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(54) **TROLLEY ASSEMBLY AND WEIGHT ARM**

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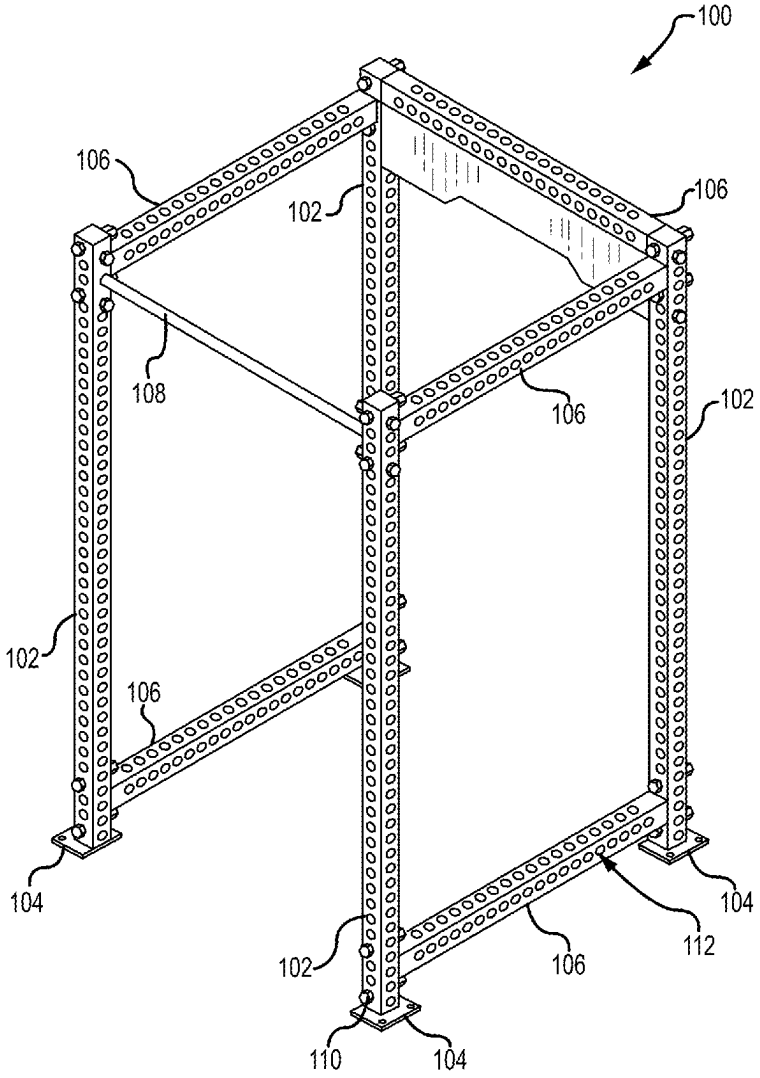
(57) **ABSTRACT**

A trolley assembly for a weight arm includes first and second trolley members that capture a vertical member of a weight rack and is selectively slidable. An arm bracket is configured to rotatably support the weight arm and the arm bracket is pivotably coupled to the trolley members about a pivot point. The pivot point defines a pivot axis that is orthogonal to the longitudinal axis. Additionally, a position lock assembly includes an engagement pin supported on the arm bracket remote from the pivot point and a guide plate defining two or more pin receivers. The position lock assembly defines a pivot angle of the arm bracket around the pivot axis relative to the trolley members.



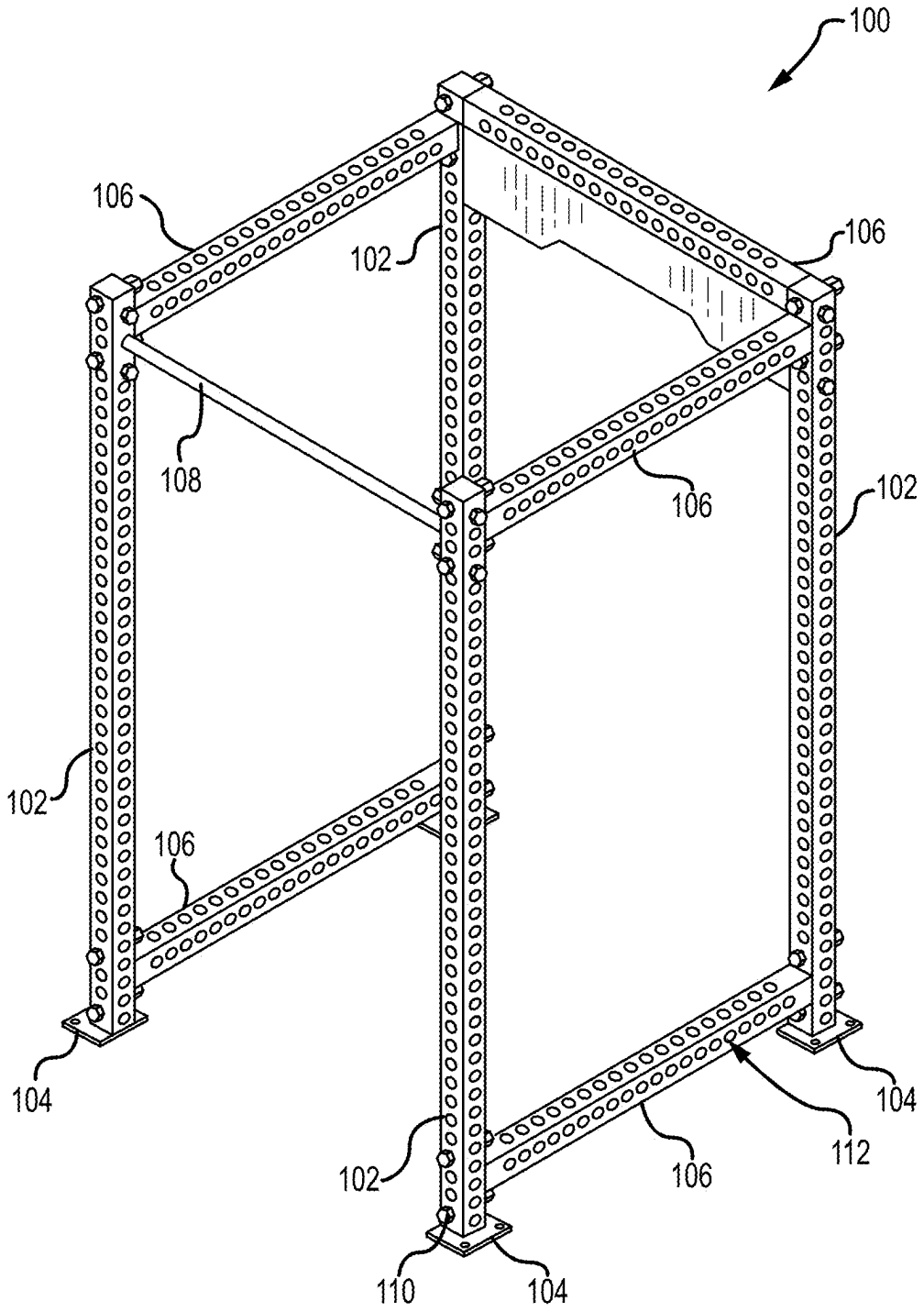
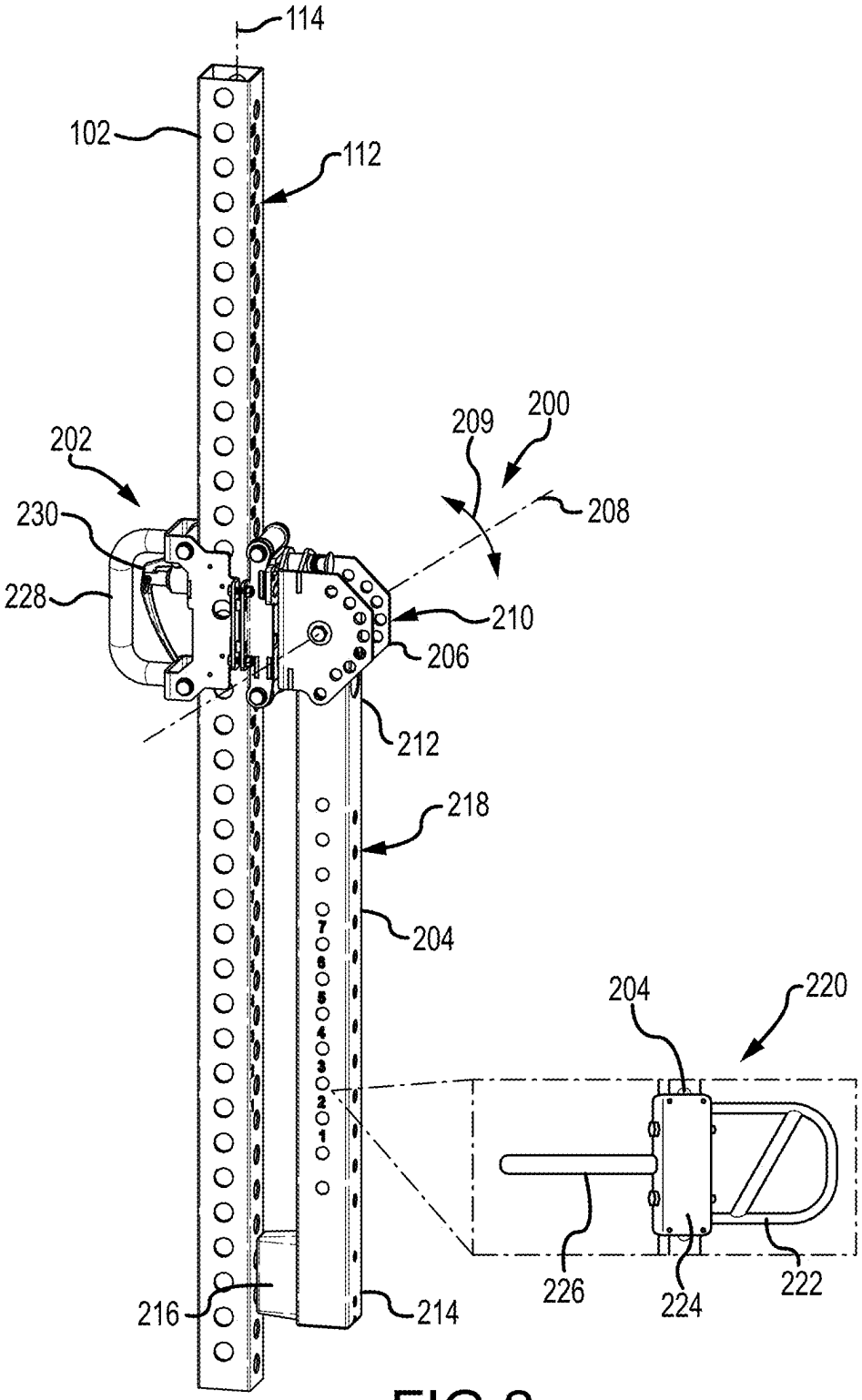


FIG.1


114
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226
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214

FIG.2

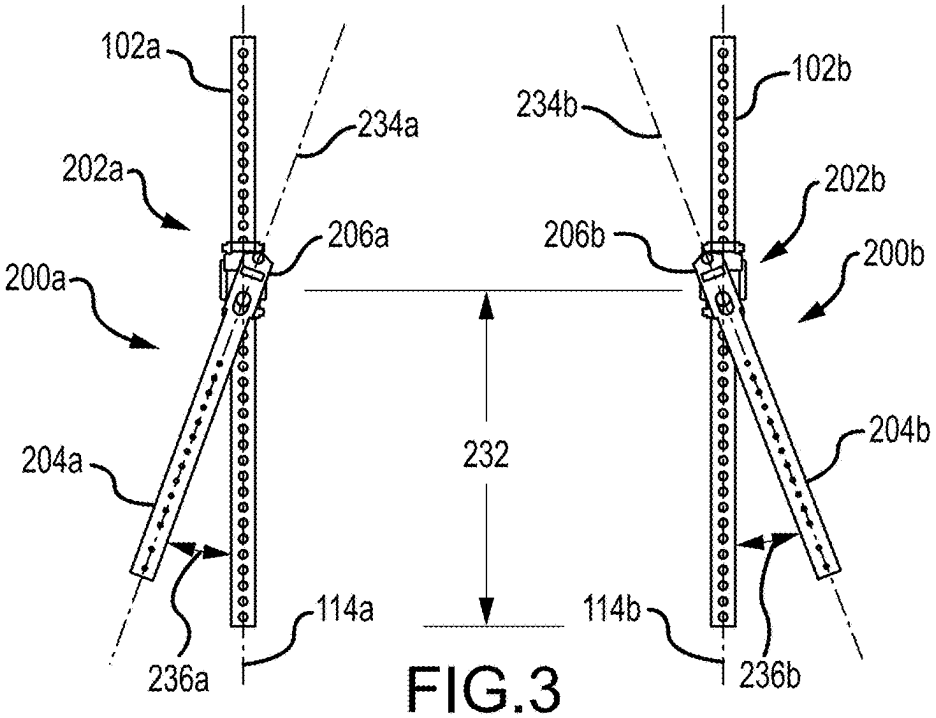
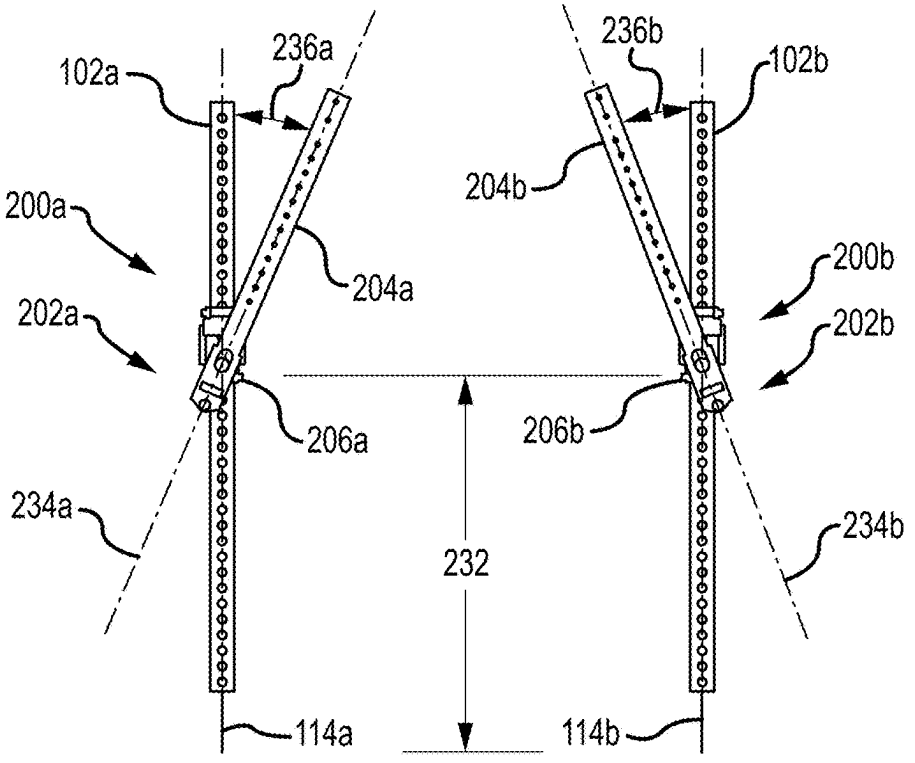

102a
234a
202a
206a
200a
204a
232
114a
236a
234b
102b
202b
206b
200b
204b
114b
236b

FIG.3


236a
102a
200a
202a
204a
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102b
204b
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234b
114b

FIG.4

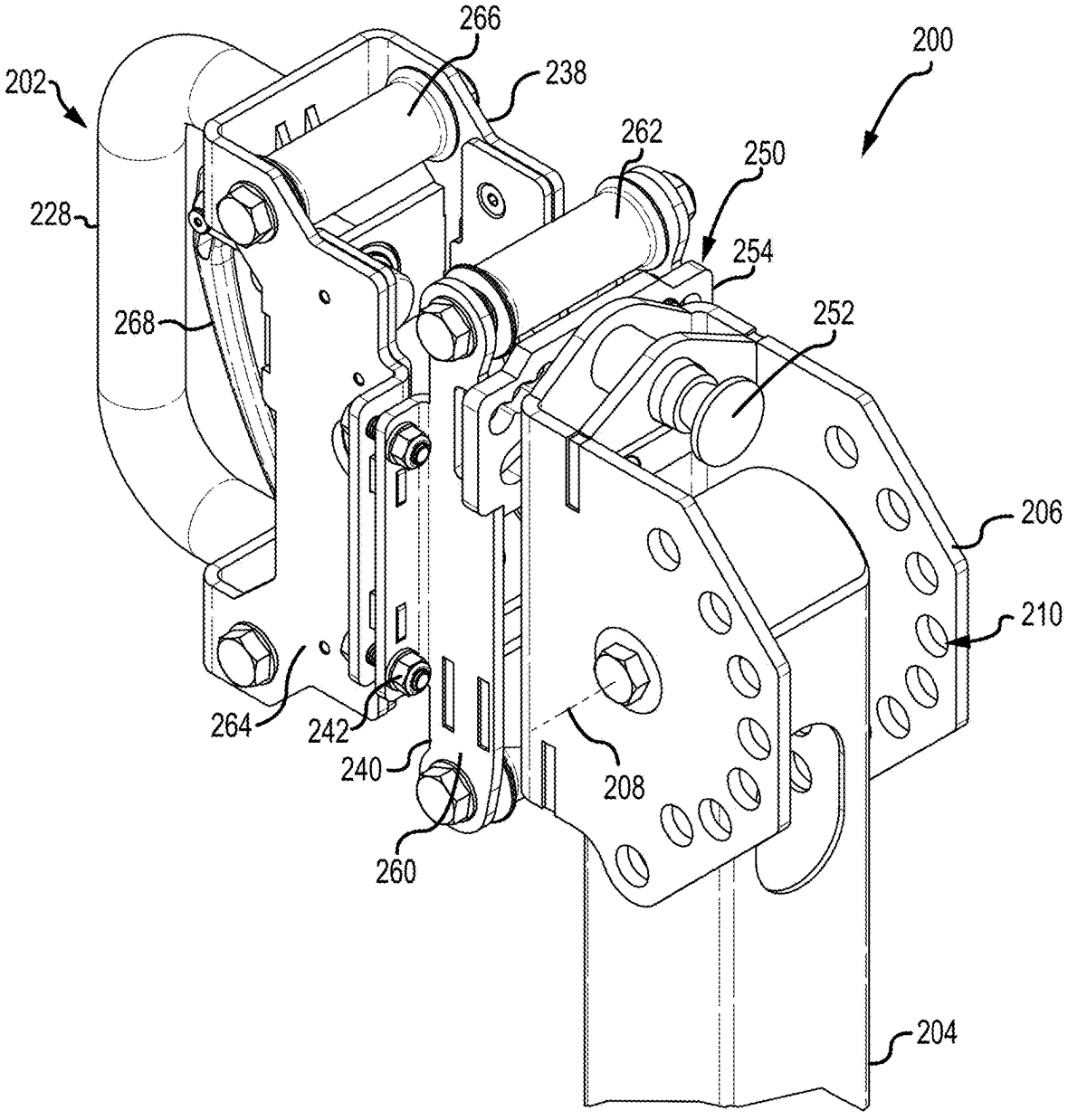
266
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FIG.5

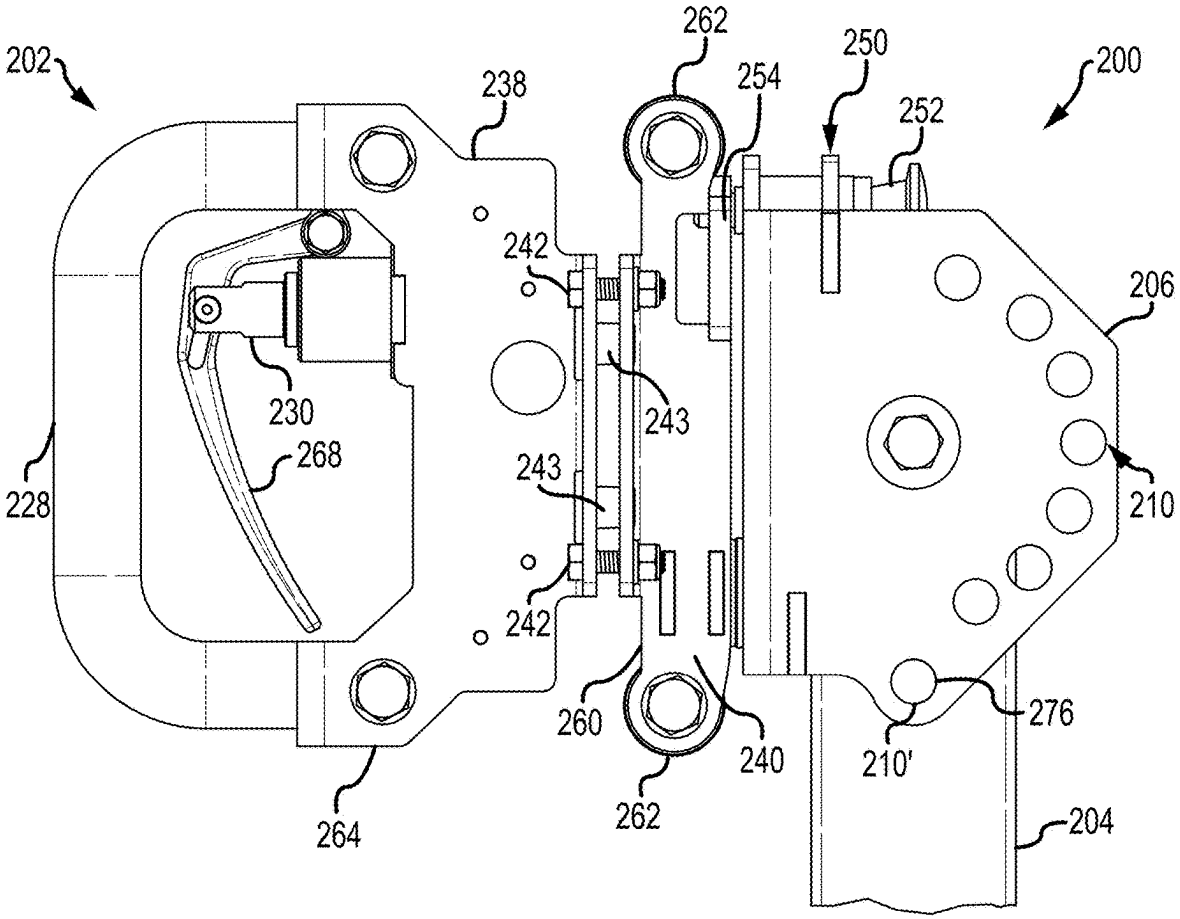
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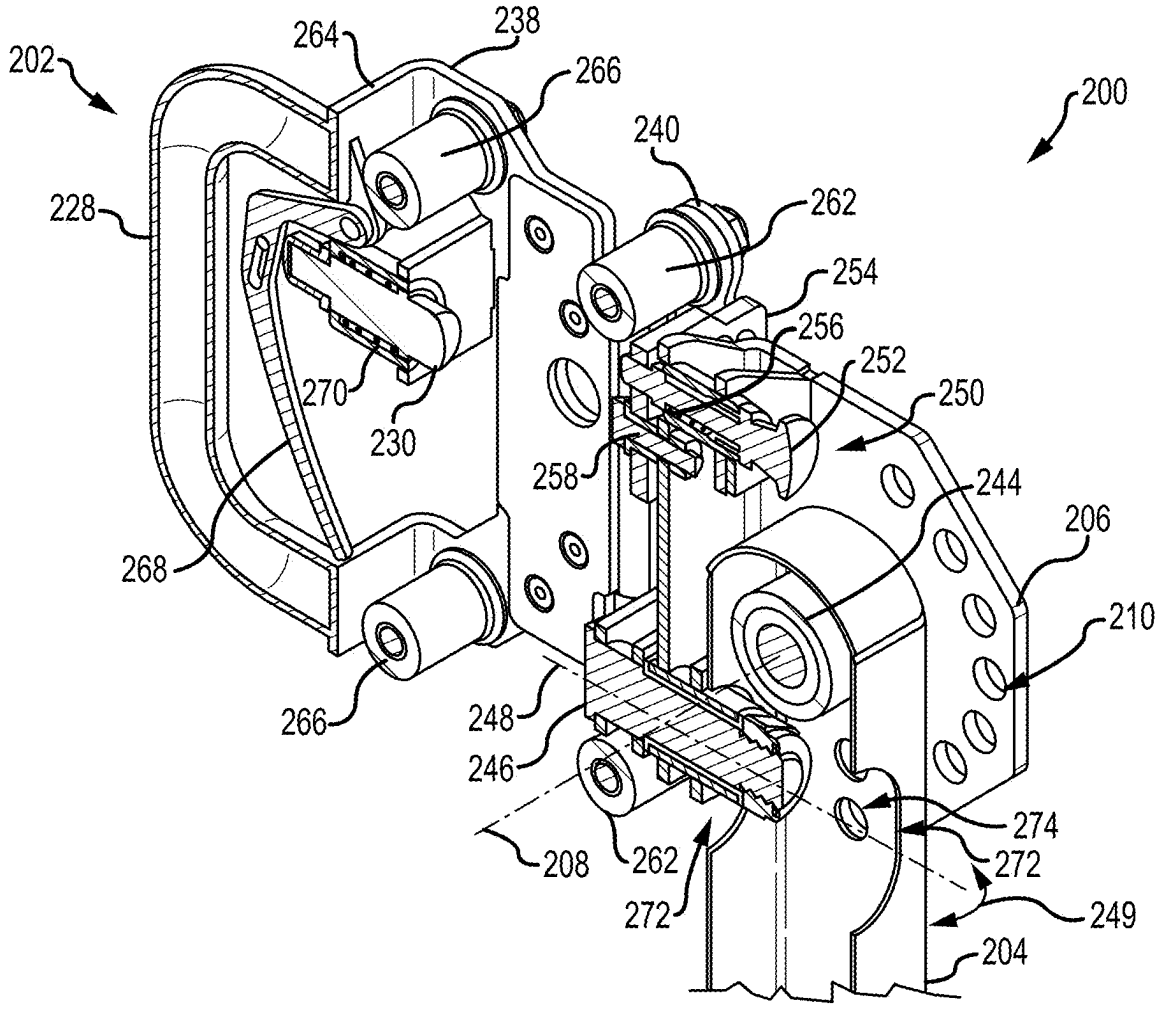
FIG.6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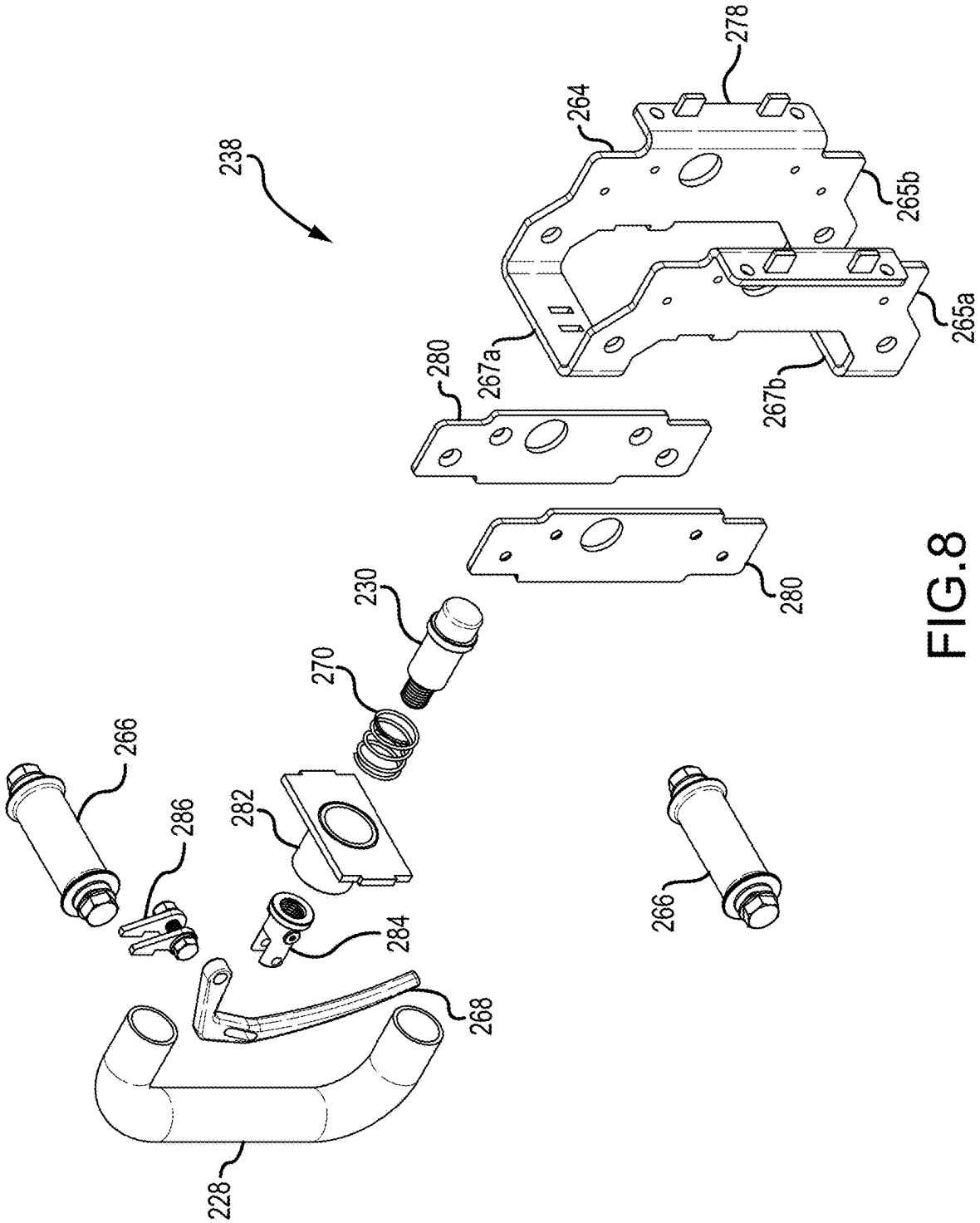
204

FIG.7


238
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265a
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267a
267b
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230
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228
266

FIG.8

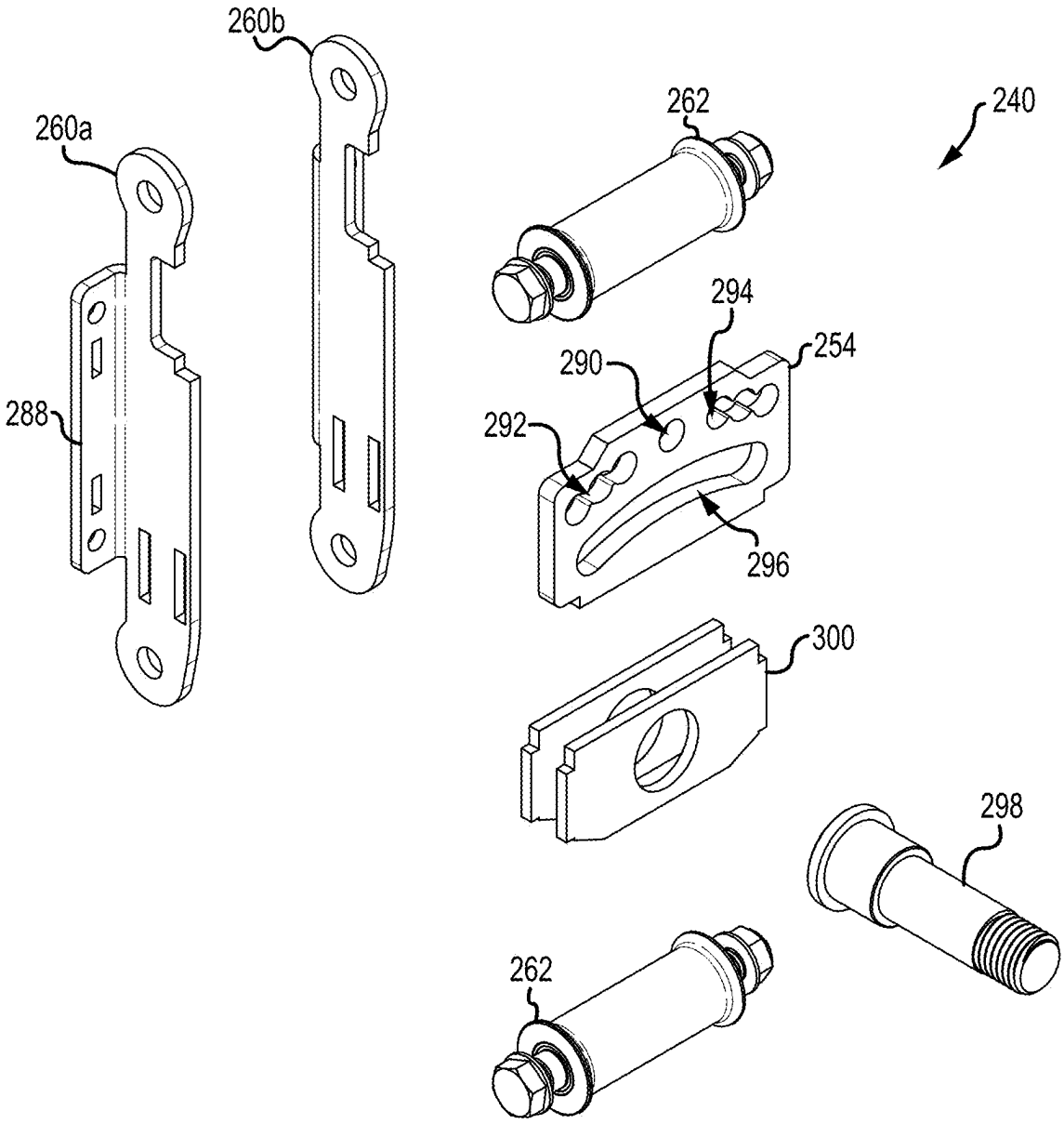

FIG.9

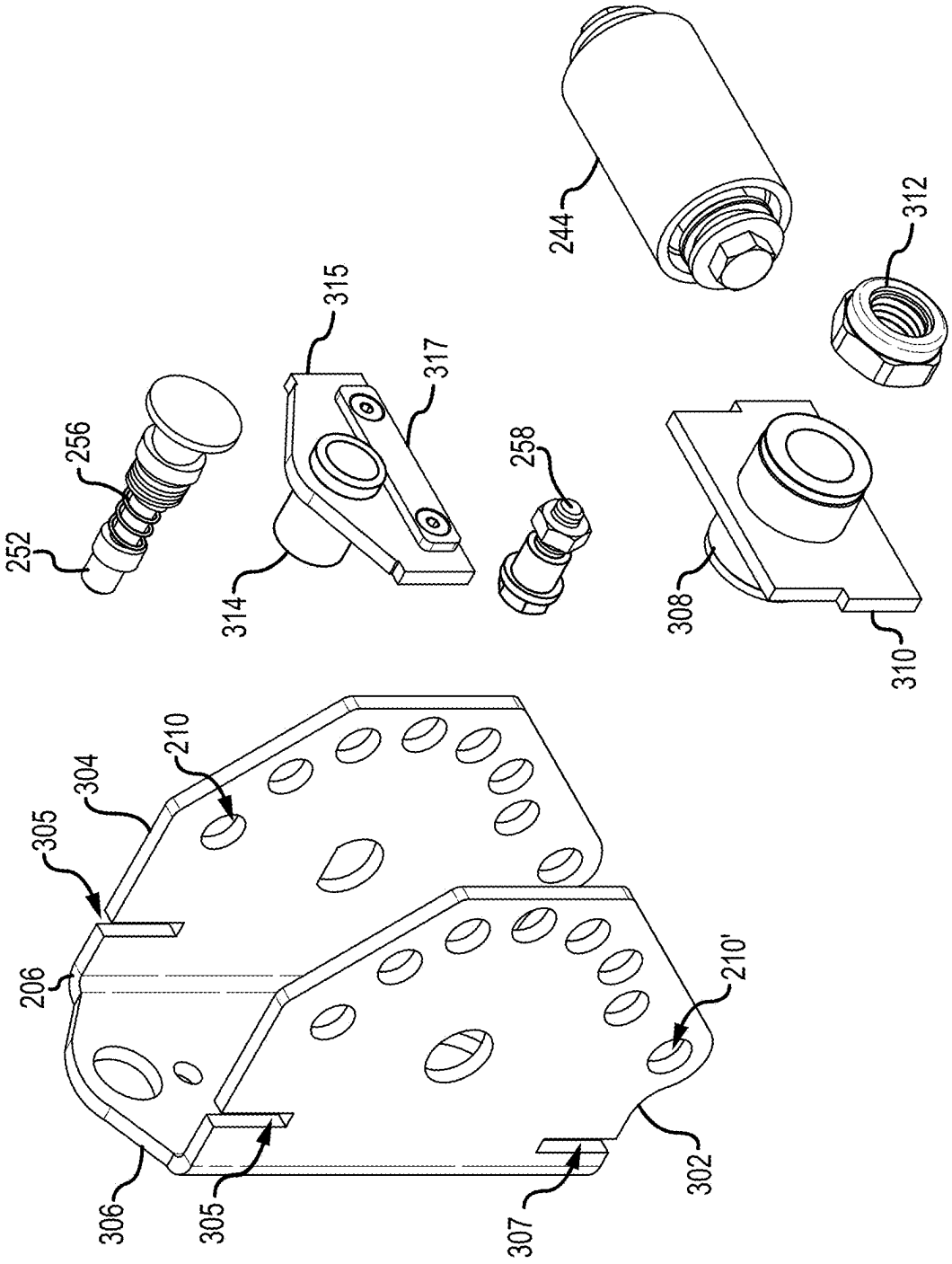
244
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FIG.10

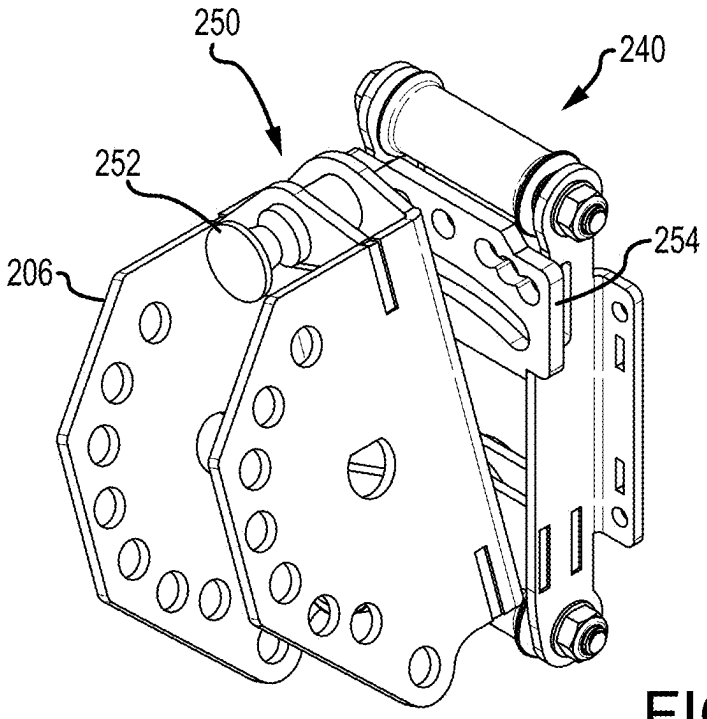

FIG.11

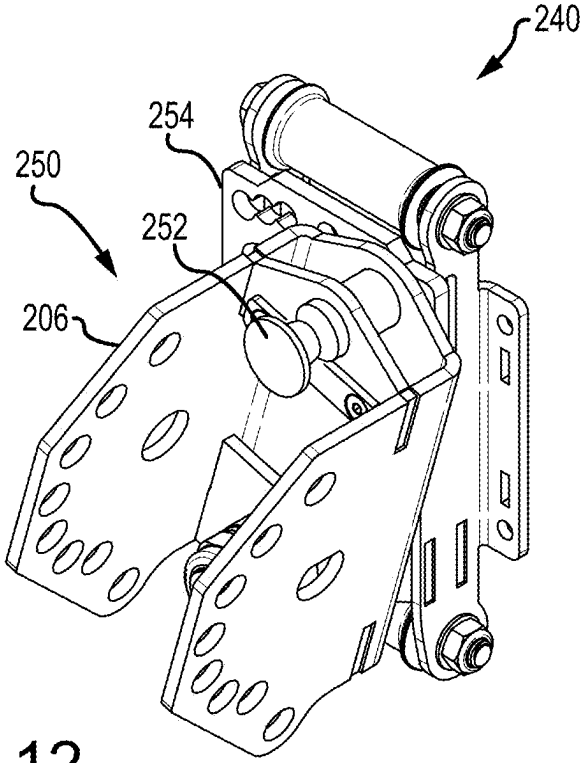

FIG.12

TROLLEY ASSEMBLY AND WEIGHT ARM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of U.S. provisional application No. 63/410,670 filed 28 Sep. 2022 entitled "Trolley assembly, weight arm assembly, and weight rack," which is hereby incorporated herein by reference in its entirety.

INTRODUCTION

[0002] Power weight racks are pieces of fitness equipment most often used for barbell exercises such as squats, deadlifts, and bench presses. Generally, the power weight racks are a cage of metal bars that surrounds the lifter. Additionally, attachments can be used on the power weight racks to add additional functionality to the power weight racks. Weight arms are one type of such attachments. Weight arms are typically plate-loaded arms that couple to vertical members of the power weight racks. A weight arm may be fixed in position to a vertical member or a trolley assembly may be used to allow the weight arm to be slidingly positionable along the length of the vertical member. A weight arm may be rotatable within a plane around a pivot point or be locked in place for static moves, like dips and pull-ups. A pair of weight arms can be used independently for unilateral movements or together.

SUMMARY

[0003] In one example implementation, the technology relates to a trolley assembly for a weight arm, the trolley assembly including a first trolley member configured to be disposed on a first side of a vertical member of a weight rack, the vertical member defining a longitudinal axis; a second trolley member configured to be disposed on an opposite, second side of the vertical member of the weight rack, the first trolley member couplable to the second trolley member to capture the vertical member of the weight rack therebetween, the trolley assembly being selectively slidable along the longitudinal axis; and an arm bracket further configured to rotatably support the weight arm about a first pivot axis axially transverse to the longitudinal axis and in a plane parallel to the first side of the vertical member; and pivotably coupled to the second trolley member about a second pivot axis that is orthogonal to both the longitudinal axis and the first pivot axis.

[0004] In an example, the second pivot axis does not intersect with the first pivot axis. In another example, the second pivot axis is located below the first pivot axis with respect to the longitudinal axis of the vertical member. In yet another example, the trolley assembly further includes a position lock assembly including an engagement pin supported on the arm bracket and spaced apart from the second pivot axis; and a guide plate coupled to the second trolley member, the guide plate defining two or more pin receivers, wherein the position lock assembly is positionable in at least a first configuration and a second configuration, such that in the first configuration, the engagement pin engages with a first pin receiver to define a first pivot angle of the arm bracket around the second pivot axis relative to the longitudinal axis of the vertical member, and in the second configuration, the engagement pin engages with a second pin receiver to define a second pivot angle of the arm bracket around the second pivot axis relative to the longitudinal axis of the vertical member and the second pivot angle is different than the first pivot angle. In still another example, the position lock assembly is also positionable in a third configuration such that the engagement pin disengages with the two or more pin receivers and the arm bracket is pivotable around the second pivot axis between at least the first pivot angle and the second pivot angle. In an example, the position lock assembly further includes a guide pin extending from the arm bracket; the guide plate further defines an arcuate channel receiving at least a portion of the guide pin; and the arcuate channel defines pivot limits of the arm bracket around the second pivot axis.

[0005] In another example, the pivot limits of the arm bracket are +/−20° from a center position that is parallel to the longitudinal axis. In yet another example, the engagement pin is spring loaded and biased towards an engaged position with the guide plate. In still another example, the trolley assembly further includes an adjustment pin supported on the first trolley member and selectively engageable with the vertical member of the weight rack to lock a position of the trolley assembly along the longitudinal axis. In an example, the trolley assembly further includes at least one handle coupled to the first trolley member. In another example, the adjustment pin includes a lever disposed within the at least one handle, connected to the adjustment pin, and operable to engage and disengage the adjustment pin with the vertical member of the weight rack. In yet another example, the first trolley member and the second trolley member each include at least one roller positionable against the vertical member of the weight rack.

[0006] In another example implementation, the technology relates to a weight arm assembly for a weight rack, the weight arm assembly including a trolley assembly configured to couple to a vertical member of the weight rack, the vertical member defining a longitudinal axis and the trolley assembly being selectively slidable along the longitudinal axis on the vertical member, the trolley assembly including a first trolley member configured to be disposed on a first side of the vertical member of the weight rack; a second trolley member configured to be disposed on an opposite, second side of the vertical member of the weight rack, the first trolley member couplable to the second trolley member to capture the vertical member of the weight rack therebetween; an arm bracket pivotably coupled to the second trolley member about a pivot point, the pivot point defining a pivot axis that is orthogonal to the longitudinal axis; and a weight arm rotatably coupled at a first end to the arm bracket around a rotation axis orthogonal to both the longitudinal axis and the pivot axis and configured to couple to a weight bar member.

[0007] In an example, the pivot axis does not intersect with the rotation axis. In another example, the pivot axis is located below the rotation axis with respect to the longitudinal axis of the vertical member. In yet another example, the weight arm assembly further includes an engagement pin supported on the arm bracket spatially apart from the pivot point; and a guide plate coupled to the second trolley member and defining two or more pin receivers, wherein the engagement pin is selectively engageable within a respective pin receiver of the two or more pin receivers to define a respective pivot angle of the arm bracket relative to the second trolley member, and the weight arm is rotatable around the rotation axis at each respective pivot angle of the

arm bracket. In still another example, the arm bracket is substantially U-shaped with two side plates and a base plate; the base plate is pivotably coupled to the second trolley member; and the weight arm is rotatably coupled between the two side plates. In an example, the arm bracket further includes a weight arm pin; the two side plates each define a plurality of apertures spaced apart relative to the rotation axis; and the weight arm is selectively positionable about the rotation axis relative to the arm bracket via engagement between the weight arm pin and the plurality of apertures.

[0008] In another example, a stop plate extends within the arm bracket, the stop plate at least partially defining a parallel orientation of the weight arm relative to the vertical member of the weight rack. In yet another example, the weight arm assembly further includes an adjustment pin supported on the first trolley member and selectively engageable with the vertical member of the weight rack to lock a position of the trolley assembly along the longitudinal axis.

[0009] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to limit the scope of the claimed subject matter. The details of one or more examples are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of these examples will be apparent from the description, drawings, and claims. Moreover, it is to be understood that both the foregoing summary of the disclosure and the following detailed description are exemplary and intended to provide further explanation without limiting the scope of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The following drawing figures, which form a part of this application, are illustrative of described technology and are not meant to limit the scope of the disclosure as claimed in any manner, which scope shall be based on the claims appended hereto.

[0011] The use of cross-hatching in the accompanying figures is generally provided to indicate a surface of a cross-section cut. The use of contour lines, shading, or stippling in the accompanying figures is generally provided indicate surface features, including curved surfaces or changes in depth, to clarify boundaries between adjacent elements, and to facilitate legibility of the figures. Accordingly, neither the presence nor the absence of cross-hatching, contour lines, shading, or stippling conveys or indicates any preference or requirement for particular materials, material properties, element proportions, element dimensions, commonalities of similarly illustrated elements, or any other characteristic, attribute, or property for any element illustrated in the accompanying figures.

[0012] Additionally, it should be understood that the proportions and dimensions (either relative or absolute) of the various features and elements (and collections and groupings thereof) and the boundaries, separations, and positional relationships presented therebetween, are provided in the accompanying figures merely to facilitate an understanding of the various example embodiments described herein and, accordingly, may not necessarily be presented or illustrated to scale, and are not intended to indicate any preference or requirement for an illustrated embodiment to the exclusion of embodiments described with reference thereto.

[0013] FIG. **1** depicts an isometric view of an exemplary weight rack.

[0014] FIG. **2** depicts an isometric view of a weight arm assembly coupled to a vertical member of the weight rack shown in FIG. **1**.

[0015] FIG. **3** depicts a pair of weight arm assemblies attached to vertical members of a weight rack in a downward position.

[0016] FIG. **4** depicts the pair of weight arm assemblies attached to vertical members of a weight rack in an upward position.

[0017] FIG. **5** depicts an isometric view of a portion of the weight arm assembly shown in FIG. **2**.

[0018] FIG. **6** depicts a side elevation view of the portion of the weight arm assembly shown in FIG. **5**.

[0019] FIG. **7** depicts an isometric view in cross section of the portion of the weight arm assembly shown in FIG. **5**.

[0020] FIG. **8** depicts an exploded isometric view of a first trolley member of the weight arm assembly shown in FIG. **2**.

[0021] FIG. **9** depicts an exploded isometric view of a second trolley member of the weight arm assembly shown in FIG. **2**.

[0022] FIG. **10** depicts an exploded isometric view of an arm bracket of the weight arm assembly shown in FIG. **2**.

[0023] FIGS. **11** and **12** illustrate different pivot angle positions of the arm bracket relative to the second trolley member.

DETAILED DESCRIPTION

[0024] Examples of the present technology are directed to a power weight rack and the attachment of rotatable weight arms. The weight arms are configured to receive weight plates so that users can perform any number of exercises such as rows, deadlifts, squats, a variety of presses, belt squats, etc. Additionally, the weight arms can be locked in place for exercises like dips, L-sits, pull-ups, etc. A trolley assembly is used to attach a respective weight arm to the power weight rack. The trolley assembly is configured to slide along a vertical member of the power weight rack and selectively engage with the vertical member to set and lock the height of the corresponding weight arm. The weight arm is rotatably coupled to the trolley assembly via an intermediate arm bracket. The weight arm can rotate about a rotational axis in an up-down orientation (e.g., along a vertical path) for some exercises or the weight arm can be locked in a fixed position with respect to the arm bracket for other exercises. Additionally, the arm bracket is pivotably coupled to the trolley assembly about a pivot axis that extends substantially in a horizontal direction away from the vertical member to which the trolley assembly is secured. In this configuration, the pivot axis of the arm bracket is orthogonal to both a longitudinal axis of the vertical member and the rotational axis of the weight arm. This coupling enables the weight arm to have an adjustable pivot angle and allow the weight arms to swing in angular paths that are different than along the vertical path described above. A position lock assembly is provided so that a pivot angle position of the arm bracket can be locked into place during such exercises.

[0025] FIG. **1** depicts an isometric view of an exemplary weight rack **100**. In the example, the weight rack **100** may

be a power rack configured for barbell use. In other examples, the weight rack **100** may be a squat rack configured for squats. The weight rack **100** is formed as a cage having a plurality of vertical members **102** (e.g., four vertical members). At the bottom of the vertical members **102**, feet **104** are provided so that the weight rack **100** stands upright on an underlying surface. A plurality of cross-bars **106** are coupled between two vertical members **102** so as to form the cage-like shape. In the example, a pair of top and bottom cross-bars extend between both the left and right vertical member pairs. Additionally, a top cross-bar may couple between the rear left and right vertical members **102**. A pull-up bar **108** can couple between the forward left and right vertical members at the top. The cross-bars **106** and pull-up bar **108** may attach to the vertical members **102** via fasteners **110** (e.g., bolts). It should be appreciated that one of skill in the art would understand that weight racks **100** can take many different configurations and have any number of modifications and/or additions thereto. The trolley and weight arm assemblies described in detail below are configured to be mounted on the vertical member **102**, and as such, the weight rack **100** used herein includes at least one vertical member **102**.

[0026] In the example, the vertical members **102** and the cross-bars **106** may be formed out of square steel tube, e.g., in some implementations, 3 inch by 3 inch 11-gauge steel. A plurality of holes **112** are formed within each of the vertical members **102** and the cross-bars **106** to facilitate attachments thereto. In an example implementation, the hole **112** size may be about 1 inch and have a 2-inch spacing along a vertical member **102** or cross-bar **106**. The height of the vertical members **102** can be sized as required or desired and, for example, may be 80 inches or 93 inches. In an example implementation, the width between the left and right vertical members **102** may be about 51 inches. The depth between the froward and rearward vertical member **102** may be 16 inches, 30 inches, or 41 inches, in some example implementations, as required or desired. These dimensions of the weight rack **100** are provided as examples only, and the height, width, and depth dimensions can be set to any length as required or desired.

[0027] FIG. **2** depicts a perspective view of a weight arm assembly **200** coupled to the vertical member **102** of the weight rack **100** (shown in FIG. **1**). The vertical member **102** defines a longitudinal axis **114** that extends in a vertical direction and that the holes **112** are spaced along. The vertical member **102** is presented as transparent in FIG. **2** for illustrative purposes. The weight arm assembly **200** is coupled to the vertical member **102** and is slidable along the longitudinal axis **114** so that the weight arm assembly **200** is selectively positionable along the vertical member **102**. The weight arm assembly **200** includes a trolley assembly **202** that couples to the vertical member **102** and a weight arm **204** that is rotatably mounted to an arm bracket **206** of the trolley assembly **202**. The weight arm **204** is rotatable around a rotation axis **208** that is substantially orthogonal (but offset) to the longitudinal axis **114**. In the example, the weight arm **204** may be rotatable along an arc **209** approximately 180° around the rotation axis **208** for various exercises as required or desired. Additionally, the arm bracket **206** includes a plurality of apertures **210** that allows the weight arm **204** to be locked into place in one or more rotational positions along the arc relative to the rotation axis **208** or to allow for different starting positions for the weight arm **204**. As shown in FIG. **2**, the weight arm **204** is substantially parallel to the vertical member **102** and in a downwards position. Such a downward position is typical when the weight arm **204** is not in use (e.g., being pivoted by a user for storage).

[0028] The weight arm **204** includes a first end **212** that rotatably couples to the arm bracket **206** and an opposite second end **214** that is configured to rotate around the rotation axis **208**. In the example, the second end **214** may include a bumper **216** for when the weight arm **204** is in the downwards position. The weight arm **204** includes a plurality of holes **218** defined therein and spaced between the first and second ends **212**, **214**. A weight bar member **220** is configured to attach to the weight arm **204** via the holes **218**. The weight bar member **220** is shown as separated in FIG. **2** for clarity. In an example implementation, at least some of the holes **218** may include indicia to assist in placement of attachments such as the weight bar member **220**. The weight bar member **220** includes a handle **222**, a bracket **224**, and a weight bar **226**. The bracket **224** is configured to at least partially receive the weight arm **204** and secure thereto with fasteners (e.g., bolts extending through the holes **218**). It is appreciated that other attachment members (e.g., a leg roller attachment—not shown) may be used with the weight arm **204** as required or desired.

[0029] The trolley assembly **202** can include a handle **228** and an adjustment pin **230**. The adjustment pin **230** selectively engages with the holes **112** within the vertical member **102** to define the position of the weight arm assembly **200** along the longitudinal axis **114**. For example, when the adjustment pin **230** is engaged with the vertical member **102**, the position of the trolley assembly **202** is fixed relative to the vertical member **102**, and when the adjustment pin **230** is disengaged with the vertical member **102**, the trolley assembly **202** is allowed to slide along the longitudinal axis **114** for repositioning.

[0030] While FIG. **2** illustrates a single weight arm assembly **200** coupled to the vertical member **102**, it should be appreciated that a pair of weight arm assemblies **200** are often used together and mounted on the weight rack **100**. For example, the weight arm assembly **200** is mounted to each of the front left and right vertical members **102** for use and as illustrated in FIGS. **3** and **4**. Each weight arm assembly **200** can thus be used individually or in combination as required or desired. Further, although the trolley assembly **202** is depicted as configured to moveably position the weight arm assembly **200** slidably along the vertical member **102**, other configurations contemplate a weight arm assembly **200** secured relative to the vertical member **102** either fixedly or via different moveable structures, as known in the art. For example, a trolley assembly may be configured to couple to the vertical member **102**, but not be slidable, and still include the pivoting structure as described further below.

[0031] In operation, the user may load weight plates (not shown) on the weight bar **226** and then, because of the free rotation of the weight arm **204** around the rotation axis **208**, perform any number of exercises, such as, but not limited to, rows, deadlifts, squats, a variety of presses, belt squats, hip/glute thrusts (with leg roller attachment), monolift bench presses, banded jumps, etc. When the weight arm **204** is rotating **209** around the rotation axis **208**, the weight arm **204** moves in a defined plane that is orthogonal to the rotation axis **208**. As illustrated in FIG. **2**, the plane that the

weight arm **204** moves within extends along the longitudinal axis **114** because the rotation axis **208** is substantially orthogonal (but offset) to the longitudinal axis **114**. For some exercises, it is desirable to change the angle of the plane in which the weight arm **204** rotates. As such, and as described further below, the arm bracket **206** is selectively positionable around a pivot axis that is substantially orthogonal to both the longitudinal axis **114** and the rotation axis **208**. This allows for the further modification of the exercises as required or desired. Additionally, the user may lock the weight arm **204** in place for exercises like dips, L-sits, pull-up and pull-up variations, etc. Even when the weight arm **204** is locked in place, it may be desirable to change the angle of the plane that the weight arm **204** extends within.

[0032] FIG. **3** depicts a pair of weight arm assemblies **200***a*, **200***b* in a downward position. FIG. **4** depicts the pair of weight arm assemblies **200***a*, **200***b* in an upward position. Referring concurrently to FIGS. **3** and **4**, left and right vertical members **102***a*, **102***b* are illustrated with left and right weight arm assemblies **200***a*, **200***b* positioned thereon and at a height **232** relative to the underlying surface. As illustrated, the left arm bracket **206***a* of the left trolley assembly **202***a* is pivoted so that the left weight arm **204***a* is positioned outward relative to the left vertical member **102***a* in the downward position and positioned inward relative to the left vertical member **102***a* in the upward position. A plane **234***a* that the left weight arm **204***a* moves within is thus defined by a pivot angle **236***a* relative to the left longitudinal axis **114***a*. The angle **236***a* is the same in both the downward and upward positions, but mirrored relative to the height **232** of the left weight arm assembly **200***a* and on opposite sides of the left vertical member **102***a*.

[0033] Similarly, the right arm bracket **206***b* of the right trolley assembly **202***b* is pivoted so that the right weight arm **204***b* is positioned outward relative to the right vertical member **102***b* in the downward position and positioned inward relative to the right vertical member **102***b* in the upward position. A plane **234***b* that the right weight arm **204***b* moves within is thus defined by a pivot angle **236***b* relative to the right longitudinal axis **114***b*. The angle **236***b* is the same in both the downward and upward positions, but mirrored relative to the height **232** of the right weight arm assembly **200***b* and on opposite sides of the right vertical member **102***b*.

[0034] In the example, the plane **234** that the weight arm **204** rotates within may be parallel to the longitudinal axis **114** and as illustrated in FIG. **2**, or the plane **234** may be non-parallel to the longitudinal axis **114** and as illustrated in FIGS. **3** and **4**. The pivot angle **236** of the weight arm **204** may be up to and including +/−20°, or greater, relative to the longitudinal axis **114**. As illustrated in FIGS. **3** and **4**, the left and right weight arms **204***a*, **204***b* are pivoted in opposite directions, and thus, are independently pivotable relative to each other. At each pivot angle **236** of the weight arm **204**, including a centered positions illustrated in FIG. **2**, the weight arm **204** is rotatable around the rotation axis **208** (shown in FIG. **2**). In other examples, the weight arm **204** may be locked in position relative to the rotation axis **208** at each pivot angle **236**.

[0035] FIG. **5** depicts a partial isometric view of the weight arm assembly **200**. FIG. **6** depicts a side elevation view of the weight arm assembly **200**. FIG. **7** depicts an isometric view in cross-section of the weight arm assembly **200**. Referring concurrently to FIGS. **5-7**, the weight arm assembly **200** includes the weight arm **204** rotatably mounted to the trolley assembly **202**. The trolley assembly **202** includes a first trolley member **238** configured to be disposed on a first side of the vertical member **102** (shown in FIG. **2**) and a second trolley member **240** configured to be disposed on an opposite, second side of the vertical member **102**. The trolley assembly **202** can also include the arm bracket **206**. The first trolley member **238** couples to the second trolley member **240** to capture the vertical member **102** therebetween. Once the trolley assembly **202** is attached to the vertical member **102**, the trolley assembly **202** is configured to slide along the longitudinal axis and be selectively secured in place via the adjustment pin **230**. The first trolley member **238** is coupled to the second trolley member **240** via a plurality of fasteners **242** (e.g., bolt and nut) that are oriented substantially orthogonal (but offset) to the rotation axis **208** of the weight arm **204**. Additionally, one or more alignment tabs **243** may be used to facilitate alignment between the first trolley member **238** and the second trolley member **240**.

[0036] The arm bracket **206** is configured to rotatably support the weight arm **204** via a bearing **244**, e.g., a hinge or sleeve bearing, that defines the rotation axis **208**. The arm bracket **206** is pivotably coupled, e.g., via a sleeve bearing, to the second trolley member **240** at a pivot point **246**. The pivot point **246** defines a pivot axis **248** that is substantially orthogonal to the longitudinal axis **114** of the vertical member **102**. The pivot axis **248** is also substantially orthogonal (but offset) to the rotation axis **208**. The pivot axis **248** may be parallel to the fasteners **242** that couple the first and second trolley members **238**, **240** together. The pivoting **249** of the weight arm **204** and the arm bracket **206** is around the pivot axis **248** is described above in reference to FIGS. **3** and **4**. The pivot axis **248** is substantially oriented in a horizontal direction. The pivot axis **248** may be positioned below the rotation axis **208** within the trolley assembly **202**. The pivot axis **248** is not vertical, e.g., not parallel to the longitudinal axes **114** of the vertical members **102** and the trolley assembly **202** does not pivot in a vertical axis direction; rather, the trolley assembly **202** can slide relative to a vertical axis.

[0037] The pivot position of the arm bracket **206** around the pivot axis **248** can be releasably secured by a position lock assembly **250**. The position lock assembly **250** includes an engagement pin **252** that is supported on the arm bracket **206** spatially offset from the pivot point **246** and a guide plate **254** coupled to the second trolley member **240**. The engagement pin **252** is selectively engageable with the guide plate **254** to define the pivot angle **236** (shown in FIGS. **3** and **4**) of the arm bracket **206** relative to the longitudinal axis **114** of the respective vertical member **102** and thus the pivot angle position of the weight arm **204**.

[0038] For example, when the position lock assembly **250** is in a first configuration (e.g., as shown in FIGS. **5-7**), the engagement pin **252** engages with the guide plate **254** to define the pivot angle **236** of the arm bracket **206** relative to the second trolley member **240**. In this first configuration, the pivot angle **236** may be 0° relative to the longitudinal axis **114** and be substantially parallel thereto. The position lock assembly **250** is moveable to a second configuration (e.g., as shown in FIGS. **3** and **4**), whereby the engagement pin **252** engages with a different area of the guide plate **254** to define a different pivot angle **236** of the arm bracket **206** relative to the second trolley member **240** and the longitu-

dinal axis **114**. Additionally, the position lock assembly **250** is also positionable in a third configuration (not shown), whereby the engagement pin **252** disengages with the guide plate **254** and allows the arm bracket **206** to freely pivot around the pivot axis **248** between at least two different pivot angles **236**. In an example implementation, a distal end of the engagement pin **252** may include an enlarged or flanged head as a handle for the user to operate the position lock assembly **250**.

[0039] In the example, a spring **256** biases the engagement pin **252** towards the guide plate **254** and towards an engaged position to lock the pivot angle **236** of the arm bracket **206**. In an example implementation, the spring **256** is a compression spring. In operation, the user pulls on the head end of the engagement pin **252**, overcoming the spring force, in order to withdraw and disengage the engagement pin **252** from the guide plate **254**. Once released, the engagement pin **252** is biased back towards the engaged and extended position. The position lock assembly **250** can also include a guide pin **258** coupled to the arm bracket **206** and extending therefrom. The guide pin **258** slidably engages with the guide plate **254** to define the pivot limits of the arm bracket **206** around the pivot axis **248**.

[0040] The second trolley member **240** is formed from a housing **260** that is disposed at least partially around the vertical member **102**. The housing **260** supports a pair of top and bottom rollers **262** that are configured to roll against the side of the vertical member **102** when the trolley assembly **202** is being moved along the longitudinal axis. The first trolley member **238** is also formed from a housing **264** that is disposed at least partially around the vertical members. The housing **264** supports a pair of top and bottom rollers **266** that are configured to roll against the side of the vertical member **102**. In an example implementation, the rollers **266** oppose the rollers **262** within the trolley assembly **202**, and the rollers **262**, **266** are substantially parallel to the rotation axis **208** of the weight arm **204**. The handle **228** is coupled to the housing **264** and is positioned on the exterior of the housing **264**. In the example, the handle **228** has a substantially circular cross-section that is formed in a U-shape. In an example implementation, the handle **228** is a single handle that is centered on the housing **264**. In another example implementation, the top and bottom connection ends of the handle **228** are positioned adjacent to the top and bottom rollers **266**.

[0041] The adjustment pin **230** is supported on the first trolley member **238**. In an example implementation, the adjustment pin **230** is disposed at least partially within the handle **228**. One end of the adjustment pin **230** is coupled to a lever **268** that is pivotably coupled to the housing **264**. A spring **270** biases the adjustment pin **230** towards the vertical member **102** and toward an engaged position extending from the first trolley member **238**. The adjustment pin **230** is configured to selectively engage (e.g., via extension therein) with the holes of the vertical member **102**. In operation, a user pulls the lever **268** (e.g., in a direction toward the handle **228**), to overcome the force of the spring **270** and retract the adjustment pin **230** so that the trolley assembly **202** can slide along the vertical member **102**. In the example, a projection of the adjustment pin **230** slides within a channel defined within the lever **268** so that pivoting movement of the lever **268** translates into linear movement of the adjustment pin **230**. Once the lever **268** is released, the adjustment pin **230** is biased back toward the engaged and extended position. In an example implementation, the adjustment pin **230**, the engagement pin **252**, and the guide pin **258**, are all substantially parallel with each other and aligned with the pivot axis **248**.

[0042] Turning to FIG. **7**, the weight arm **204** includes a pair of opposing openings **272** disposed proximate to the bearing **244**. The openings **272** are elongated along the length of the weight arm **204**. When the weight arm **204** is positioned in its downward position, at least a portion of the pivot point **246** extends into the opening **272**. This configuration enables the weight arm **204** to be positioned substantially parallel to the vertical member **102** when in the downward position. In an example, the illustrated downward position may correspond to a storage configuration and the openings **272** allow for the weight arm **204** to be positioned closer to the vertical member **102**. Similarly, when the weight arm **204** is positioned in its upward position, at least a portion of the engagement pin **252** may extend into the opening **272** so that the weight arm **204** can be positioned substantially parallel to the vertical member **102**. In an example implementation, the weight arm **204** is rotatable around the rotation axis **208** approximately 180°. In other example implementations, the weight arm **204** may be rotatable around the rotation axis **208** less than 180°, for example, about 175°, 170°, 165°, 160°, or less.

[0043] Additionally, the weight arm **204** includes at least one hole **274** (e.g., a pair of holes) that are on the sides of the weight arm **204** that do not include the openings **272** and are proximate to the bearing **244**. The holes **274** are radially spaced from the bearing **244** and are configured to selectively align with the apertures **210** on the arm bracket **206**. When a hole **274** and an aperture **210** align, a weight arm pin **276** (shown in FIG. **6**) can be used to lock the rotational position of the weight arm **204** relative to the rotation axis **208**. In the example, a pair of holes **274** are used because the apertures **210** may have different radial spacing from the rotation axis **208** as shown in FIG. **6**. In the example implementation depicted, the downward position aperture **210'** is radially different than the others. In other examples, the weight arm pin **276** may be coupled only to the arm bracket **206** and be used as a rotational stop for the freely rotatable weight arm **204**. This configuration can reduce the angle of rotation of the weight arm **204** to angles that are less than 180°.

[0044] FIG. **8** depicts an exploded isometric view of the first trolley member **238** of the weight arm assembly **200** (shown in FIG. **2**). The first trolley member **238** includes a housing **264** that supports a plurality of components. In the example, the housing **264** may have two parallel side plates **265***a*, **265***b* with top and bottom cross plates **267***a*, **267***b* extending therebetween. The side plates may have flanges **278** that are used to couple the first trolley member **238** to the second trolley member **240** via fasteners **242** and alignment tabs **243** (both shown in FIG. **6**). A pair of liners **280** may couple to the inside of the parallel side plates **265***a*, **265***b* of the housing **264**. Top and bottom rollers **266** also couple between the parallel side plates **265***a*, **265***b* of the housing **264**. The handle **228** couples to the top and bottom cross plates **267***a*, **267***b* of the housing **264**. A pin sleeve **282** couples to the housing **264** and slidably supports the adjustment pin **230** with the spring **270** disposed therein. An end cap **284** attaches to one end of the adjustment pin **230** and is used to couple the lever **268** that pivotably couples to the housing **264** via a lever bracket **286**.

[0045] FIG. **9** depicts an exploded isometric view of the second trolley member **240** of the weight arm assembly **200** (shown in FIG. **2**). The second trolley member **240** has the housing **260** that supports a plurality of components. In the example, the housing **260** may have two parallel side plates **260***a*, **260***b*. The side plates **260***a*, **260***b* may have flanges **288** that are used to couple the second trolley member **240** to the first trolley member **238** via fasteners **242** and alignment tabs **243** (both shown in FIG. **6**). Top and bottom rollers **262** coupled between the parallel side plates **260***a*, **260***b*. The guide plate **254** is also coupled between the parallel side plates **260***a*, **260***b* proximate the top roller **262**. The guide plate **254** defines two or more pin receivers. In this example, the guide plate **254** has a center pin receiver **290** and left and right pin receivers **292**, **294**. The left and right pin receivers **292**, **294** may be formed as slots with a plurality of semi-circular grooves formed within at least one side of the slot. In an example implementation, the left and right pin receivers **292**, **294** are symmetrical relative to the center pin receiver **290**.

[0046] The pin receivers **290**, **292**, **294** are configured to at least partially receive the engagement pin **252** of the position lock assembly **250** (both shown in FIG. **7**) and lock the pivot angle of the arm bracket **206** (shown in FIG. **7**) relative to the second trolley member **240**. For example, when the engagement pin **252** engages with the center pin receiver **290**, the arm bracket **206** is parallel to the longitudinal axis **114** of the vertical member **102**. When the engagement pin **252** engages with one of the left and right pin receivers **292**, **294** the arm bracket **206** is defined with a pivot angle **236** as shown in FIGS. **3** and **4** with respect to the longitudinal axis **114**. In an example implementation, the left and right pin receivers **292**, **294** define +/−10°, 15°, and 20° angles. A greater or lesser number of pin receivers are also contemplated. It is appreciated, that the left and right pin receivers **292**, **294** can define any other angular position as required or desired. In other examples, the left and right pin receivers **292**, **294** may include discrete holes instead of slots.

[0047] Additionally, the guide plate **254** includes an arcuate channel **296** disposed below the pin receivers. The arcuate channel **296** is configured to slidingly receive at least a portion of the guide pin **258** (shown in FIG. **7**). The arcuate channel **296** increases performance of the pivoting motion of the arm bracket **206** relative to the second trolley member **240**. Additionally, the lateral ends of the arcuate channel **296** can form pivot stops for the arm bracket **206** and define the pivot limits of the arm bracket **206** around the pivot axis. In an example implementation, the pivot limits of the arm bracket **206** are +/−20° relative to the center pin receiver **290** and the centered position.

[0048] The second trolley member **240** also includes a swivel rod **298** that extends from the housing **260** and forms a portion of the pivot point for the arm bracket **206**. In the example, the swivel rod **298** is fixedly supported on the housing **260** by a pair of cross plates **300**.

[0049] FIG. **10** depicts an exploded isometric view of the arm bracket **206** and the components supported thereon of the weight arm assembly **200** (shown in FIG. **2**). The arm bracket **206** couples between the second trolley member **240** (shown in FIG. **9**) and the weight arm **204** (shown in FIG. **7**). The arm bracket **206** is substantially U-shaped with two side plates **302**, **304** and a base plate **306** with top and bottom slots **305**, **307** in each of the side plates **302**, **304**. The base plate **306** is pivotably coupled to the swivel rod **298** (shown in FIG. **9**) of the second trolley member **240** via a swivel tube **308** that mounts to the arm bracket **206** via a plate **310** extending across the side plates **302**, **304** and seats within slots **307** at the bottom of the arm bracket **206**. The plate **310** may also act as a stop plate to restrict the weight arm **204** from pivoting past the plate **310** and define the downward position as illustrated in FIG. **2**. A nut **312** is used to secure the swivel tube **308** on the swivel rod **298**. In the example, the swivel tube **308** is disposed proximate to the bottom of the arm bracket **206**. The bearing **244** is used to rotatably couple the weight arm **204** to the arm bracket **206** between the two side plates **302**, **304**. The bearing **244** spans between the two side plates **302**, **304** and is approximately centered therein.

[0050] The engagement pin **252** and the surrounding, concentric spring **256** are supported within a sleeve **314** connected to an end plate **315** that seats within slots **305** at the top of the arm bracket **206**. The end plate **315** can also function as a stop plate to restrict the weight arm **204** from pivoting past the plate and thereby define the upward position as illustrated in FIG. **4**. In an example implementation, the end plate **315** may include a plastic pad component **317** to reduce metal on metal contact. The engagement pin **252** is configured to selectively engage with the guide plate **254** (shown in FIG. **9**) and define the pivot angle of the arm bracket **206**. When the engagement pin **252** is engaged with the guide plate **254**, the arm bracket **206** is fixed in position and is not freely rotatable around the pivot axis **248**. The engagement pin **252** extends through the base plate **306**. Additionally, the base plate **306** supports the guide pin **258**. In an example implementation, the guide pin **258** may be a threaded bolt and nut with a spacer that rides within the arcuate channel within the guide plate **254**. The side plates **302**, **304** also include the plurality of apertures **210** that are configured to selectively receive the weight arm pin **276** as illustrated in FIG. **6**.

[0051] FIGS. **11** and **12** illustrate different pivot angle positions of the arm bracket **206** relative to the second trolley member **240**. As described above, the arm bracket **206** is pivotable relative to the second trolley member **240**, and thus relative to the longitudinal axis **114** of the corresponding vertical member **102**, around the pivot axis **248** (shown in FIG. **7**). The position lock assembly **250** enables the user to selectively engage the engagement pin **252** with the guide plate **254** to define the pivot angle of the arm bracket **206**, and thus the weight arm **204** (shown in FIG. **7**), for a required or desired exercise. The arm bracket **206** can pivot in either direction around the pivot axis **248**.

[0052] All directional references (e.g., proximal, distal, upper, lower, upward, downward, left, right, lateral, longitudinal, front, back, top, bottom, above, below, vertical, horizontal, radial, axial, clockwise, counterclockwise, etc.) are only used for identification purposes to aid the reader's understanding of the structures disclosed herein, and do not create limitations, particularly as to the position, orientation, or use of such structures. Connection references (e.g., attached, coupled, connected, and joined) are to be construed broadly and may include intermediate members between a collection of elements and relative movement between elements unless otherwise indicated. As such, connection references do not necessarily infer that two elements are directly connected and in fixed relation to each other. The exemplary drawings are for purposes of illustration only and

the dimensions, positions, order, and relative sizes reflected in the drawings attached hereto may vary.

[0053] It is to be understood that this disclosure is not limited to the particular structures, process steps, or materials disclosed herein, but is extended to equivalents thereof as would be recognized by those ordinarily skilled in the relevant arts. It should also be understood that terminology employed herein is used for the purpose of describing particular examples only and is not intended to be limiting. It must be noted that, as used in this specification, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Moreover, one having skill in the art will understand the degree to which terms such as "about," "approximately," or "substantially" convey in light of the measurement techniques utilized herein. To the extent such terms may not be clearly defined or understood by one having skill in the art, the term "about" shall mean plus or minus ten percent.

[0054] As used herein, including in the claims, the term "and/or," when used in a list of two or more items, means that any one of the listed items can be employed by itself, or any combination of two or more of the listed items can be employed. For example, if a composition is described as containing components A, B, and/or C, the composition can contain A alone; B alone; C alone; A and B in combination; A and C in combination; B and C in combination; or A, B, and C in combination. Also, as used herein, including in the claims, "or" as used in a list of items (for example, a list of items prefaced by a phrase such as "at least one of" or "one or more of") indicates a disjunctive list such that, for example, a list of "at least one of A, B, or C" means A or B or C or AB or AC or BC or ABC, or A and B and C.

[0055] It will be clear that the systems and methods described herein are well adapted to attain the ends and advantages mentioned as well as those inherent therein. The terms "example" and "exemplary," when used in this description, mean "serving as an example, instance, or illustration," and not "preferred" or "advantageous over other examples." Those skilled in the art will recognize that the methods and systems within this specification may be implemented in many manners and as such is not to be limited by the foregoing examples. In this regard, any number of the features of the different examples described herein may be combined into one single example and alternate examples having fewer than or more than all of the features herein described are possible.

[0056] While various examples have been described for purposes of this disclosure, various changes and modifications may be made which are well within the scope contemplated by the present disclosure. Numerous other changes may be made which will readily suggest themselves to those skilled in the art and which are encompassed in the spirit of the disclosure.

What is claimed is:

1. A trolley assembly for a weight arm, the trolley assembly comprising

a first trolley member configured to be disposed on a first side of a vertical member of a weight rack, the vertical member defining a longitudinal axis;

a second trolley member configured to be disposed on an opposite, second side of the vertical member of the weight rack, the first trolley member couplable to the second trolley member to capture the vertical member of the weight rack therebetween, the trolley assembly being selectively slidable along the longitudinal axis; and

an arm bracket further

configured to rotatably support the weight arm about a first pivot axis axially transverse to the longitudinal axis and in a plane parallel to the first side of the vertical member; and

pivotably coupled to the second trolley member about a second pivot axis that is orthogonal to both the longitudinal axis and the first pivot axis.

2. The trolley assembly of claim **1**, wherein the second pivot axis does not intersect with the first pivot axis.

3. The trolley assembly of claim **1**, wherein the second pivot axis is located below the first pivot axis with respect to the longitudinal axis of the vertical member.

4. The trolley assembly of claim **1** further comprising a position lock assembly including

an engagement pin supported on the arm bracket and spaced apart from the second pivot axis; and

a guide plate coupled to the second trolley member, the guide plate defining two or more pin receivers, wherein the position lock assembly is positionable in at least a first configuration and a second configuration, such that

in the first configuration, the engagement pin engages with a first pin receiver to define a first pivot angle of the arm bracket around the second pivot axis relative to the longitudinal axis of the vertical member, and

in the second configuration, the engagement pin engages with a second pin receiver to define a second pivot angle of the arm bracket around the second pivot axis relative to the longitudinal axis of the vertical member and the second pivot angle is different than the first pivot angle.

5. The trolley assembly of claim **4**, wherein the position lock assembly is also positionable in a third configuration such that the engagement pin disengages with the two or more pin receivers and the arm bracket is pivotable around the second pivot axis between at least the first pivot angle and the second pivot angle.

6. The trolley assembly of claim **4**, wherein

the position lock assembly further comprises a guide pin extending from the arm bracket;

the guide plate further defines an arcuate channel receiving at least a portion of the guide pin; and

the arcuate channel defines pivot limits of the arm bracket around the second pivot axis.

7. The trolley assembly of claim **6**, wherein the pivot limits of the arm bracket are +/−20° from a center position that is parallel to the longitudinal axis.

8. The trolley assembly of claim **4**, wherein the engagement pin is spring loaded and biased towards an engaged position with the guide plate.

9. The trolley assembly of claim **1** further comprising an adjustment pin supported on the first trolley member and selectively engageable with the vertical member of the weight rack to lock a position of the trolley assembly along the longitudinal axis.

10. The trolley assembly of claim **9** further comprising at least one handle coupled to the first trolley member.

11. The trolley assembly of claim **10**, wherein the adjustment pin includes a lever disposed within the at least one

handle, connected to the adjustment pin, and operable to engage and disengage the adjustment pin with the vertical member of the weight rack.

12. The trolley assembly of claim **1**, the first trolley member and the second trolley member each include at least one roller positionable against the vertical member of the weight rack.

13. A weight arm assembly for a weight rack, the weight arm assembly comprising a trolley assembly configured to couple to a vertical member of the weight rack, the vertical member defining a longitudinal axis and the trolley assembly being selectively slidable along the longitudinal axis on the vertical member, the trolley assembly comprising

a first trolley member configured to be disposed on a first side of the vertical member of the weight rack;

a second trolley member configured to be disposed on an opposite, second side of the vertical member of the weight rack, the first trolley member couplable to the second trolley member to capture the vertical member of the weight rack therebetween;

an arm bracket pivotably coupled to the second trolley member about a pivot point, the pivot point defining a pivot axis that is orthogonal to the longitudinal axis; and

a weight arm rotatably coupled at a first end to the arm bracket around a rotation axis orthogonal to both the longitudinal axis and the pivot axis and configured to couple to a weight bar member.

14. The weight arm assembly of claim **13**, wherein the pivot axis does not intersect with the rotation axis.

15. The weight arm assembly of claim **13**, wherein the pivot axis is located below the rotation axis with respect to the longitudinal axis of the vertical member.

16. The weight arm assembly of claim **13** further comprising

an engagement pin supported on the arm bracket spatially apart from the pivot point; and

a guide plate coupled to the second trolley member and defining two or more pin receivers, wherein

the engagement pin is selectively engageable within a respective pin receiver of the two or more pin receivers to define a respective pivot angle of the arm bracket relative to the second trolley member, and

the weight arm is rotatable around the rotation axis at each respective pivot angle of the arm bracket.

17. The weight arm assembly of claim **13**, wherein

the arm bracket is substantially U-shaped with two side plates and a base plate;

the base plate is pivotably coupled to the second trolley member; and

the weight arm is rotatably coupled between the two side plates.

18. The weight arm assembly of claim **17**, wherein

the arm bracket further comprises a weight arm pin;

the two side plates each define a plurality of apertures spaced apart relative to the rotation axis; and

the weight arm is selectively positionable about the rotation axis relative to the arm bracket via engagement between the weight arm pin and the plurality of apertures.

19. The weight arm assembly of claim **17**, wherein a stop plate extends within the arm bracket, the stop plate at least partially defining a parallel orientation of the weight arm relative to the vertical member of the weight rack.

20. The weight arm assembly of claim **13**, further comprising an adjustment pin supported on the first trolley member and selectively engageable with the vertical member of the weight rack to lock a position of the trolley assembly along the longitudinal axis.

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