly as in claim 14, wherein said clamp member carriage has a clamp member cavity extending therein from an upper surface thereof, said clamp member positioned within the clamp member cavity.

20. The clamp assembly as in claim 14, wherein said clamp member carriage is a pair of clamp member carriages, said guide rod is a pair of guide rods, and said clamp member is a pair of clamp members; each one of the pair of clamp member carriages positioned on an opposite longitudinal side of the elongate member support section of said clamp base, each one of the pair of guide rods positioned on an opposite longitudinal side of the elongate member support section of said clamp base, and each one of the pair of clamp members positioned on an opposite longitudinal side of the elongate member support section of said clamp base.