US 20030196565A1

(19) **United States**

(12) **Patent Application Publication**

Decker et al.

(10) **Pub. No.: US 2003/0196565 A1**

(43) **Pub. Date: Oct. 23, 2003**

(54) **RAIL PULLER INCLUDING A CLAMPING BEAM AND TWO CLAMPING MEMBERS AND A METHOD THEREOF**

(75) Inventors: **Arnold F. Decker**, Aurora, IL (US); **Steven A. Held**, Hillside, IL (US)

Correspondence Address:
MICHAEL BEST & FRIEDRICH, LLP
100 E WISCONSIN AVENUE
MILWAUKEE, WI 53202 (US)

(73) Assignee: **Templeton, Kenly & Co., Inc.**, Broadview, IL

(21) Appl. No.: **10/127,385**

(22) Filed: **Apr. 22, 2002**

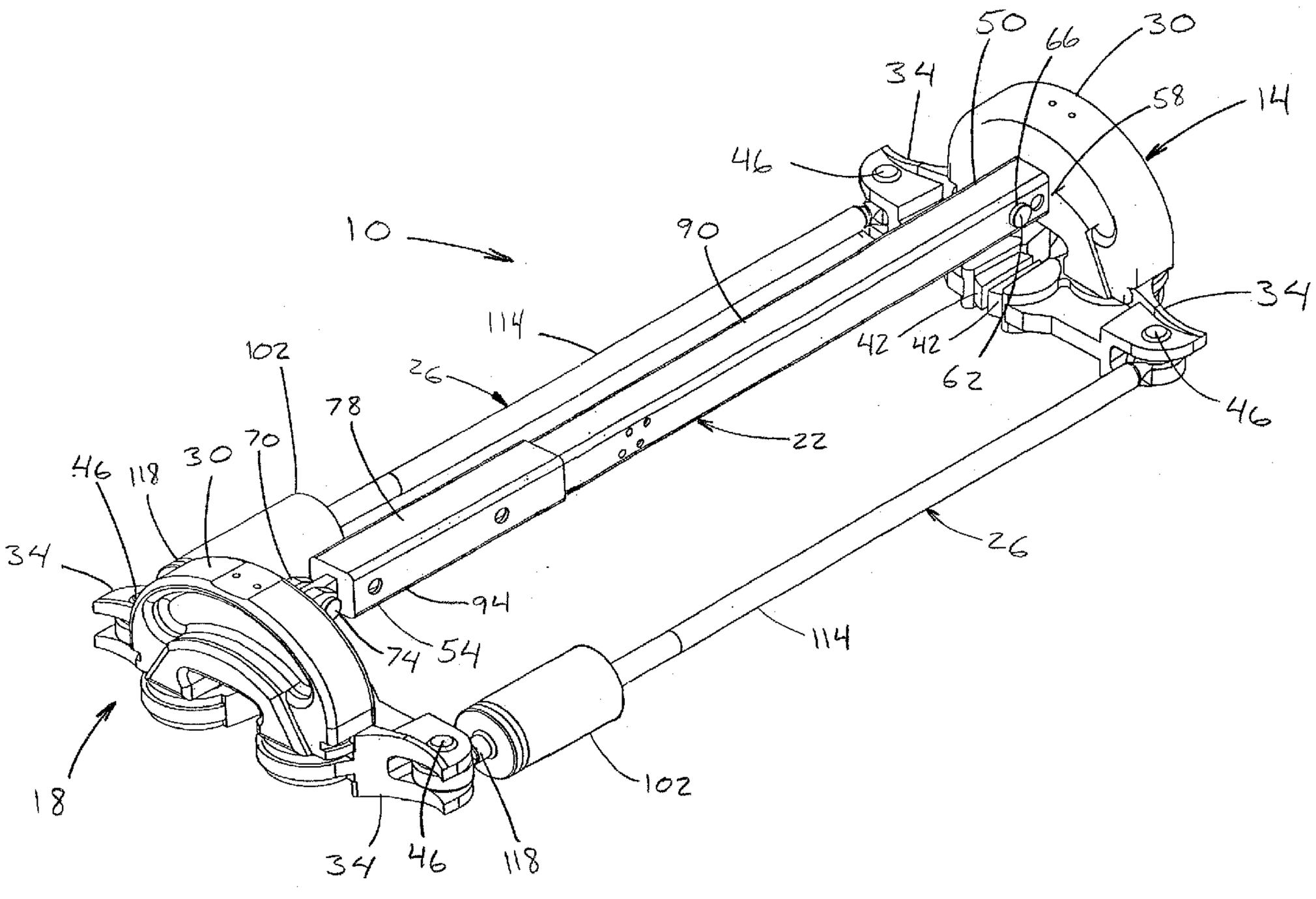
Publication Classification

(51) **Int. Cl.**[7] **E01B 27/17**

(52) **U.S. Cl.** **104/7.2**

(57) **ABSTRACT**

A rail puller that applies tension to rail sections to reduce the gap between the ends of rail sections. The rail puller comprises a first clamp assembly and a second clamp assembly located at opposite ends of the rail puller. A clamping beam is coupled to the first clamp assembly and the second clamp assembly, and has a clamping cylinder that extends and retracts to adjust the length of the clamping beam. At least two pulling members are coupled to the first clamp assembly and the second clamp assembly, and each pulling member has a pulling cylinder that extends and retracts to adjust the length of the pulling member. The clamping cylinder extends to clamp the clamp assemblies to rail sections, and the pulling cylinders retract to draw the clamp assemblies toward one another and reduce the gap between the rail sections.



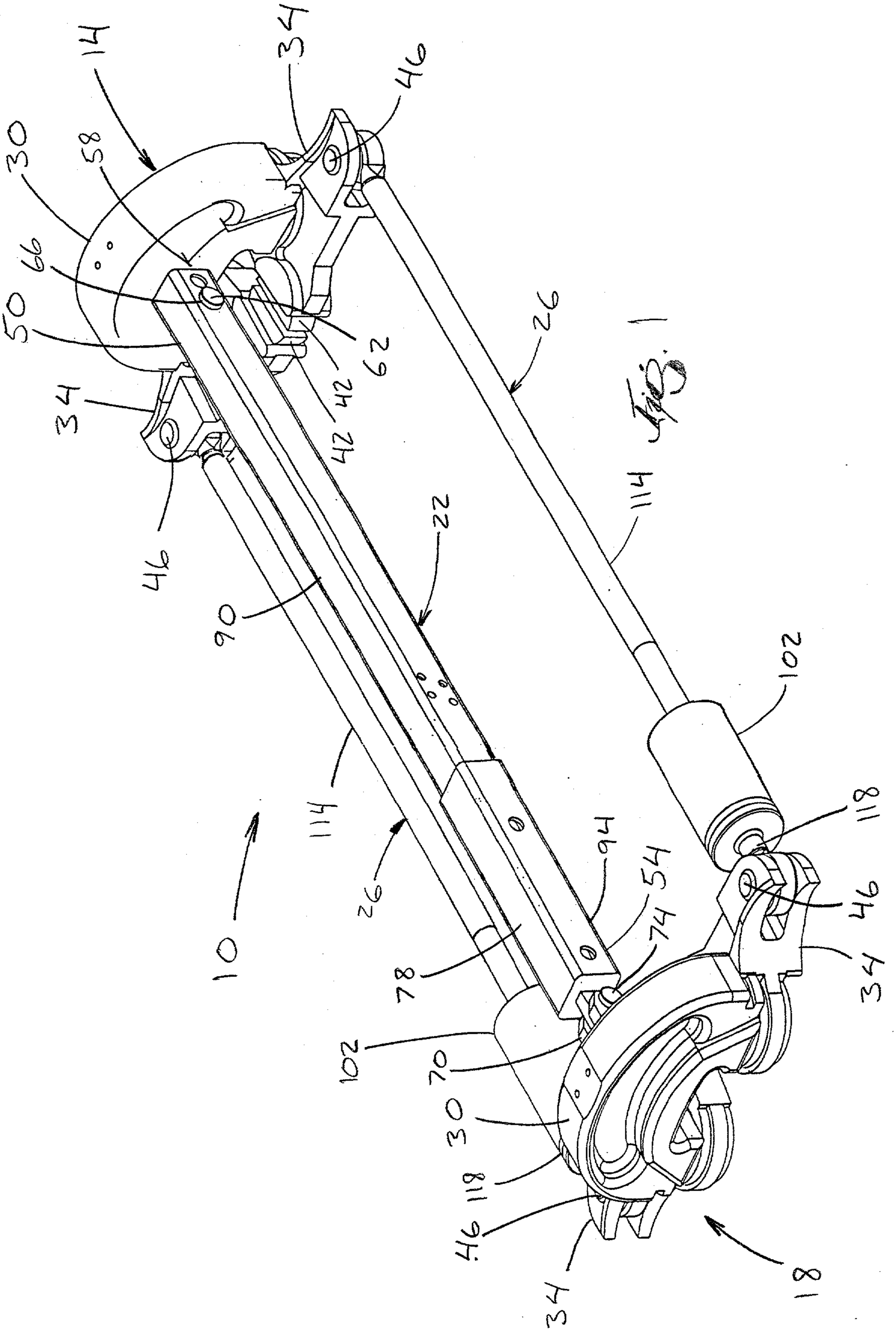
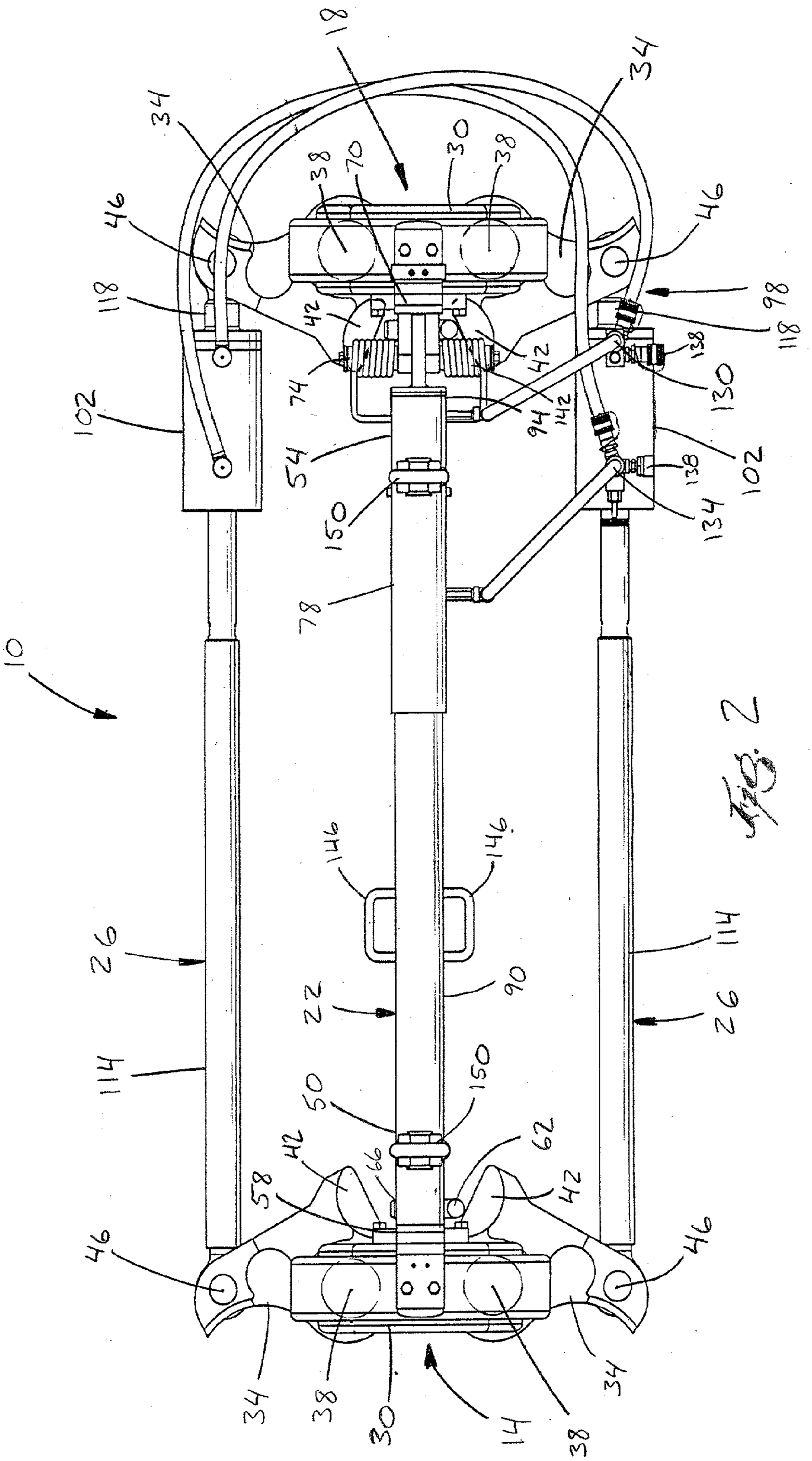

14
34
46
30
58
66
50
62
42
42
34
46
90
22
26
114
102
114
26
10
78
94
74
54
118
46
34
30
118
46
34
18

Fig. 1


18
34
34
46
46
38
70
30
38
118
98
118
42
42
74
42
138
130
94
142
102
54
138
102
150
134
78
10
146
146
26
114
22
90
50
150
62
42
66
58
42
46
46
34
38
30
14
38
34
26
114
Fig. 2

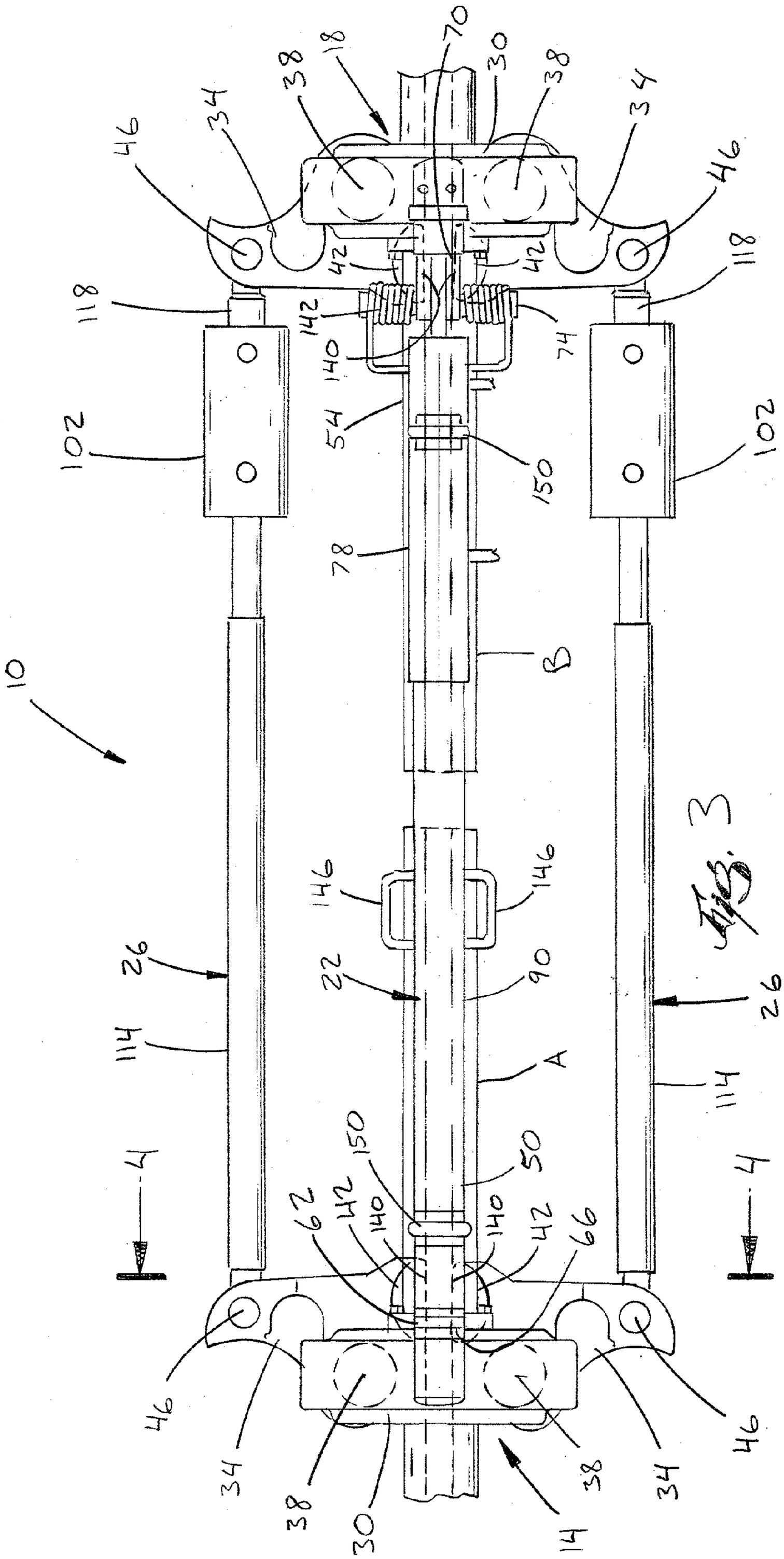

18
70
30
38
38
34
34
46
46
118
118
42
42
142
140
74
54
150
102
102
78
B
10
146
146
22
90
26
26
114
114
A
4
4
62
42
140
150
50
140
42
66
46
46
34
34
38
38
30
14

Fig. 3

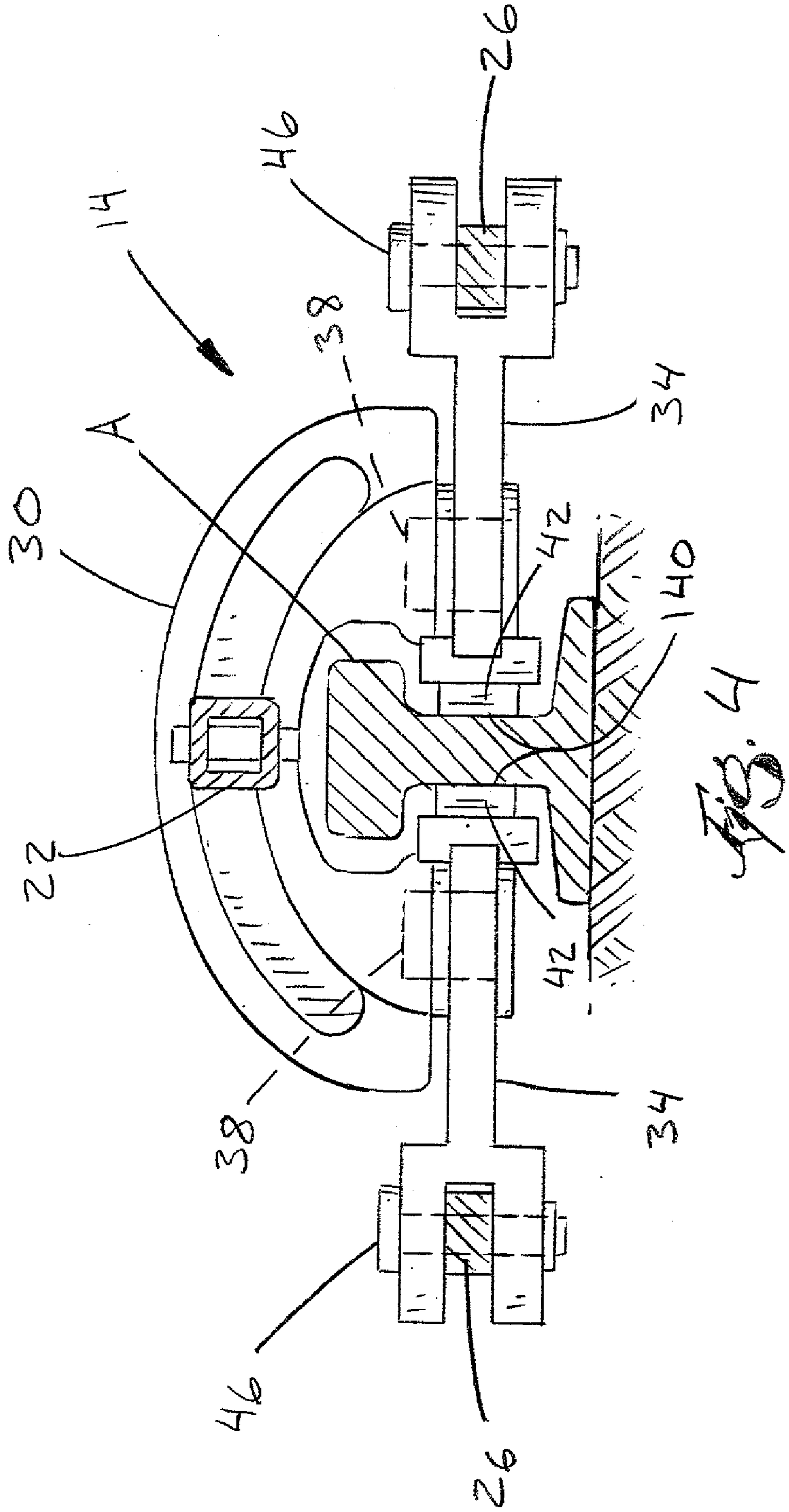


Fig. 4

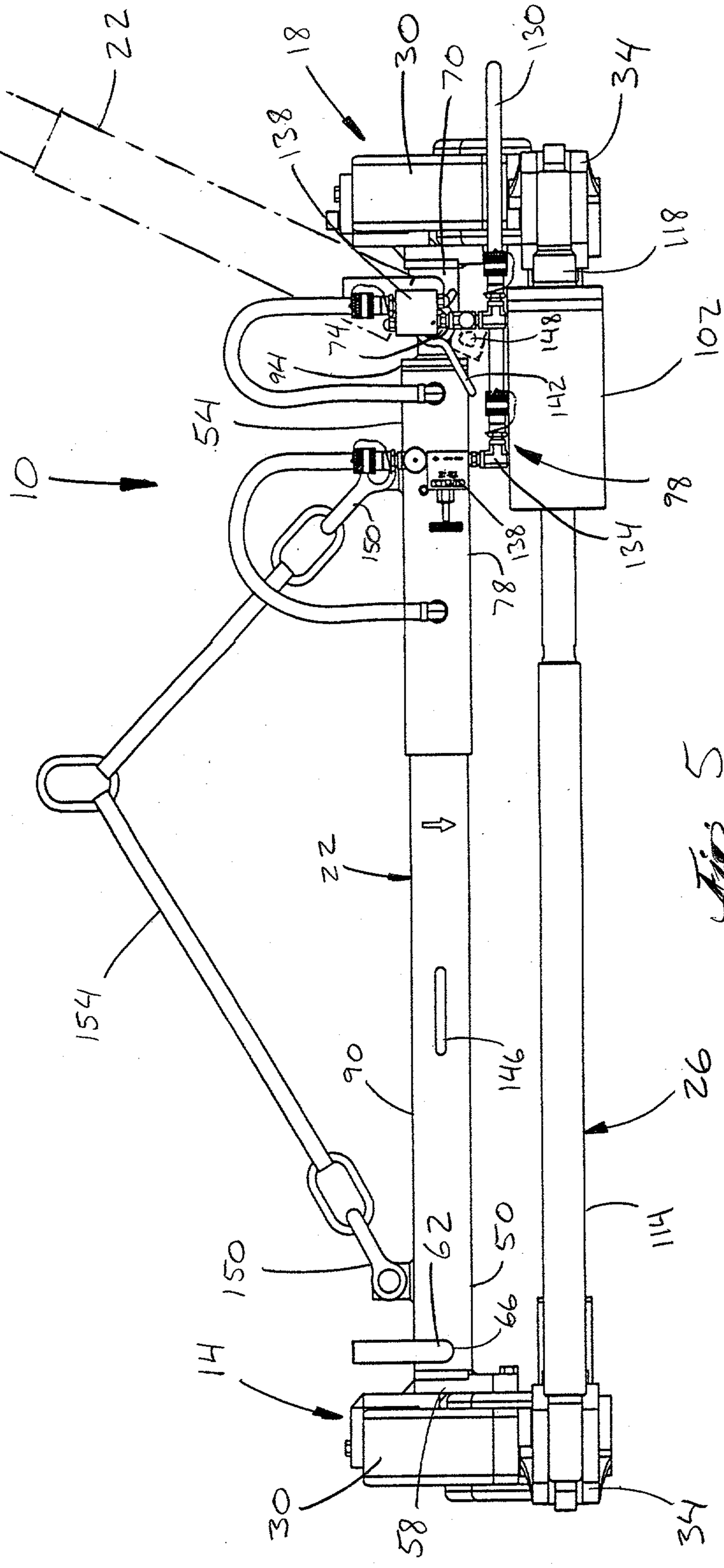

22
18
30
70
130
34
138
118
102
148
144
94
54
10
98
150
134
138
78
154
90
146
26
150
62
50
114
66
14
30
58
34

Fig. 5

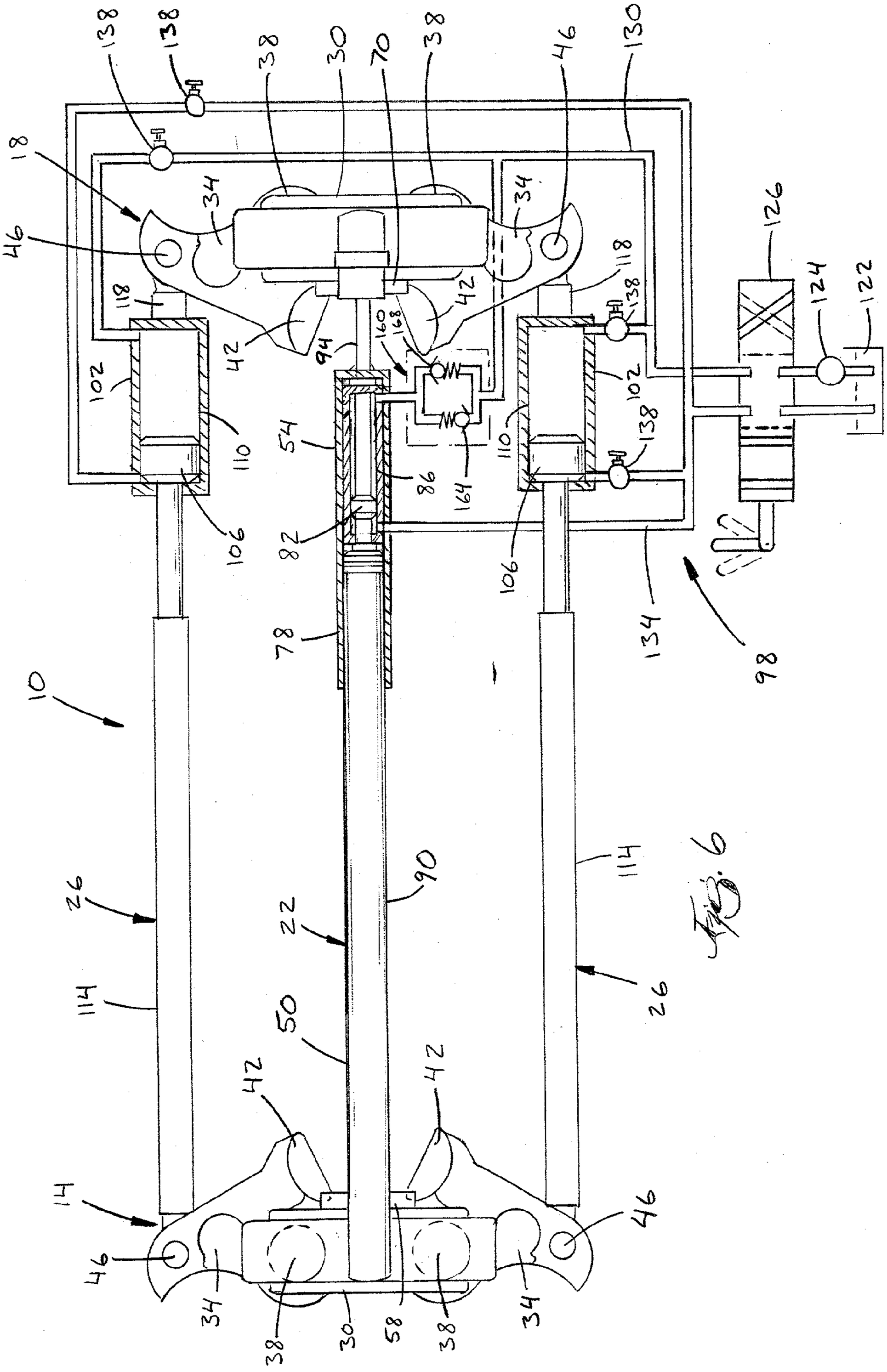

138
138
38
30
70
38
46
130
18
34
34
46
126
124
122
118
138
42
42
94
160
168
811
201
102
110
110
54
138
86
164
106
82
106
78
134
98
10
26
114
22
50
90
42
42
26
114
14
46
46
34
38
30
58
38
34

Fig. 6

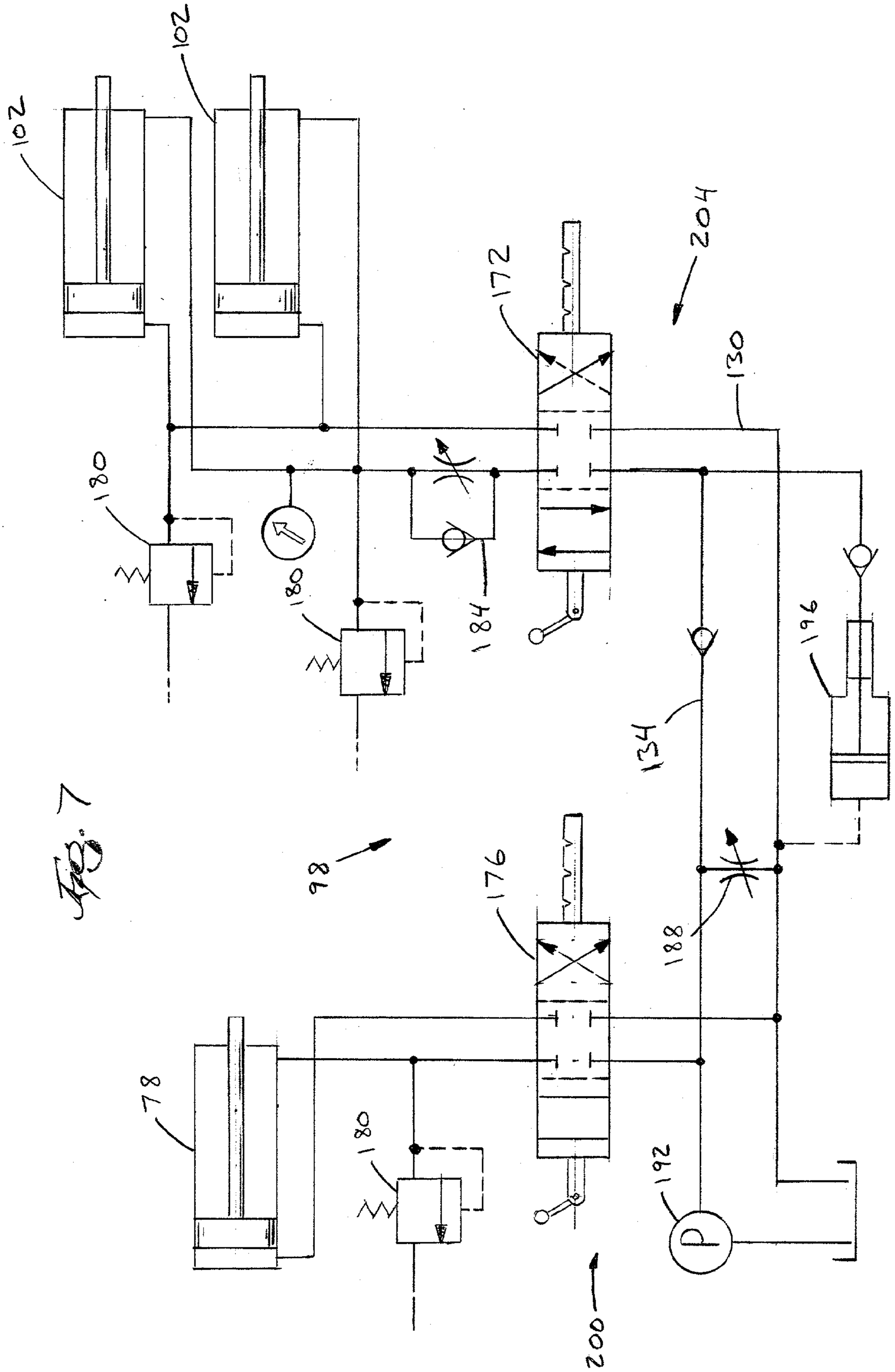

102
102
172
204
130
180
180
184
134
196
98
176
188
178
180
192
200

Fig. 7

RAIL PULLER INCLUDING A CLAMPING BEAM AND TWO CLAMPING MEMBERS AND A METHOD THEREOF

FIELD OF THE INVENTION

[0001] This invention relates to rail pullers, and more particularly to hydraulic clamping rail pullers used to tension rails.

BACKGROUND OF THE INVENTION

[0002] Rail pullers are commonly used in railways to pull the ends of rail sections together. Rail sections are relatively long, and may be as long as one quarter mile. The rail sections are usually aligned linearly with a gap between the ends of the rail sections. The gap between the rail sections may be approximately 6 inches. The rail puller puts the rail sections in tension to reduce the gap between the rail sections. Once the rail sections are pulled together, the ends of the rail sections are welded together to form a continuous track.

[0003] Rail sections are relatively heavy, and the force required to pull rail sections together and reduce the gap between the rail section is relatively large. Some prior art rail pullers use rams or hydraulic cylinders to pull the rail sections together. The hydraulic cylinders needed to generate the relatively large force required to pull the rail sections together are relatively heavy and expensive. Two characteristics of hydraulic cylinders are the travel distance and the pull capacity of the cylinder. The travel distance is dependent upon the length of the cylinder, and determines the distance between the fully retracted cylinder to the fully extended cylinder. The pull capacity is related to the cross-sectional area of the cylinder, and determines the amount of force the cylinder can generate.

[0004] Rail pullers generally clamp the rail sections, and then pull the rail sections together. The force required to clamp the rail sections is significantly less than the force required to pull the rail sections together. In some prior art rail pullers, the same hydraulic cylinders are used to both clamp the rail sections and pull the rail sections together.

SUMMARY OF THE INVENTION

[0005] The rail puller embodying the invention applies tension to rail sections to reduce the gap between the ends of rail sections. The rail puller comprises a first clamp assembly at one end of the rail puller, and a second clamp assembly at the opposite end of the rail puller. An elongated clamping beam is coupled to the first clamp assembly and the second clamp assembly, and includes a clamping cylinder that is extendable and retractable to adjust the length of the clamping beam. Elongated pulling members are coupled to the first clamp assembly and the second clamp assembly, and each pulling member has a pulling cylinder that is extendable and retractable to adjust the length of the pulling member. The clamping cylinder extends to position and clamp the first clamp assembly and second clamp assembly to rail sections, and the pulling cylinders retract to draw the first clamp assembly and second clamp assembly toward one another and reduce the gap between the rail sections.

[0006] The rail puller minimizes the travel distance of hydraulic cylinders used to pull the rail sections together. The clamping cylinder extends to lengthen the clamping beam and clamp the clamp assemblies onto the rail sections. Once the rail sections have been clamped, the pulling cylinders retract to pull the rail sections together. The travel distance of the pulling cylinders is reduced because the clamping cylinder is used to clamp the rail sections. Since the travel distance of the pulling cylinders is reduced, the weight and cost of the pulling cylinders is also reduced.

[0007] The force required to position the clamp assemblies clamp the rail sections is significantly less than the force required to pull the rail sections together, and the pulling capacity of the clamping cylinder can be substantially less than the pulling capacity of the pulling cylinders. Additionally, a single clamping cylinder can be used to clamp the rail sections. Since the pulling capacity of the clamping cylinder can be less than the required pulling capacity of the pulling cylinders, the overall weight and cost of the rail puller can be minimized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIG. 1** is a perspective view of a rail puller embodying the invention.

[0009] **FIG. 2** is a plan view of the rail puller of **FIG. 1** in an open condition.

[0010] **FIG. 3** is a plan view of the rail puller of **FIG. 1** in a closed condition.

[0011] **FIG. 4** is a cross-sectional view taken along line **4-4** of **FIG. 3**.

[0012] **FIG. 5** is an elevation view of the rail puller of **FIG. 1**.

[0013] **FIG. 6** is a plan view of the rail puller of **FIG. 1**, including a schematic of a hydraulic circuit.

[0014] **FIG. 7** is a schematic of a hydraulic circuit for the rail puller of **FIG. 1**.

[0015] Before the embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[0016] Although references are made below to directions, such as left, right, up, down, top, bottom, front, rear, back etc., in describing the drawings, they are made relative to the drawings (as normally viewed) for convenience. These directions are not intended to be taken literally or limit the present invention in any form.

DETAILED DESCRIPTION

[0017] **FIG. 1** illustrates a rail puller **10** for tensioning rails and reducing the gap between the ends of rail sections. The rail puller **10** generally has a longitudinal direction along its length and a lateral direction across its width. The rail puller **10** comprises a first clamp assembly **14** and a second clamp assembly **18** disposed at opposite ends of the rail puller **10**. A clamping beam **22** and at least two pulling

members **26** are coupled to the first and second clamp assemblies **14, 18**. The clamping beam **22** extends longitudinally between the clamp assemblies **14, 18** near the middle of the rail puller **10**, and the pulling members **26** extend longitudinally between the clamp assemblies **14, 18** along the sides of the rail puller **10** parallel and spaced apart from each other and from the clamping beam **22**.

[**0018**] In the illustrated embodiment, the clamp assemblies **14, 18** are similar to each other, and each clamp assembly **14, 18** includes a clamp bracket **30** and two swing arms **34**. The swing arms **34** are pivotally coupled to the clamp bracket **30** at inner joints **38**. Each swing arm **34** has a grip **42** disposed longitudinally inwardly from the inner joint **38** near the inner side of the clamp assembly **14, 18** facing the opposing clamp assembly **14, 18**. The grips **42** are pivotally coupled to the swing arms **34**.

[**0019**] The clamping beam **22** is coupled to the clamp assemblies **14, 18** near the middle of the clamp brackets **30**. The clamp brackets **30** generally extend in a lateral direction and are substantially transverse to the clamping beam **22**. As shown in **FIG. 4**, the clamp brackets **30** are curved and generally C-shaped with the curved opening near the bottom portion of the clamp bracket **30** to provide clearance for a rail section A. The inner joints **38** coupling the clamp bracket **30** and the swing arms **34** are near the ends of the clamp bracket **30**.

[**0020**] In **FIG. 1**, the pulling members **26** are coupled to the clamp assemblies **14, 18** near the outer ends of the swing arms **34**. The pulling members **26** are pivotally coupled to the swing arms **34** at outer joints **46**, which are disposed laterally outwardly from the inner joints **38**. The swing arms **34** are generally triangular, with the inner joints **38**, outer joints **46** and grips **42** as the corners of the triangle. Movement of the inner joints **38** or outer joints **46** causes the swing arms **34** to pivot and move the grips **42** toward or away from the rail.

[**0021**] The clamping beam **22** extends between the first clamp assembly **14** and the second clamp assembly **18**. In the illustrated embodiment, the clamping beam **22** has a detachable end **50** that is removably coupled to the first clamp assembly **14**, and a pivot end **54** that is pivotally coupled to the second clamp assembly **18**. The detachable end **50** is removably coupled to a mounting bracket **58** on the first clamp assembly **14** with a lock pin **62**. The detachable end **50** and the mounting bracket **58** have lock holes **66**, and the lock pin **62** is inserted through the lock holes **66** to couple the clamping beam **22** to the first clamp assembly **14**. The lock pin **62** is removed from the lock holes **66** to disconnect the clamping beam **22** from the first clamp assembly **14**.

[**0022**] The pivot end **54** is pivotally coupled with a pivot pin **74** to a mounting bracket **70** on the second clamp assembly **18**. When the detachable end **50** is disconnected from the first clamp assembly **14**, the clamping beam **22** may be pivoted upwardly about the pivot pin **72**. The clamping beam **22** may then be pivoted downwardly and the detachable end **50** reconnected to the first clamp assembly **14**. As described below, the clamping beam **22** is pivoted to provide access to the rail sections and clearance within the rail puller **10**. Alternatively, the detachable end **50** and pivot end **54** of the clamping beam **22** could be reversed with the detachable end **50** removably coupled to the second clamp assembly **18** and the pivot end **54** coupled to the first clamp assembly **14**. Additionally, the clamping beam **22** could be rigidly attached to the first clamp assembly **14** and second clamp assembly **18** to prevent the clamping beam **22** from pivoting.

[**0023**] The clamping beam **22** includes a clamping cylinder **78** that adjusts the length of the clamping beam **22**. The clamping cylinder **78** extends to increase the length of the clamping beam **22**, or retracts to decrease the length of the clamping beam **22**. As shown in **FIG. 6**, the clamping cylinder **78** is a hydraulic cylinder and includes a piston **82** and a housing **86**. A first portion **90** of the clamping beam **22** is interconnected to the piston **82** and a second portion **94** of the clamping beam **22** is interconnected to the housing **86**. In **FIG. 6**, the detachable end **50** is interconnected to the first portion **90** and the piston **82**, and the pivot end **54** is interconnected to the second portion **94** and the housing **86**.

[**0024**] The piston **82** creates a seal with the housing **86**, and a hydraulic circuit **98** provides hydraulic fluid to the clamping cylinder **78** to move the piston **82** in an extend direction or a retract direction with respect to the housing **86** to lengthen or shorten the clamping beam **22**. The length of the clamping beam **22** determines the distance between the clamp brackets **30**. Shortening the clamping beam **22** decreases the distance between the clamp brackets **30**, and lengthening the clamping beam **22** increases the distance between the clamp brackets **30**. As mentioned above, the swing arms **34** are coupled to the clamp brackets **30** at the inner joints **38**.

[**0025**] In the illustrated embodiment, the pulling members **26** are similar to each other, and each pulling member **26** has a pulling cylinder **102** that adjusts the length of the pulling member **26**. The pulling cylinders **102** extend to increase the length of the pulling members **26**, or retract to decrease the length of the pulling members **26**. As shown in **FIG. 6**, the pulling cylinders **102** are hydraulic cylinders, and each pulling cylinder **102** includes a piston **106** and a housing **110**. A first portion **114** of the pulling member **26** is interconnected to the piston **106** and a second portion **118** of the pulling member **26** is interconnected to the housing **110**. In the illustrated embodiment, the first portions **114** are interconnected to one of the swing arms **34** of the first clamp assembly **14**, and the second portions **118** are interconnected to one of the swing arms **34** of the second clamp assembly **18**.

[**0026**] The pistons **106** create a seal with the housings **110**, and the hydraulic circuit **98** provides hydraulic fluid to the pulling cylinders **102** to move the pistons **106** in an extend direction or a retract direction with respect to the housings **110** to lengthen or shorten the pulling members **26**. The length of the pulling members **26** determines the distance between the outer joints **46** of the first clamp assembly **14** and the outer joints **46** of the second clamp assembly **18**. Shortening the pulling members **26** decreases the distance between the outer joints **46**, and lengthening the pulling members **26** increases the distance between the outer joints **46**. As described below, when the clamp assemblies **14, 18** engage the rail sections, retracting the pulling cylinders **102** and shortening the pulling members **26** draws the clamp assemblies **14, 18** closer to one another and reduces the gap between rail sections. The pulling cylinders **102** usually operate together in unison.

[**0027**] As shown in **FIG. 6**, the hydraulic circuit **98** directs hydraulic fluid to extend or retract the clamping cylinder **78**

and the pulling cylinders **102**. In the illustrated embodiment, the hydraulic circuit **90** includes a power source **122**, a pump **124**, a controller **126**, an advance circuit **130**, and a retract circuit **134**. The power source **122** is a reservoir that provides hydraulic fluid for the hydraulic circuit **90**. The pump generates fluid flow through the hydraulic circuit **98**. The controller **126** is a valve that controls the flow of hydraulic fluid from the power source **122** to the advance circuit **130** or retract circuit **134**. The controller **126** generally has three settings: an extend or advance setting, a retract or pull setting, and a neutral setting. The advance circuit **130** extends or advances the clamping cylinder **78** and pulling cylinders **102** to lengthen the clamping beam **22** and pulling members **26** respectively. The retract circuit **134** retracts or pulls the clamping cylinder **78** and pulling cylinders **102** to shorten the clamping beam **22** and pulling members **26** respectively. The hydraulic circuit **98** also includes at least one shut-off valve **138** to control the flow of hydraulic fluid to the clamping cylinder **78** and the pulling cylinders **102**.

[**0028**] In the illustrated embodiment, the clamping cylinder **78** and pulling cylinders **102** are hydraulic cylinders, and the hydraulic circuit **98** is used to control the rail puller **10**. Alternatively, a pneumatic system, or other similar actuating devices could be used to actuate the clamping beam **22** and pulling members **26** to reduce the gap between rail sections.

[**0029**] The rail puller **10** reduces the gap between the ends of rail sections. In order to reduce the gap, the clamp assemblies **14**, **18** clamp the rail sections, and the clamp assemblies **14**, **18** are then drawn closer together to pull the rail sections closer together. Generally, the clamping beam **22** is used to clamp the clamp assemblies **14**, **18** onto the rail sections, and the pulling members **26** are used to pull the clamp assemblies **14**, **18** and rail sections together.

[**0030**] Some prior art rail pullers have a single set of pulling cylinders that clamp the rail sections, as well as draw the rail sections together. Two important features of hydraulic cylinders are the pulling capacity and the travel distance of the cylinder. Hydraulic cylinders generally comprise a piston enclosed within a housing. The pulling capacity of the cylinder generally represents the amount of force the cylinder can generate, and is related to the diameter of the cylinder and the surface area of the piston in the cylinder. The travel distance of the cylinder generally represents the overall range and length of the cylinder, and is the distance between the fully retracted cylinder and the fully extended cylinder. The travel distance is related to the length of the housing. Generally, as the pulling capacity and travel distance of a cylinder increases, the weight and the cost of the cylinder also increase.

[**0031**] The force required to draw the rail sections together is significantly greater than the force required to initiate the clamping of the rail sections. In the illustrated embodiment, the clamping cylinder **78** clamps the rail sections, and the pulling cylinders **102** draw the rail sections together. The pulling cylinders **102** have a pulling capacity significantly greater than the pulling capacity of the clamping cylinder **78**. In the illustrated embodiment, the clamping cylinder **78** is a double acting hydraulic cylinder with a capacity of approximately 10 tons on the extend or push side and approximately 4 tons on the pull side, and a travel distance of approximately 10 inches. The pulling cylinders **102** are double acting hydraulic cylinders with a capacity of approximately 60 tons on the pull side, and a travel distance of approximately 6 inches.

[**0032**] The rail puller **10** uses the relatively smaller capacity clamping cylinder **78** to set and clamp the rail sections and reduce the necessary travel distance of the relatively larger capacity pulling cylinders **102**. Since the length of the larger pull capacity pulling cylinders **102** is decreased, the weight and cost of the pulling cylinders **102** are also decreased.

[**0033**] The required travel path for cylinders of a rail puller can generally be divided into a clamping path and a pulling path. For example, in some prior art rail pullers having only pulling cylinders, the pulling cylinders travel a clamping path of approximately 10 inches, and a pulling path of approximately 6 inches. Therefore, each pulling cylinder would require a total travel distance of approximately 16 inches.

[**0034**] In the illustrated embodiment, a single clamping cylinder **78** is used to clamp the rail sections and actuate the rail puller **10** through the clamping path which requires a relatively smaller force. The pulling cylinders **102** are only needed for the pulling path, which requires a relatively larger force in comparison to the clamping path. Therefore, in the illustrated embodiment, the travel distance of the pulling cylinders **102** may be reduced from the travel distance of prior art pulling cylinders. Using the previous example, the travel distance could be reduced approximately 10 inches. The reduction in travel distance of the pulling cylinders **102** reduces the weight and cost of the rail puller **10**.

[**0035**] As shown in **FIG. 6**, the clamping cylinder **78** has a smaller diameter than the pulling cylinder **102**, and the piston **82** of the clamping cylinder **78** has a smaller exposed surface area than the pistons **106** of the pulling cylinders **102**. As mentioned above, capacity is related to the diameter and exposed surface area of the pistons **82**, **106**. The capacity of the clamping cylinder **78** is significantly less than the capacity of the pulling cylinders **102**. The weight and cost savings from reducing the travel distance of the pulling cylinders **102** is significantly larger than the additional weight and cost of the clamping cylinder **78**. Therefore, the overall weight and cost of the rail puller **10** is less than the weight and cost of some prior art rail pullers.

[**0036**] The rail puller **10** is movable between an open condition and a closed condition. **FIGS. 1, 3** and **4** illustrate the rail puller **10** in the open condition, and **FIGS. 2 and 6** illustrate the rail puller **10** in the closed condition. When the rail puller **10** is in the open condition, as shown in **FIG. 2**, the grips **42** are pivoted away from one another, and away from the rail sections. In the open condition, the clamping cylinder **78** is retracted, and the pulling cylinders **102** are extended. The clamping cylinder **78** extends to move the rail puller **10** from the open condition to the closed condition.

[**0037**] **FIG. 6** illustrates the rail puller **10** in the open condition with the hydraulic circuit **98**. As mentioned above, the hydraulic circuit **98** includes the advance circuit **130** that extends the cylinders **78**, **102**, the retract circuit **134** that retracts the cylinders, and shut-off valves **138** that restrict the flow through the hydraulic circuit **98**. To move the rail puller **10** to the closed condition, the controller **126** is adjusted to

permit flow through the advance circuit **130** and extend the cylinders **78**, **102**. Since the pulling cylinders **102** are already extended, they will remain extended while the clamping cylinder **78** also extends.

[**0038**] As the clamping cylinder **78** extends, the clamping beam **22** increases in length and the clamp brackets **30** move away from one another in a longitudinally outward direction. The clamp brackets **30** and the inner joints **38** of the respective clamp assemblies **14**, **18** move away from one another, but the distance between the outer joints **46** of the respective clamp assemblies **14**, **18** remains substantially the same, which causes the swing arms **34** to pivot. The pivoting swing arms **34** move the grips **42** laterally inward toward the rail sections. As the swing arms **34** continue to pivot, the grips **42** engage the rail sections, and the clamp assemblies **14**, **18** clamp the rail sections.

[**0039**] Once the clamping cylinder **78** is extended and the clamp assemblies **14**, **18** clamp the rail sections, the rail puller **10** is in the closed condition. **FIG. 3** illustrates the rail puller **10** in the closed condition clamping a first rail section A and a second rail section B. The first clamp assembly **14** clamps the first rail section A, and the second clamp assembly **18** clamps the second rail section B. In the illustrated embodiment, the grips **42** are pivotally coupled to the swing arms **34** to ensure that an engaging surface **140** properly aligns with the rail sections A, B. The grips **42** pivot with respect to the swing arms **34** to maximize contact between the engaging surface **140** and the rail sections A, B as the swing arms **34** pivot to the clamped closed condition. The pivoting grips **42** permit the clamp assemblies **14**, **18** to properly clamp rail sections of varying widths, and prevents uneven wear of the engaging surface **140**. **FIG. 4** illustrates the first clamp assembly **14** in the closed condition clamping the rail section A with the engaging surfaces **140** of the grips **42** contacting the rail section A.

[**0040**] The swing arms **34** are opposed and rotate toward each other when pulling force is applied to the pulling members **26** by the pulling cylinders **102**. The clamping force developed by the clamp assemblies **14**, **18** is a ratio of the pulling force applied by the pulling cylinders **102** and is dependent on the ratio of the distance from the center line of the grips **42**, to the center line of the inner joints **38**, and the distance from the center line of the outer joints **46** to the center line of the inner joints **38**. The ratio can be varied as required to insure sufficient clamping pressure on the grips **42** to make them bite and hold the rail sections A and B.

[**0041**] In **FIG. 6**, the hydraulic circuit **98** includes a priority valve **160** to control the extend sequence of the pulling cylinders **102** and the clamping cylinder **78** such that the pulling cylinders **102** always extend to their maximum travel before the clamping cylinder **78** extends the beam **22** to close the clamp assemblies **14**, **18**. The priority valve **160** also includes spring biased check valves **164**, **168** to provide a resistance to flow in and out of the extend port of clamping cylinder **78**. The resistance to flow provided by valve **164** of priority valve **160** insures full extension of the pulling cylinders **102** before extension of cylinder **78** of beam **22** to close the clamp assemblies **14**, **18**. The resistance to flow provided by valve **168** of priority valve **160** requires the retract circuit **134** to build and maintain sufficient pressure in the pulling cylinders **102** to keep the clamp assemblies **14**, **18** closed on the rail sections A and B while retracting the beam **22**.

[**0042**] In **FIG. 3**, after the clamp assemblies **14**, **18** clamp the respective rail sections A, B, the lock pin **62** may be removed from the detachable end **50** to unlock the clamping beam **22** from the first clamp assembly **14**. In the illustrated embodiment, the clamping cylinder **78** has a smaller cross-sectional area than the pulling cylinders **102**, and travels at a faster rate than the pulling cylinders **102**. Therefore, the clamping beam **78** is disengaged from the first clamp assembly **14** to prevent the clamp brackets **30** and the inner joints **38** from moving longitudinally inward at a faster rate than the outer joints **46**, which could cause the swings arms **34** to pivot the grips **42** outward and disengage the rail sections A, B. Removing the lock pin **62** ensures that the clamp assemblies **14**, **18** will not unclamp from the rail sections A, B while the rail puller **10** is pulling the rail sections A, B.

[**0043**] To pull the rail sections using the hydraulic circuit **98** shown in **FIG. 6**, the controller **126** is switched to a pull position and fluid flows into the retract circuit **134** to retract the cylinders **78**, **102**. The hydraulic circuit of beam **22** is protected by the priority valve **160** to limit the loading and control the retraction of the beam **22**. The spring biased valve **168** provides resistance to close the beam **22**. After the pin **62** is removed from the beam **22**, the priority valve **160** will force the puller **10** to first try to pull the rail before the beam **22** can disconnect from the clamp assemblies **14**, **18**. This action helps the puller **10** set itself on the rail before the beam **22** retracts. Once the beam **22** retracts, the full operating pressure of the hydraulic circuit **98** can be supplied to the pulling cylinders **102** to develop the force required to pull the rail. By maintaining the initial clamping pressure, the priority valve **160** insures that the beam **22** retracts before the pulling cylinders **102**.

[**0044**] The hydraulic pressure required to pull the rail sections A and B together is greater than the pressure required to retract the clamping cylinder **78** of beam **22**. The lock pin **62** is removed to disconnect the clamping beam **22** from the first clamp assembly **14**. The retracting pulling cylinders **102** pull the clamp assemblies **14**, **18** toward one another. The pulling cylinders **102** generally operate in unison to pull the rail sections together. Since the clamp assemblies **14**, **18** are clamped onto the rail sections A, B, the retracting pulling cylinders **102** also pull the rail sections A, B toward one another and reduce the gap between the rail sections A, B.

[**0045**] After the clamping beam **22** is retracted and the rail sections are pulled together, the clamping beam **22** may be pivoted upwardly about the pivot pin **74** to provide clearance for welding the rail sections together. **FIG. 5** illustrates the clamping beam **22** in the substantially horizontal position coupled to the first clamp assembly **14**. The dashed lines of **FIG. 5** illustrate the clamping beam **22** in the upward pivoted position. With the clamping beam **22** pivoted upward, there is additional clearance near the middle of the rail puller **10** to provide a clear workspace for welding the rail sections together.

[**0046**] A spring **142** biases the clamping beam **22** toward the pivoted position to reduce the amount of effort required to lift and pivot the clamping beam **22**. In the illustrated embodiment, the spring **142** does not provide enough force to lift the clamping beam **22** independently, but it does provide assistance for lifting and pivoting the clamping

beam **22**. The clamping beam **22** also includes handles **146** along the sides of clamping beam **22** to help a person lift and pivot the clamping beam **22**. After the clamping beam **22** is pivoted upward, the lock pin **62** may be inserted into a retaining hole **148** at the pivot end **54** near the pivot pin **74**. The lock pin **62** in the retaining hole **148** prevents the clamping beam **22** from unexpectedly pivoting downwardly before the welding activities are completed.

[**0047**] The cylinders **78**, **102** may be located at any position along the clamping beam **22** and pulling members **26**. In the illustrated embodiment, the clamping cylinder **78** is located near the pivot pin **74** and the second clamp assembly **18**. Since the clamping cylinder **78** generally weighs more than the remaining portion of the clamping beam **22**, locating the clamping cylinder **78** near the pivot end **54** lowers the center of gravity of the clamping beam **22** as it pivots and reduces the amount of effort required to pivot the clamping beam **22** upward. Additionally, the pulling cylinders **102** are located near second clamp assembly **18** to minimize the amount of piping or hoses required for the hydraulic circuit **98** to connect the pulling cylinders **102** and clamping cylinder **78**.

[**0048**] After the ends of the rail sections are welded together, the rail puller **10** is moved to the open condition and removed from the rail sections. First, the controller **126** (**FIG. 6**) is moved to the extend position to release the clamping pressure. Next, the lock pin **62** is removed from the retaining hole **148** and the clamping beam **22** is pivoted downwardly. The clamping cylinder **78** is extended until the clamping beam **22** can reengage with the first clamp assembly **14** and the lock pin **62** is inserted through the lock holes **66** to couple the detachable end **50** to the mounting bracket **58**.

[**0049**] The pulling cylinders **102** continue to extend until they reach the maximum extended travel. After the pulling cylinders **102** are extended, the shut-off valves **138** are closed to prevent flow to the pulling cylinders **102**, and the controller **126** (**FIG. 6**) is moved to the retract position. The clamping cylinder **78** retracts to shorten the clamping beam **22** and move the clamp brackets **30** toward one another. As the clamp brackets **30** and inner joints **38** move longitudinally inward, the pulling members **26** maintain their length because the shut-off valves **138** prevent the retract circuit **134** from retracting the pulling cylinders **102**. The distance between the outer joints **46** of the first clamp assembly **14** and the outer joints **46** of the second clamp assembly **18** remains substantially the same. The movement of the inner joints **38** with respect to the outer joints **46** causes the swing arms **34** to pivot and move the grips **42** laterally outward and away from the rail sections. After the clamping cylinder **78** is retracted, the rail puller **10** is once again in the open condition.

[**0050**] As shown in **FIG. 5**, the rail puller **10** has hooks **150** on the clamping beam **22** to facilitate removing the rail puller **10** from the rail sections. A sling **154** is connected to the hooks **150** to help lift the rail puller **10**. The lock pin **62** is inserted through the lock holes **66** before the rail puller **10** is lifted. A crane, hoist, pulley system or other similar lifting device may be attached to the sling to lift the rail puller **10** and remove the rail puller **10** from the rail sections.

[**0051**] **FIG. 7** illustrates an additional embodiment of the hydraulic circuit **98** having an advance circuit **130** and retract circuit **134**. The hydraulic circuit **98** includes a pull control valve **172** that controls the pulling cylinders **102**, and a beam control valve **176** that controls the clamping cylinder **78**. The control valves **172**, **176** may be used to operate the cylinders **78**, **102** independently. The hydraulic circuit **98** also includes at least one relief valve **180**. In the illustrated embodiment, each cylinder **78**, **102** is in fluid flow communication with a relief valve **180**. The hydraulic circuit **98** also includes a load lock valve **184** and a speed control valve **188**. The load lock valve **184** may include a needle valve to regulate flow in a first direction and a check valve to regulate flow in a second direction. The speed control valve **188** regulates the speed of fluid flow through the hydraulic circuit **98** and may include a needle valve.

[**0052**] In **FIG. 7**, the hydraulic circuit **98** includes a power connection **192** that may be connected to a power take off unit (PTO) on a railway vehicle or other power source. Railway vehicles commonly include a PTO to provide power, such as hydraulic power, for auxiliary equipment, such as a rail puller. In the illustrated embodiment, the PTO may provide hydraulic flow to the hydraulic circuit **98** at approximately 5 to 10 GPM (gallons per minute) and 2000 PSI (pounds per square inch).

[**0053**] A hydraulic booster **196** may increase the pressure of the hydraulic flow through at least a portion of the hydraulic circuit **98**. The hydraulic booster **196** may increase the pressure of the 5-10 GPM at 2000 PSI fluid flow to approximately 1-2 GPM at 10,000 PSI. In the illustrated embodiment, the hydraulic circuit **98** may include a low pressure portion **200** having the lower pressure fluid flow input from the PTO, and a high pressure portion **204** having a higher pressure fluid flow from the hydraulic booster **196**. In **FIG. 7**, the beam control valve **176** controls the clamping cylinder **78** on the low pressure portion **200**, and the pull control valve **176** controls the pulling cylinders **102** on the high pressure portion **204**. The increased pressure on the high pressure portion **204** may be used to generate a higher pulling force in the pulling cylinders **102**.

1. A rail puller for reducing the gap between rail sections, the rail puller comprising:

a first clamp assembly and a second clamp assembly disposed at opposite ends of the rail puller;

an elongated clamping beam coupled to the first clamp assembly and the second clamp assembly, and including a clamping cylinder that is extendable and retractable to adjust the length of the clamping beam, and the clamping cylinder being movable to clamp the first clamp assembly and second clamp assembly to rail sections; and

at least one elongated pulling member coupled to the first clamp assembly and the second clamp assembly, and the at least one elongated pulling member being movable to draw the first clamp assembly and second clamp assembly toward one another to reduce the gap between the rail sections.

2. The rail puller of claim 1, wherein the at least one elongated pulling member includes a pulling cylinder which is extendable and retractable, and the rail puller is movable between an open condition and a closed condition, the rail puller being in the open condition when the clamping cylinder is retracted and the pulling cylinder is extended, and

the rail puller being in the closed condition when the clamping cylinder is extended.

3. The rail puller of claim 2, wherein the rail puller clamps the rail sections when the rail puller is in the closed condition.

4. The rail puller of claim 1, wherein the first clamp assembly and second clamp assembly each comprise:

a clamp bracket coupled to the clamping beam; and

a swing arm pivotally coupled to the clamp bracket at an inner joint and pivotally coupled to the pulling member at an outer joint, the swing arm having a grip.

5. The rail puller of claim 4, wherein the grips are pivotally coupled to the swing arms.

6. The rail puller of claim 4, wherein the swings arms pivot with respect to the outer joints when the clamping cylinder extends.

7. The rail puller of claim 1, wherein the clamping cylinder has a travel path greater than the travel path of the pulling cylinders.

8. The rail puller of claim 1, wherein the pulling cylinders have a pull capacity greater than the pull capacity of the clamping cylinder.

9. The rail puller of claim 1, wherein the clamping beam is removably coupled to the first clamp assembly, and pivotally coupled to the second clamp assembly.

10. The rail puller of claim 1, further comprising a hydraulic circuit including:

an advance circuit that extends the clamping cylinder and pulling cylinders;

a retract circuit that retracts the clamping cylinder and pulling cylinders;

a controller that controls flow through the hydraulic circuit; and

at least one shut-off valve that restricts flow to the pulling cylinders when the shut-off valve is closed.

11. The rail puller of claim 10 where the hydraulic circuit includes a priority valve to control the sequence of operation between the clamping cylinder and the pulling cylinders.

12. The rail puller of claim 1, further comprising a hydraulic circuit including:

a power source generating a fluid flow through the hydraulic circuit;

a first portion having a first fluid flow;

a second portion having a second fluid flow, and the pressure of the second fluid flow is greater than the pressure of the first fluid flow; and

a hydraulic booster that increases the pressure of the first fluid flow in the first portion to the pressure of the second fluid flow in the second portion.

13. The rail puller of claim 12, further comprising a beam control valve controlling the clamping cylinder, wherein the beam control valve is in fluid flow communication with the first portion.

14. The rail puller of claim 12, further comprising a pull control valve controlling a pulling cylinder, wherein the pulling cylinder is interconnected to the pulling member, and the pull control valve is in fluid flow communication with the second portion.

15. A rail puller for reducing the gap between rail sections, the rail puller comprising:

a first clamp assembly and a second clamp assembly disposed at opposite ends of the rail puller, each clamp assembly including a clamp bracket and at least two swing arms pivotally coupled to the clamp bracket at an inner joint;

an elongated clamping beam coupled to the first clamp assembly and the second clamp assembly, and having a clamping cylinder that is extendable and retractable to adjust the length of the clamping beam, wherein the clamp brackets are coupled to both ends of the clamping beam;

at least two elongated pulling members coupled to the first clamp assembly and the second clamp assembly, wherein each pulling member has a pulling cylinder that is extendable and retractable to adjust the length of the pulling members, and the ends of each pulling member are pivotally coupled one of the swing arms at an outer joint;

wherein the swing arms pivot with respect to the outer joints to clamp the rail sections.

16. The rail puller of claim 15, wherein each swing arm includes a grip that is pivotally mounted to the swing arm, and the grips contact the rail sections when the rail puller clamps the rail sections.

17. The rail puller of claim 16, wherein the grips pivot laterally inward and longitudinally outward with respect to the outer joints when the clamping beam extends.

18. The rail puller of claim 15, wherein the clamping cylinder extends to clamp the first clamp assembly and second clamp assembly to rail sections, and the pulling cylinders retract to draw the first clamp assembly and second clamp assembly toward one another and reduce the gap between the rail sections.

19. The rail puller of claim 15, wherein the rail puller is movable between an open condition and a closed condition, and the rail puller is in the open condition when the clamping cylinder is retraced and the pulling cylinders are extended, and the rail puller is in the closed condition when the clamping cylinder is extended.

20. The rail puller of claim 19, wherein the rail puller clamps the rail sections when the rail puller is in the closed condition.

21. The rail puller of claim 15, wherein the clamping cylinder has a travel path greater than the travel path of the pulling cylinders.

22. The rail puller of claim 15, wherein the pulling cylinders have a pull capacity greater than the pull capacity of the pull cylinders.

23. The rail puller of claim 15, wherein the clamping beam is removably coupled to the first clamp assembly, and pivotally coupled to the second clamp assembly.

24. The rail puller of claim 15, further comprising a hydraulic circuit including

an advance circuit that extends the clamping cylinder and pulling cylinders;

a retract circuit that retracts the clamping cylinder and pulling cylinders;

a controller that controls flow through the hydraulic circuit; and

at least one shut-off valve that restricts flow to the pulling cylinders when the shut-off valve is closed.

25. The rail puller of claim 24 where the hydraulic circuit includes a priority valve to control the sequence of operation between the clamping cylinder and the pulling cylinder.

26. The rail puller of claim 15, further comprising a hydraulic circuit including:

a power source generating a fluid flow through the hydraulic circuit;

a first portion having a first fluid flow;

a second portion having a second fluid flow, and the pressure of the second fluid flow is greater than the pressure of the first fluid flow; and

a hydraulic booster that increases the pressure of the first fluid flow in the first portion to the pressure of the second fluid flow in the second portion.

27. The rail puller of claim 26, further comprising a beam control valve controlling the clamping cylinder, wherein the beam control valve is in fluid flow communication with the first portion.

28. The rail puller of claim 26, further comprising a pull control valve controlling a pulling cylinder, wherein the pulling cylinder is interconnected to the pulling member, and the pull control valve is in fluid flow communication with the second portion.

29. A method for reducing a gap between rails comprising:

providing a rail puller including:

a first clamp assembly and a second clamp assembly disposed at opposite ends of the rail puller;

a clamping beam coupled to the first clamp assembly and the second clamp assembly, and including a clamping cylinder; and

at least two pulling members coupled to the first clamp assembly and the second clamp assembly, each pulling member including a pulling cylinder, wherein the pulling members are on opposite sides of the clamping beam;

positioning the rail puller near the rails with the clamp assemblies on opposite sides of the gap;

extending the clamping cylinder to move the clamp assemblies away from one another and engage the clamp assemblies with the rails; and

retracting the pulling cylinders to move the clamp assemblies toward one another and reduce the gap between the rails.

30. The method of claim 29, wherein the clamp assemblies each comprise:

a clamp bracket coupled to the clamping beam;

at least two opposing swing arms, wherein each swing arm is pivotally coupled to the clamp bracket at an inner joint, and pivotally coupled to one of the pulling members at an outer joint, each swing arm having a grip disposed between the inner joint and the opposite clamping assembly that engages one of the rails; and

wherein extending the clamping cylinder moves the clamp brackets away from each other, moves the inner joints in a substantially linear direction, and pivots the swing arms about the outer joints to pivot the grips inwardly and engage one of the rails.

31. The method of claim 29, further comprising disconnecting the boom member from the first clamp assembly and pivoting the clamping beam upwardly in relation to the second clamp assembly after the clamping cylinder is extended and before the pulling cylinders are retracted.

32. The method of claim 31, further comprising:

extending the pulling cylinders;

pivoting the clamping beam downwardly in relation to the second clamp assembly and reconnecting the clamping beam to the first clamp assembly;

retracting the clamping cylinder to move the clamp assemblies toward one another and disengage the clamp assemblies from the rails; and

removing the rail puller from the rails.

* * * * *