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Wayne

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[54] **FRAME HANDLER WITH IMPROVED CARRIAGE ASSEMBLY**

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[52] **U.S. Cl.** ..... **214/91 R;** 198/177 R; 214/1 Q; 214/130 R

[51] **Int. Cl.** **B65g 47/60**

[58] **Field of Search** .. 214/91 R, 1 Q, 130 R, 147 T; 198/177 R

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Primary Examiner—Robert G. Sheridan

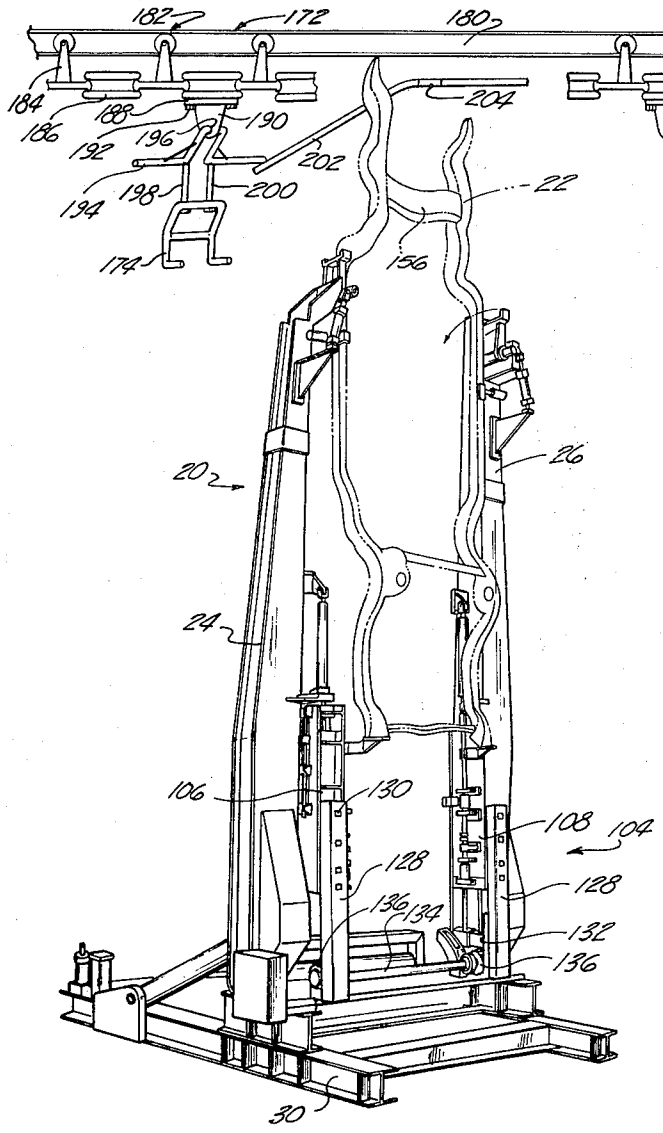
Attorney, Agent, or Firm—Gifford, Chandler & Sheridan

[57] **ABSTRACT**

A frame handler adapted to tilt vehicle frames between a horizontal to a vertical position. The frame handler generally comprises a pair of spaced and parallel arms pivotally mounted on a base around a horizontal axis. The arms are adapted to receive a vehicle frame therebetween, whereupon the vehicle frame is clamped between the arms. Hydraulic power means are then utilized to tilt the frame from a horizontal to a vertical position, or vice versa.

The above mentioned clamping means include a top guide on each arm which engages the side rails of the frame, and a bottom carriage assembly. The carriage assembly includes at least two carriage arms for each frame handler arm pivotally mounted around a vertical axis when the frame handler is in an upright position. The carriage assembly is in addition movable along a vertical axis so that when a frame is received between the arms, the carriage arms pivot into the interior of the frame and lift upward, thereby engaging a frame cross member or end of the side rail and clamping the frame between the top guides and the bottom carriage assembly.

8 Claims, 8 Drawing Figures



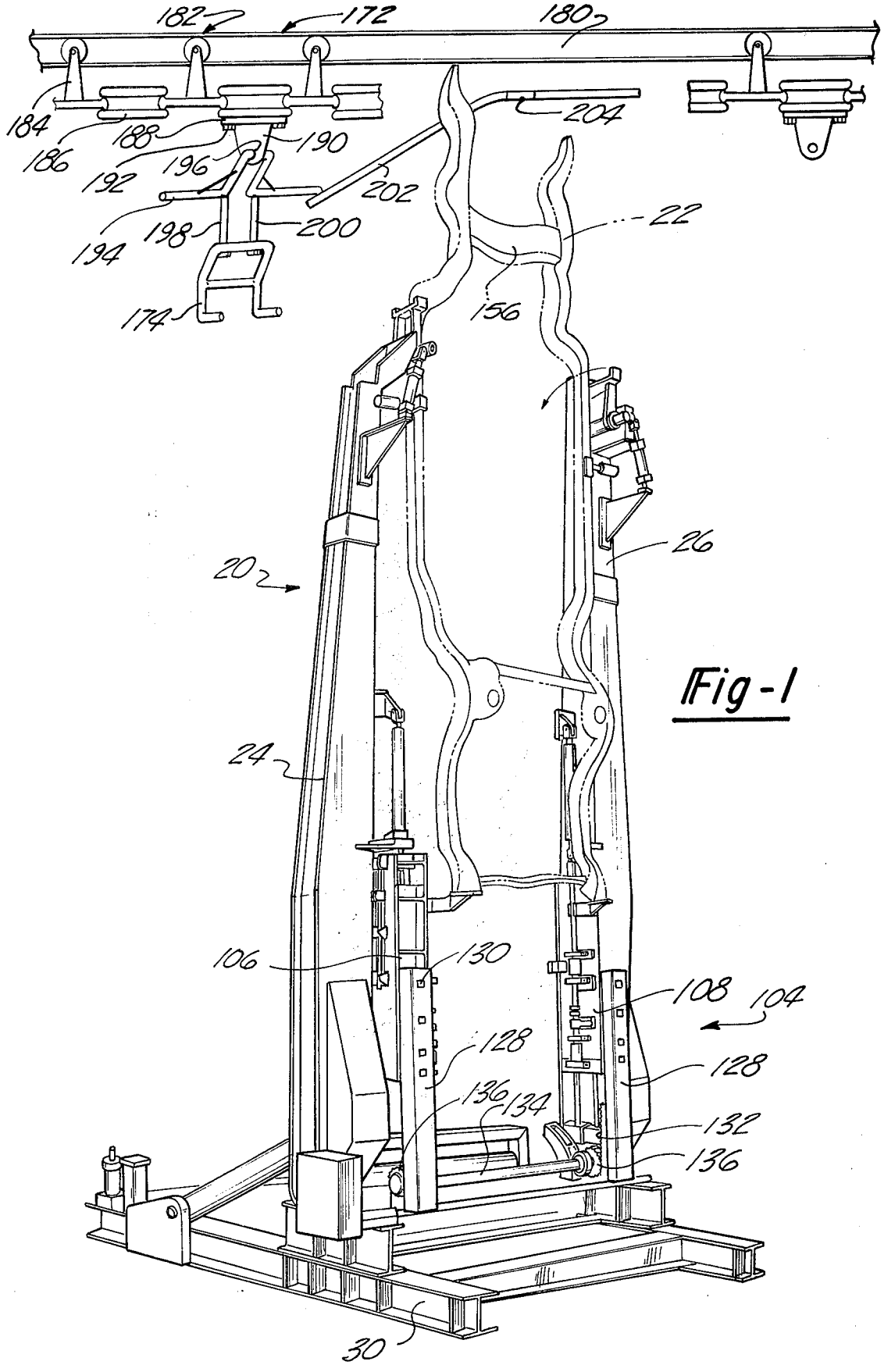

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Fig-1

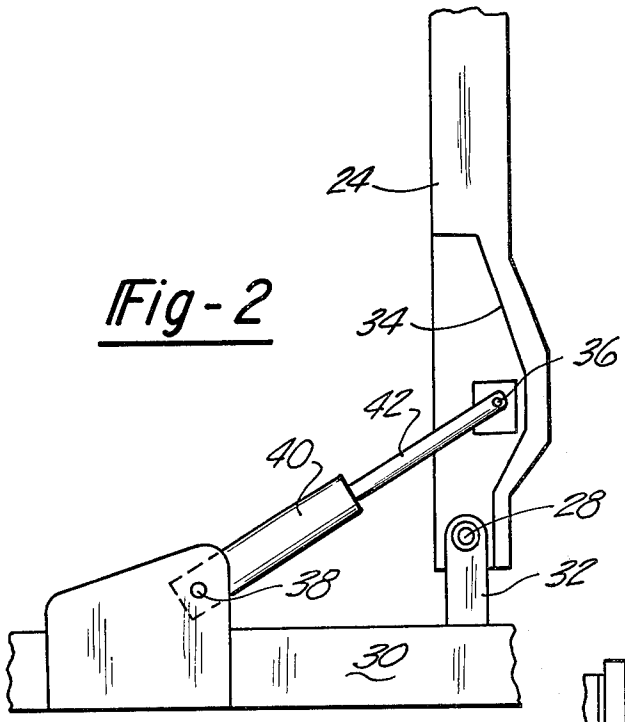


Fig-2

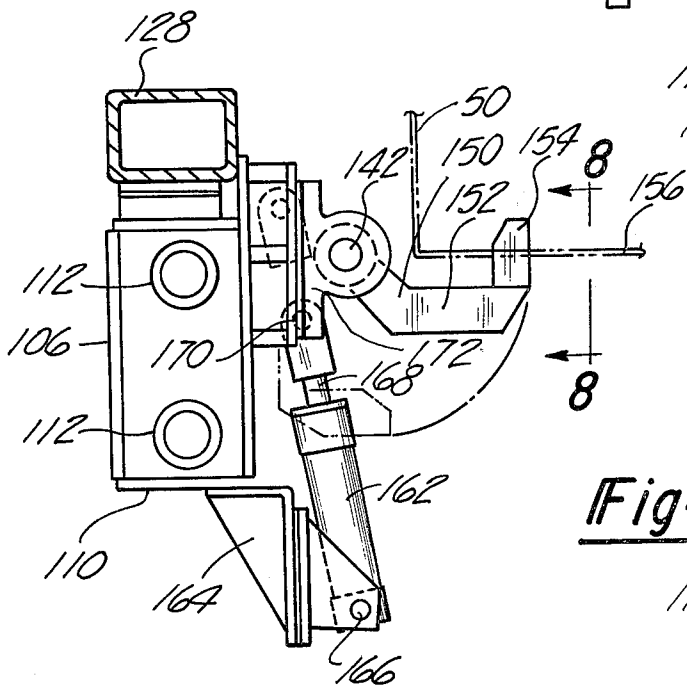


Fig-4

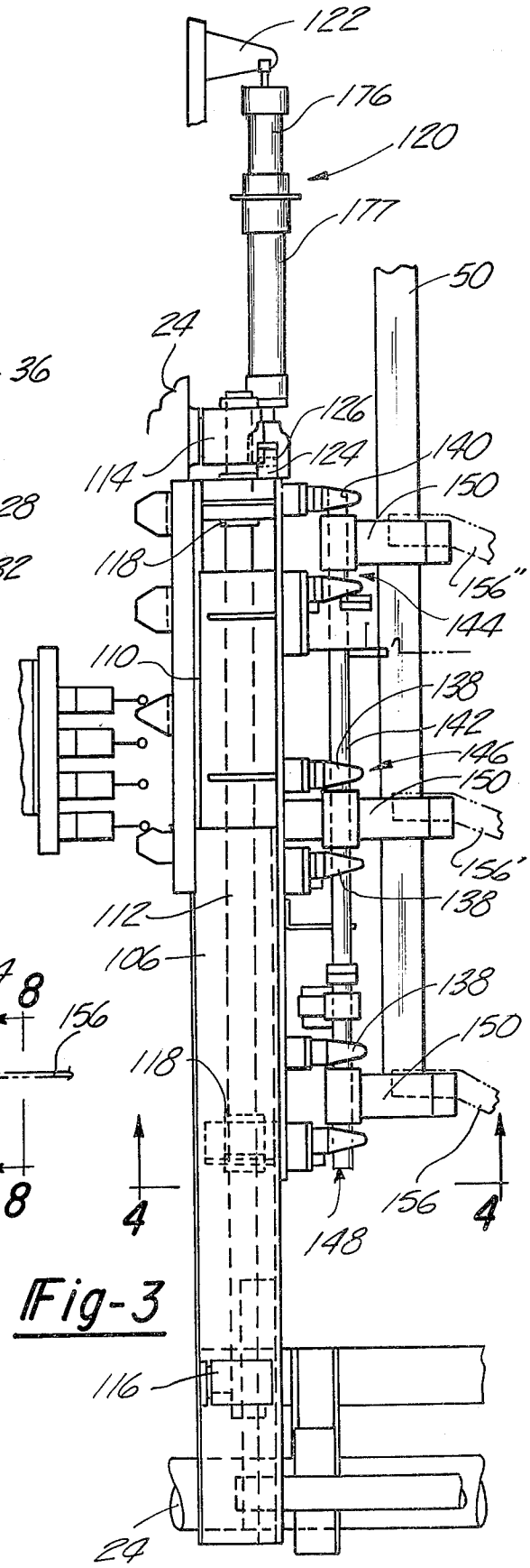


Fig-3

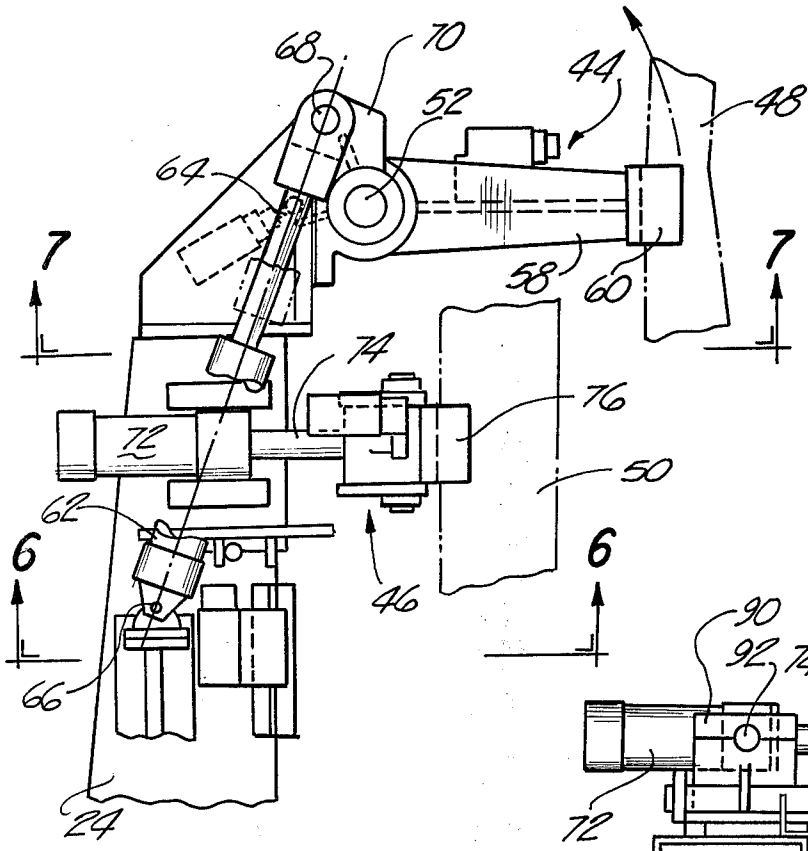


Fig-5

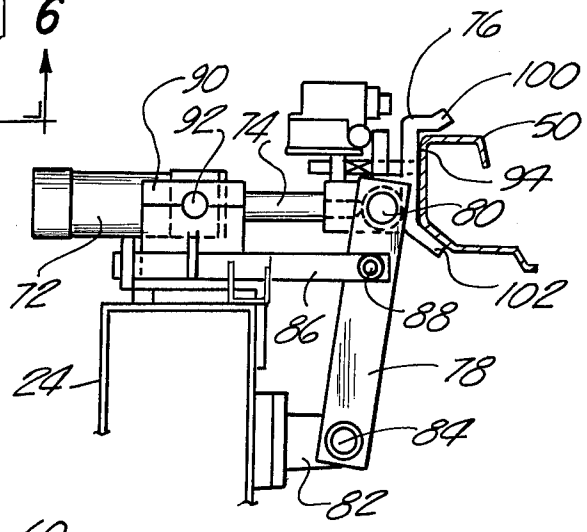


Fig-6

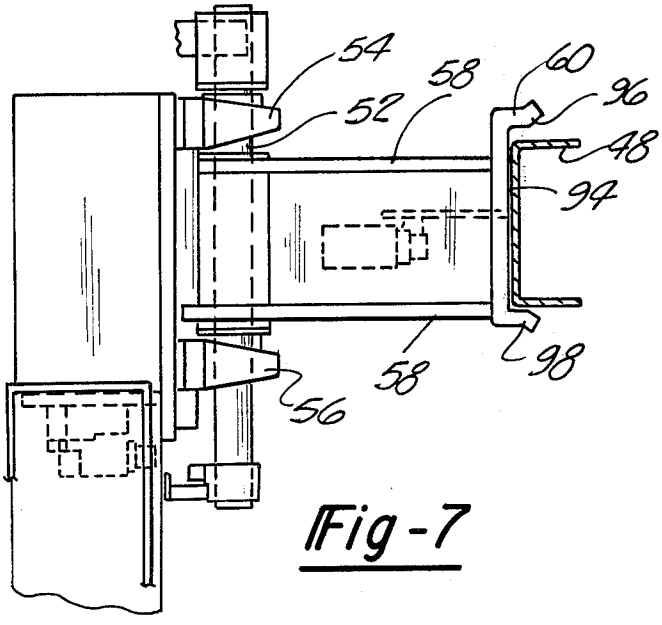


Fig-7

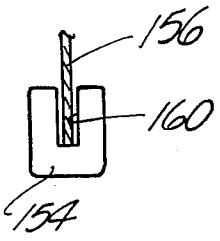


Fig-8

FRAME HANDLER WITH IMPROVED CARRIAGE ASSEMBLY

BACKGROUND OF THE INVENTION

I. Field of the Invention

The present invention generally relates to material handling devices and more particularly to a device adapted to tilt a vehicle frame between a horizontal and a vertical position.

II. Description of the Prior Art

Vehicle frame handlers, i.e. devices which raise a vehicle frame from a horizontal to a vertical position (generally known as a tip-up unit) or, conversely, devices which lower a vehicle frame from a vertical position to a horizontal position (generally known as a tip-down unit), have become quite essential in modern day assembly lines. Such devices typically place or remove vehicle frames on or from a horizontal hook conveyor suspended in an elevated position. While on the hook conveyor, the frames are typically painted, dried and then taken to a stacking apparatus to be stacked and transported to the point of use.

In previously known frame handlers, a pair of spaced and parallel arms are pivotally mounted on a base around a horizontal axis. The arms are adapted to receive a vehicle frame therebetween after which clamping means at the outer ends of the arms engage the side rails of the vehicle frame, while a carriage assembly at the other end of the arms locks the bottom end of the vehicle frame.

The previously known carriage assemblies are movable along an axis substantially parallel to the longitudinal axis of the arms and generally comprise an elongated horizontal channel extending between the arms with the open portion of the channel between the arms facing upward. The channel is adapted to receive the bottom of the vehicle frame as the carriage assembly shifts upward, thereby securing the frame between the top clamps and the channel guide. Thus, it should be apparent that in order to accommodate vehicle frames of different lengths, the carriage must axially slide different distances before the bottom of the frame is received in and, hence, secured by the channel.

Although the previously known carriage assemblies have proven adequate in the past, such carriage assemblies have proven to be inadequate for modern frame handlers due to the great differences in the length of the frames between different types of frames. Thus, in order for the previously known frame handler carriage assemblies to accommodate both long and short vehicle frames, the carriage assembly must travel the difference in length between the long and short frames, which distance is often in excess of five feet.

The problem and major disadvantage of the previously known carriage assemblies is not that the carriage assemblies are incapable of traveling the required distance between short and long frames, but rather that the cycle time for a complete tip-up or tip-down operation is greatly increased due to the travel time required by the carriage assembly. Thus, as modern day vehicle assembly plants require shorter and shorter cycle times for the frame tip-up or tip-down operation, the previously known carriage assemblies have been unable to meet the cycle time requirements, thereby slowing production lines.

SUMMARY OF THE INVENTION

The frame handler of the present invention provides a new and improved carriage assembly which overcomes the above mentioned disadvantages of the previously known frame handler carriage assemblies. Viewing the frame handler in an upright position at the beginning of a tip-down operation, the frame handler generally comprises a pair of spaced and parallel arms pivotally mounted on a base and adapted to receive a vehicle frame therebetween. Guide means are provided at the top of each arm to engage the side rails of the frame.

The improved carriage assembly, adapted to engage and secure the vehicle frame near its bottom, includes a first carriage slidably mounted along a vertical axis on one arm and a second substantially identical carriage mounted on the other arm of the frame handler. The two carriages are synchronized for vertical movement.

Each carriage includes at least two carriage arms which are pivotally mounted around a vertical axis. Thus, after a vehicle frame is received between the frame handler arms, the carriage arms swing into the interior of the frame and lift upward to engage at least one cross member of the vehicle frame. Hydraulic cylinders are then activated to pivot the frame handler arms around the base from a vertical to a horizontal position. The carriage arms are then retracted to their original position and the frame handler is returned to a vertical position in order to receive the next frame therebetween.

By providing a plurality of carriage arms vertically spaced relative to each other, it can be seen that the carriage assembly need travel along its vertical axis only a relatively short distance before one of the carriage arms engages one of the frame cross members. By reducing the length of travel for the carriage, the cycle time for the frame handler is correspondingly reduced, thereby eliminating the previously mentioned disadvantages of previously known frame handlers.

BRIEF DESCRIPTION OF THE INVENTION

The frame handler of the present invention will be more clearly understood by reference to the following detailed description of the invention when read in conjunction with the accompanying drawing, wherein like reference characters refer to like parts throughout the several views, and in which:

FIG. 1 is a perspective view of the frame handler of the present invention;

FIG. 2 is a partial cross-sectional view showing the means to tilt the frame handler between a horizontal and a vertical position, with parts removed and enlarged for clarity;

FIG. 3 is a front elevational view of a portion of the carriage of the present invention with parts removed and enlarged for clarity;

FIG. 4 is a cross-sectional view taken substantially along line 4—4 in FIG. 3 and enlarged for clarity;

FIG. 5 is an elevational view of a portion of the top clamping means of the present invention with parts removed and enlarged for clarity;

FIG. 6 is a cross-sectional view taken substantially along line 6—6 in FIG. 5; and

FIG. 7 is a cross-sectional view taken substantially along line 7—7 in FIG. 5.

FIG. 8 is a cross-sectional view taken substantially along line 8—8 in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

The frame handler of the present invention, generally indicated by the numeral 20, for ease of description will be described in an upright position, as shown in FIG. 1, unless otherwise specifically noted. In addition, the frame handler 20 will also be described in conjunction with its tip-down operation, i.e. receiving a frame 22 in a vertical position and tilting the frame 22 downward to a generally horizontal position. However, as will later be described when specifically noted, the frame handler 20 may also be used for a tip-up operation, i.e. receiving a frame in a horizontal position and raising the frame to a vertical position.

Referring particularly to FIGS. 1 and 2, the frame handler 20 generally comprises a pair of spaced and parallel vertical support arms 24 and 26 which are substantially identical. The arms 24 and 26 are pivotally mounted on a shaft 28 laterally disposed between the arms 24 and 26 so that the arms 24 and 26 may pivot in unison from a generally vertical position to a horizontal position around the shaft 28. The shaft 28 is secured to a base 30 in any conventional manner, such as by a support bar 32.

Each arm 24 or 26 includes a recess 34 along its lower portion with a transverse pivot pin 36 thereacross. A hydraulic cylinder 40 has one end rotatably mounted to the pivot pin 36 and its other end pivotally mounted around a pin 38 which is secured to the base 30 at a point radially offset from the shaft 28. Thus, as can best be seen in FIG. 2, actuation of the hydraulic cylinder 40, i.e. retraction of the piston member 42 of the hydraulic cylinder 40, will cause the arm 24 to pivot in a counterclockwise direction around the shaft 28 so that the arm 24 will assume a generally horizontal position. Conversely, extension of the hydraulic cylinder piston member 42, while the arm 24 is in a horizontal position, will cause the arm 24 to pivot in a clockwise position until the arm 24 attains a vertical position. It will be appreciated that, although the above description has referred only to the arm 24, both arms 24 and 26 are coupled together for simultaneous rotation around the shaft 28. In addition, in the preferred form, a separate hydraulic cylinder 40 is fastened to each arm 24 and 26.

An upper side guide 44 and lower side guide 46, best shown in FIGS. 5–7, are secured to the upper end of each arm 24 and 26. Since the side guides 44 and 46 on each arm 24 or 26 are substantially identical, only the side guides 44 and 46 on the arm 24 will be described in detail. The upper side guide 44 is adapted to engage the side rail 48 of a relatively narrow frame 22, whereas the lower side guide 46 is adapted to engage the side rail 50 of a frame 22 which is wider than the frame 22 engaged by the side guide 44. Thus, in the form shown in FIG. 5, the side guides 44 and 46 are capable of accommodating two different width frames 22 as will be more fully described hereinbelow. Should it be necessary to accommodate a third frame width size, a third side guide may be provided, as required, without departing from the spirit or scope of the present invention.

The upper side guide 44 generally comprises a pair of spaced and parallel ribs 58 fastened to a U-shaped guide member 60 at one end thereof and secured to a shaft 52 at the other end of the ribs 58. The shaft 52 is rotatably secured to the arm 24 by bearing supports 54 and 56 so that the side guide 44 rotates in a vertical plane. A hydraulic cylinder 62, with its associated piston 64, is secured by a pin 66 to the arm 24 at the cylinder end, while the hydraulic piston 64 is rotatably secured by a pin 68 to a plate 70 which in turn is rigidly secured to the shaft 52. The axis of the pin 68 is parallel to, but spaced from, the axis of the shaft 52 so that retraction of the hydraulic piston 64, as viewed in FIG. 5, will cause the shaft 52 with the attached side guide 44 to rotate counterclockwise until the ribs 58 of the guide assume a vertical position. Extension of the hydraulic piston 64 will, conversely, rotate the side guide 44 in a clockwise direction from a vertical position to the horizontal position shown in FIG. 5 so that the U-shaped member 60 receives the frame side rail 48 therein.

The lower side guide 46 generally comprises a hydraulic cylinder 72 with its associated piston 74 and guide member 76 fastened to the outer end of the piston 74 and adapted to receive the frame side rail 50 therein. In order to prevent the guide member 76 from rotating around the axis of the hydraulic cylinder 72, which would result in an improper engagement between the guide member 76 and the frame side rail 50, a bar 78 is pivotally mounted to the guide member 76 by a shaft 80 and its first end and pivotally mounted to a bracket 82 by a pin 84 at its opposite end. The bracket 82, in turn, is rigidly secured to the arm 24. To further aid in properly guiding the guide member 76, a second bar 86 is rotatably mounted by a pin 88 to the bar 78 at one end of the bar 86 and the opposite end of the bar 86 is received in a pair of registering slots (not shown) formed through a bracket 90 which in turn is secured to the arm 24. The hydraulic cylinder 72 is also secured to the bracket 90 by pins 92.

The lower side guide 46 performs essentially the same function as the upper side guide 44, but in a somewhat different manner. In order for the guide member 76 to engage the frame side rail 50, the hydraulic cylinder 72 is actuated, thereby extending the hydraulic piston 74 to the position shown in FIG. 6.

For a reason which will be later explained in detail, there is a small clearance space 94 between the guide member 60 or 76 and the frame side rail 48 or 50, respectively, when the guides 44 and 46 engage the frame side rail 48 or 50. The lips 96 and 98 on the guide member 60 and the lips 100 and 102 on the guide member 76, however, retain the frame side rails 48 and 50 against lateral movement with the recess of the guide members 60 and 76. It should also be understood that the shape of the recess defined by the guide members 60 and 76 corresponds to the shape of the frame side rail cross section so that the guide members 60 and 76 must be designed to accommodate different frame side rail designs.

The improved carriage assembly of the present invention, generally indicated by the numeral 104, is best shown in FIGS. 1, 3 and 4. The carriage assembly 104 comprises a left carriage 106 and a right carriage 108 which are substantially the same and, therefore, only the left carriage 106 will be described in detail. A vertically disposed elongated rectangular channel 110 forms the housing of the carriage 106. Two spaced and parallel bearings 112 extend throughout the length of the channel 110 and are secured by a bracket 114 to

the arm 24 at a short distance above the carriage 106. Similarly, the bearings 112 are secured by a second bracket 116 to the arm 24 somewhat below the carriage 106. At least one bushing 118, adapted to slide axially along the bearings 112, is secured to the carriage 106 so that the entire carriage 106 may axially slide along and be guided by the bearings 112 within the limits defined by the brackets 114 and 116. A back-to-back hydraulic cylinder pair 120, comprising an upper cylinder 176 and a lower cylinder 177, is secured at its upper end by a bracket 122 to the arm 24 and is secured at its lower end by a bracket 124 and pin 126 to the top of the carriage 106. The back-to-back cylinder 120 is utilized to effect vertical movement of the carriage 106 along the bearings 112. As should be apparent, contraction of the hydraulic cylinder 120 will lift the carriage 106, while extension of the cylinder 120 will lower the carriage 106. The purpose of utilizing a back-to-back hydraulic cylinder 120, rather than a single hydraulic cylinder, will be understood when the operation of the present invention is hereinafter described.

Although a back-to-back cylinder 120 is connected to each carriage 106 and 108, the carriages 106 and 108 are synchronized in their respective vertical movement by a rack and pinion in the following manner. An elongated rectangular channel 128 is rigidly secured by bolts 130 or the like to the lower end of each carriage 106 and 108 so that the lower end of the channel 128 extends below the carriage 106 and 108. A gear rack 132 is fastened to the lower end of each channel 128 (only one is shown) so that the gear racks 132 are spaced and parallel. A shaft 134 with an attached pinion 136 at each end thereof is horizontally disposed between the channels 128 so that the pinions 136 mesh with the gear racks 132. It can therefore be seen that a vertical movement of one carriage 106 with the attached channel 128 is synchronized with the other carriage 108 via the racks 132, pinions 136 and shaft 134. The shaft 134 is journaled by conventional bearing means (not shown) to the base 30.

Referring now particularly to FIGS. 3 and 4, a number of brackets 138 are secured to the carriage 106 along the right side of the carriage 106 as viewed in FIG. 3. Each bracket 138 includes a vertical bore 140 therethrough. The bores 140 in each bracket 138 register with each other and are adapted to receive a shaft 142 therethrough. The bores 140 are also provided with appropriate bearings (not shown) so that the shaft 142 is journaled for rotation in the brackets 138.

As shown in FIG. 3, six brackets 138 are secured to the carriage 106. The brackets 138 are preferably not equidistantly spaced along the carriage 106, but rather are grouped in three pairs of brackets 138, hereinafter referred to as the upper, middle and lower bracket pair 144, 146 and 148 respectively. Three carriage arms 150 are secured to the shaft 142 so that the arms 150 rotate with the shaft 142 in any conventional manner. Preferably, one arm is positioned between the brackets 138 of each bracket pair 144, 146 and 148.

Each arm 150 comprises a central segment 152 and an outer hook segment 154. The central segment 152 is adapted to swing over the frame side rail 50, as will be shortly explained, while the hook segment 154 engages a frame cross member 156 and thus supports the bottom of the frame 22. As shown in FIG. 8, the hook segment 154 of the arm 150 preferably includes a recess 158 to receive an edge of the cross member 156 therein. It will be appreciated, however, that the hook segment 154 of the arm 150 must be designed to accommodate the particular frame cross member 156 with which it is to be used.

The aforementioned swing of the arms 150 is effectuated by a hydraulic cylinder 162 (see FIGS. 3 and 4). The hydraulic cylinder 162 is secured at one end to a bracket 164 by a shaft 166, which bracket 164 is in turn secured to the carriage 106 by any conventional method such as welding. The piston 168 of the cylinder 162 is pivotally secured by a pin 170 to a plate 172 which is fixed to the shaft 142. The axis of the pin 170 is parallel to the axis of the shaft 142, but spaced therefrom, and the axis of the cylinder 162 is normal to the axis of the shaft 142 so that extension of the hydraulic piston 168 causes the shaft 142 with the attached arm 150 to swing clockwise (as viewed in FIG. 4) to the position shown in phantom lines. Conversely, retraction of the hydraulic piston 168 causes the middle segment 152 of the arm 150 to swing over the frame side rail 50 so that the hook segment 154 of the arm 152 engages the frame cross member 156.

Having described the component parts of my invention, the tip-down operation will now be described. As shown in FIG. 1, a hook conveyor 172 typically comprises a number of hooks 174 moving horizontally in an elevated position. The hook conveyor 172 generally comprises an I-beam 180 secured in an elevated position above the frame handler 20. A plurality of wheel pairs 182 ride along the base of the I-beam and have downwardly extending brackets 184 which are secured in any conventional manner to a chain 186. A number of plates 188, having downwardly extending brackets 190, are secured at evenly spaced intervals along the bottom of the chain 186 by any conventional means such as bolts 192. A hook 174, having a pair of laterally extending cylindrical members 194, is pivotally connected to the bracket 190 by a pin 196. Preferably, a pair of spaced supports 198 and 200 comprise the support leg of the hook 174 so that the hook 174 may pivot upward until the spaced supports 198 and 200 straddle the chain 186. A ramp 202 (only one is shown) is adapted to engage each cylindrical member 194 to effect the above mentioned pivotal movement of the hook 174. A selectively operable door 204 is provided in said track to release the cylindrical members 194 and drop the hook 174 in order to engage the frame cross member 156 when all safety conditions, and the like, have been satisfied. If all safety conditions and the like have not been met, the door 204 is not opened and the hook 174 will pass over and/or through the frame 22 without contacting the frame 22.

The hooks 174 support the frames 22 in a vertical position by typically engaging the cross member 156. As the frame 22 moves between the arms 24 and 26, limit switches, which have not been described in detail for such switches are well known in the art, are actuated which indicate both the width of the frame 22 and initiate the tip-down operation. Accordingly, either the upper side guide 44 or the lower side guide 46 is actuated to engage the frame side rails 48 or 50, respectively.

The hydraulic cylinder 162 is then actuated to swing the central segment 152 of the arms 150 over the frame side rails 50 so that at least one of the hook segments 154 of the arms 150 is underneath a frame cross mem-

ber **156.** The upper cylinder **176** of the back-to-back cylinder **120** is then actuated, thus lifting the carriage assembly **104** upward so that the bottom frame cross member **156** is received in the recess **160** of the hook segment **154** of the arm **150.** In the operation as thus far described, the frame **22** is firmly secured in the frame handler **20** between the side guide **44** or **46** and the arms **150.**

The lower cylinder **177** of the back-to-back cylinder **120** is then actuated, thereby again lifting the carriage assembly **104.** The arms **150** will thus push the frame **22** upward through the sliding engagement of the side guides **44** or **46** to lift the frame **22** off the hook **174** so that the frame **22** may be lowered. Hydraulic cylinders **40** are then actuated to lower the arms **24** and **26** of the frame handler **20** to a generally horizontal position. The arms **150** and the guides **44** or **46** are then retracted to free the frame **22.** A conveyor (not shown) typically moves the lowered frame **22** away from the unloading station and the frame handler **20** is returned to a vertical position to receive the next frame **22** for lowering.

The tip-up operation is essentially the reverse of the above described tip-down operation. The frame **22** is received typically from a conveyor (not shown) in a horizontal position between the arms **24** and **26.** The side guides **44** or **46** and the arms **150** are actuated to lock the frame **22** between the arms **24** and **26** of the frame handler as hereinbefore described. Hydraulic cylinders **40** are actuated to lift the arms **24** and **26** to a vertical position. When a hook **174** is properly positioned under the top cross member **156** of the frame, the carriage assembly **104** is lowered by the back-to-back hydraulic cylinder **120** to drop the frame **22** onto the hook **174.** The side guides **44** or **46** and the arms **150** are then retracted to free the frame **22** and the frame handler **20** is lowered to a horizontal position to receive the next frame **22** for lifting.

The advantages achieved by the present invention over previously known frame handlers can best be understood by reference to FIG. **3.** The carriage **106** is shown engaging three different frame lengths designated as having bottom cross members **156, 156'** and **156''.** It must be realized, however, that the carriage **106** engages only a single frame cross member **156,** 156' or **156''** at any given time and that the three separate frame lengths are shown for illustration and explanation only.

The top arm **150** engages cross member **156''** which corresponds to a relatively short frame **22,** the middle arm **150** engages cross member **156'** and the bottom arm **150** engages cross member **156** which correspond to relatively longer frames. Thus, because the carriage arms **150** are spaced along the carriages **106** and **108,** only a vertical movement (typically four inches) of the carriage **106** is required to accommodate a variance in frame length between cross members **156** and **156'',** which typically exceeds five feet. By reducing the length of the travel of the carriages **106** and **108,** the cycle time for the tip-up or tip-down operation is significantly reduced, thereby enabling the frame handler **20** to meet the short cycle time requirements of modern day assembly plants.

Having described my invention, many modifications and alterations will be apparent to those skilled in the art to which the present invention pertains without departing from the spirit of the invention as defined by the scope of the appended claims.

What is claimed is:

1. A frame handler adapted to move a vehicle frame between a horizontal and a vertical position, said frame having at least two side rails and at least one cross member, said frame handler comprising:

a base;

a pair of spaced and parallel arms pivotally mounted around a horizontal axis to said base;

means to move said arms between a substantially horizontal and a substantially vertical position;

side guide means secured to said arms near the upper end of each of said arms when said arms are in a vertical position, said side guide means adapted to engage the side rails of said frame in a sliding engagement therewith; and

a carriage assembly comprising:

a first and a second carriage respectively secured to each of said arms at a position spaced from said guide means along said arms, wherein said carriages are slidably mounted towards said guide means;

means to move said carriages along said frame handler arms;

at least two carriage arms secured to each of said carriages, said carriage arms being rotatably mounted around a vertical axis when said frame handler arms are in a vertical position, wherein said carriage arms are adapted to swing into the interior of said frame to engage at least one of said cross members of said frames; and means to rotate said arms.

2. The invention as defined in claim **1** and including means to synchronize said vertical movement of said carriage.

3. The invention as defined in claim **2** wherein said last mentioned means comprises a shaft rotatably mounted to said base between and generally perpendicular to said frame handler arms, a pinion fixed to each end of said last mentioned shaft and a rack secured to each carriage, wherein each of said racks meshes with one of said pinions.

4. The invention as defined in claim **1** in which said first mentioned means comprises at least one hydraulic cylinder secured at one end to said base and secured at its second end to one of said frame handler arms, wherein the longitudinal axis of said hydraulic cylinder is substantially perpendicular to the pivotal axis of said frame handler arms.

5. The invention as defined in claim **1** in which said side guide means comprises at least two side guide members on each of said frame handler arms and means to extend said side guide members towards the corresponding guide members on the opposing frame handler arm.

6. The invention as defined in claim **5** wherein the distance between corresponding side guide members when fully extended towards each other is less for one pair of corresponding side guide members than for the second corresponding pair of side guide members when said second corresponding pair of side guide members are fully extended.

7. The invention as defined in claim **1** and including a hook conveyor, said hook conveyor having a plurality of spaced and downwardly extending hooks, wherein each of said hooks is adapted to support one of said

frames by one of said frame cross members, and means to pivot said hook to a horizontal position and release said hook to a downwardly extending vertical position, when desired, to engage said frame cross member.

8. The invention as defined in claim **7** wherein said hook includes at least one laterally extending member and wherein said last mentioned means comprises a ramp adapted to receive said laterally extending member to raise said hook to said horizontal position, and a selectively operable door in said track adapted to drop said hook to said downwardly extending vertical position when said door is open.

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