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(54) **JIG FOR SHARPENING MOWER BLADES**

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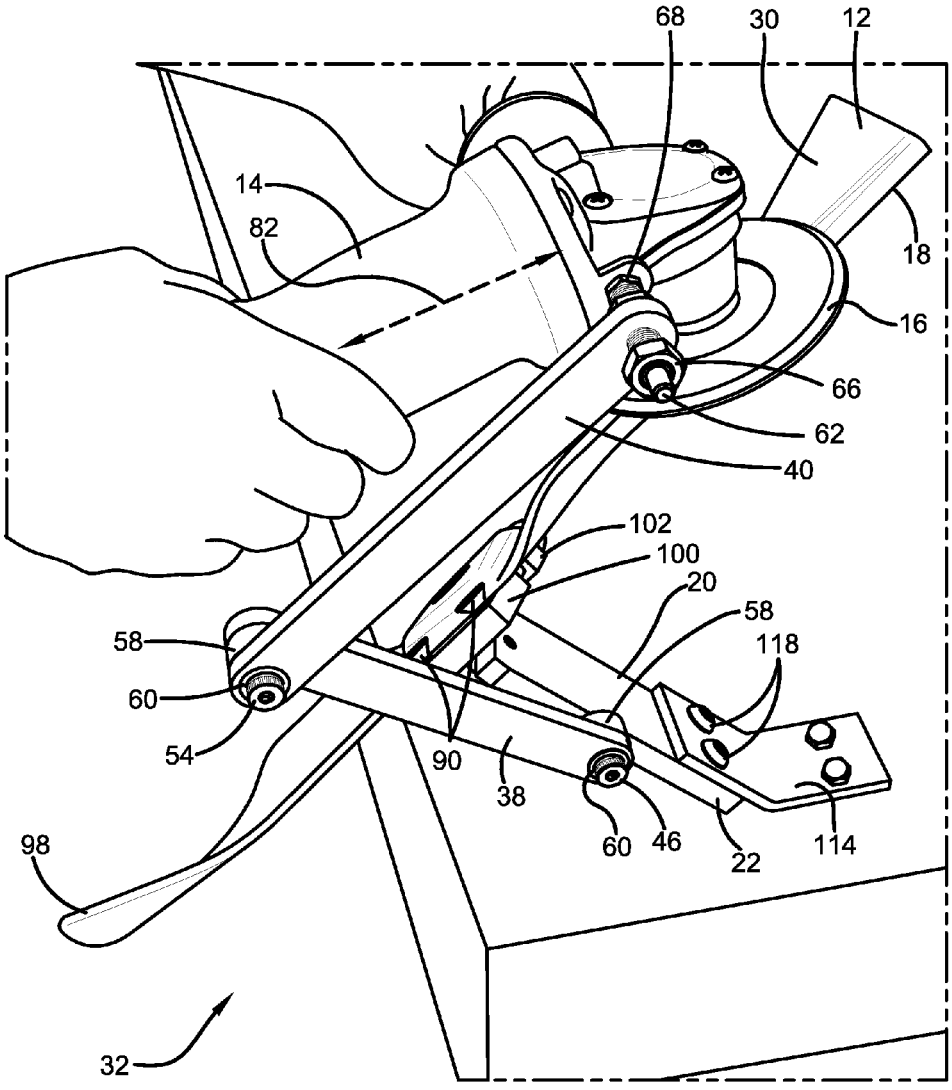
(57) **ABSTRACT**

A jig assembly is disclosed herein for holding a mower blade and a grinding tool during a sharpening operation on the mower blade. The jig assembly includes a mast, a fixture portion, and a jig portion. The fixture portion and jog portion can be mounted to the mast. The jig portion can include an arm and a tool-seat. The arm can include at least a first link and a second link movable relative to one another. The first link can be pivotally connected to the mast with a first pin defining an arm pivot axis. The first link and the second link can be interconnected whereby the second link is prevented from rotating in any plane that contains the arm pivot axis. The tool-seat can be disposed on the second link.



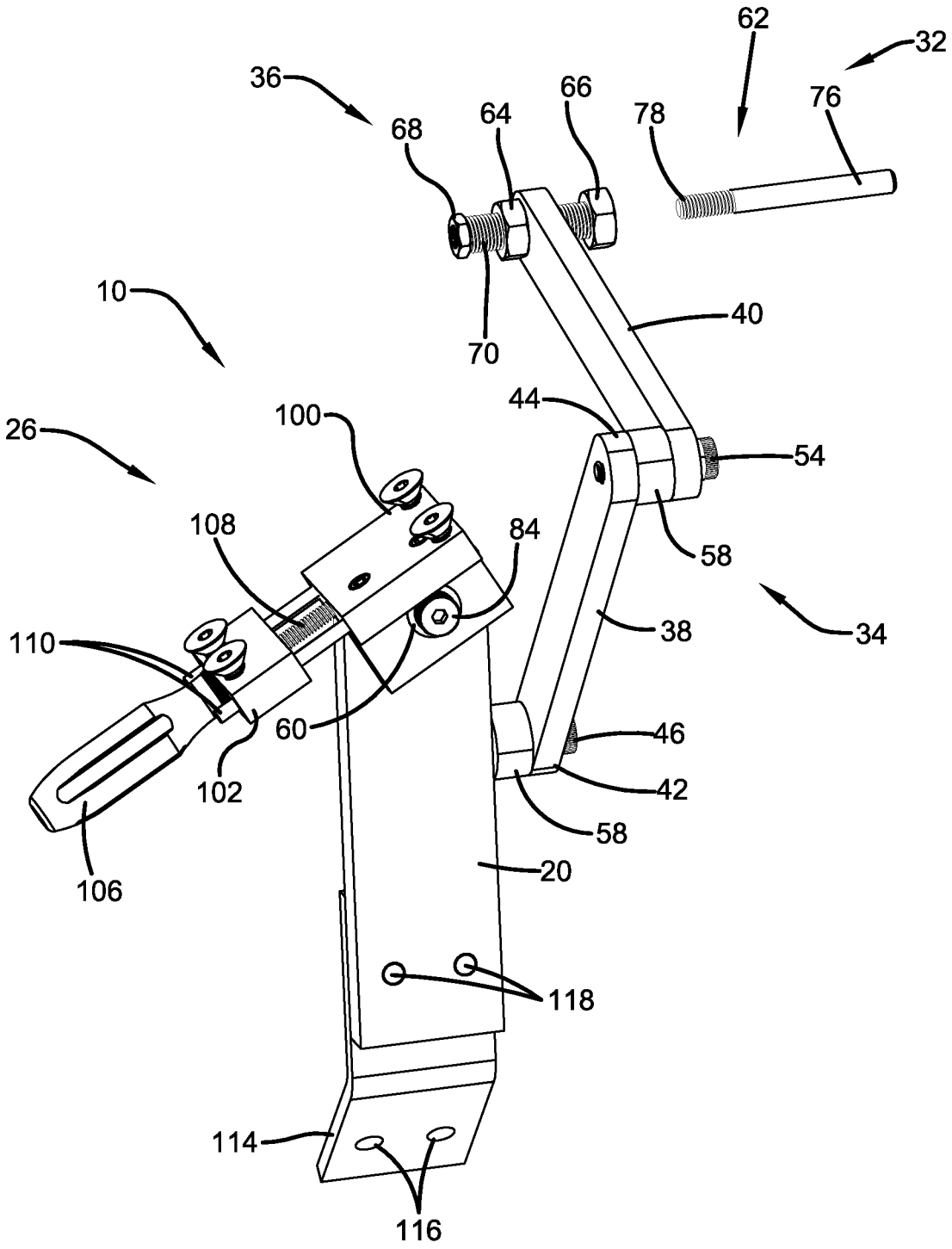

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Figure 1

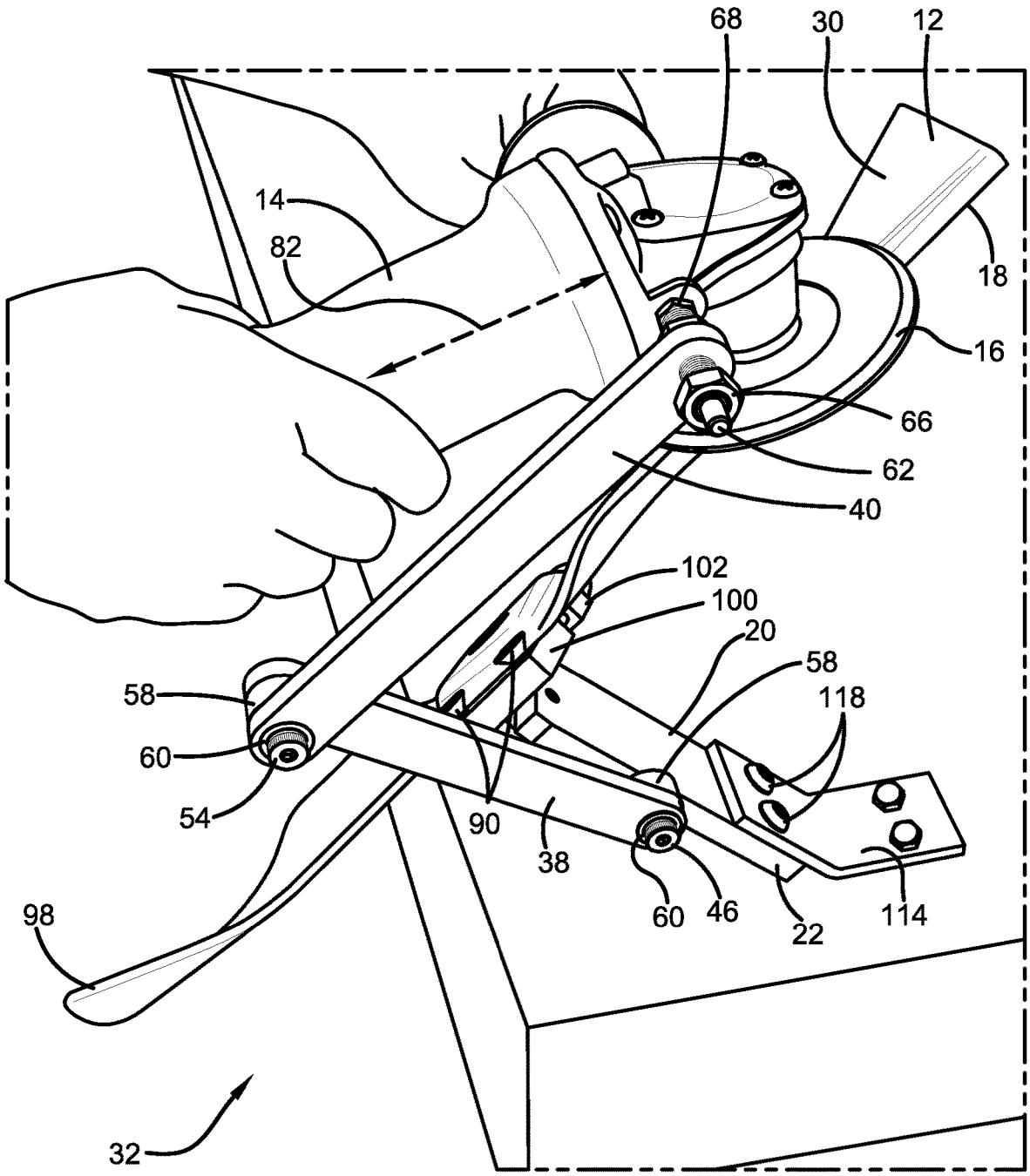
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Figure 2

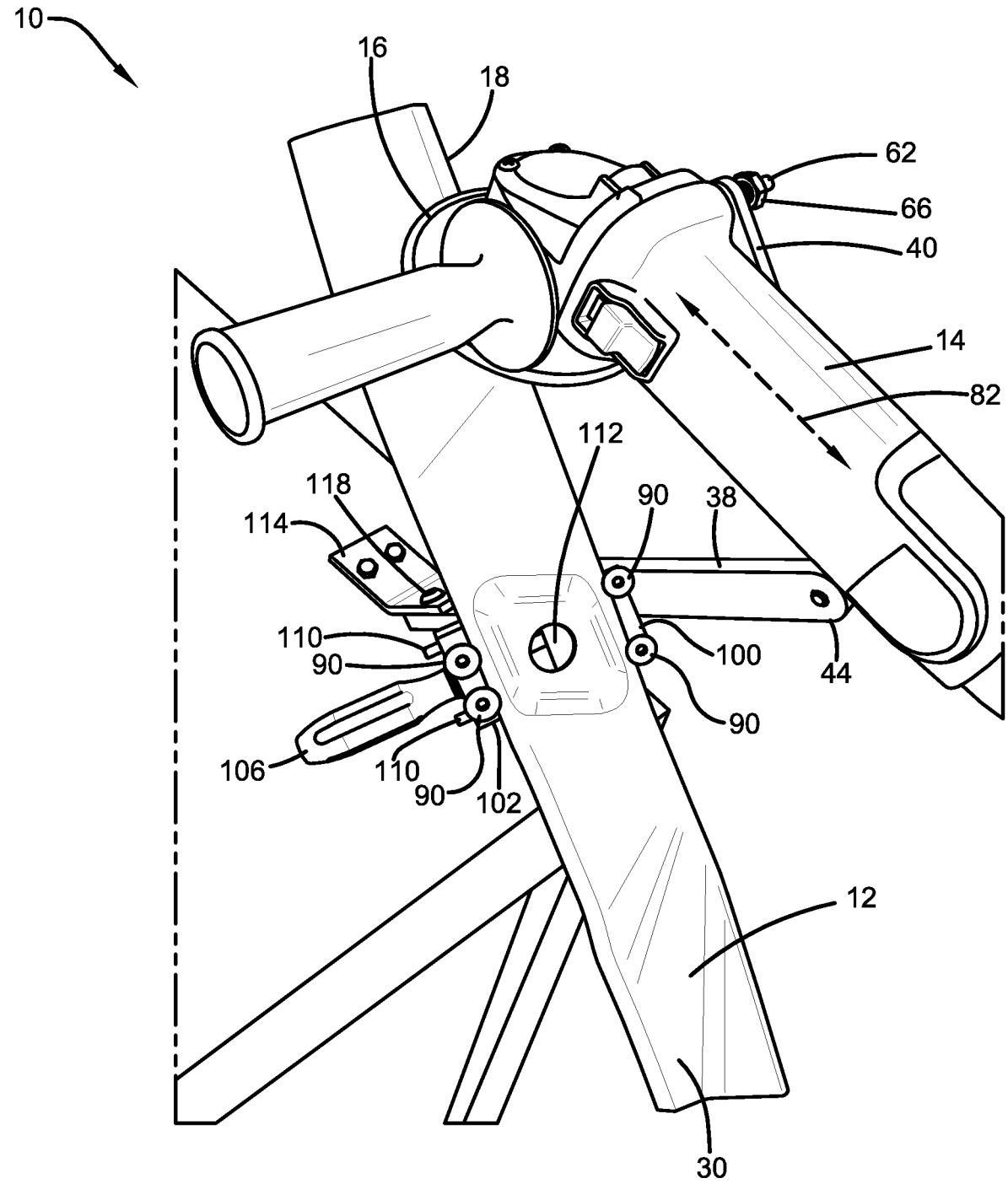
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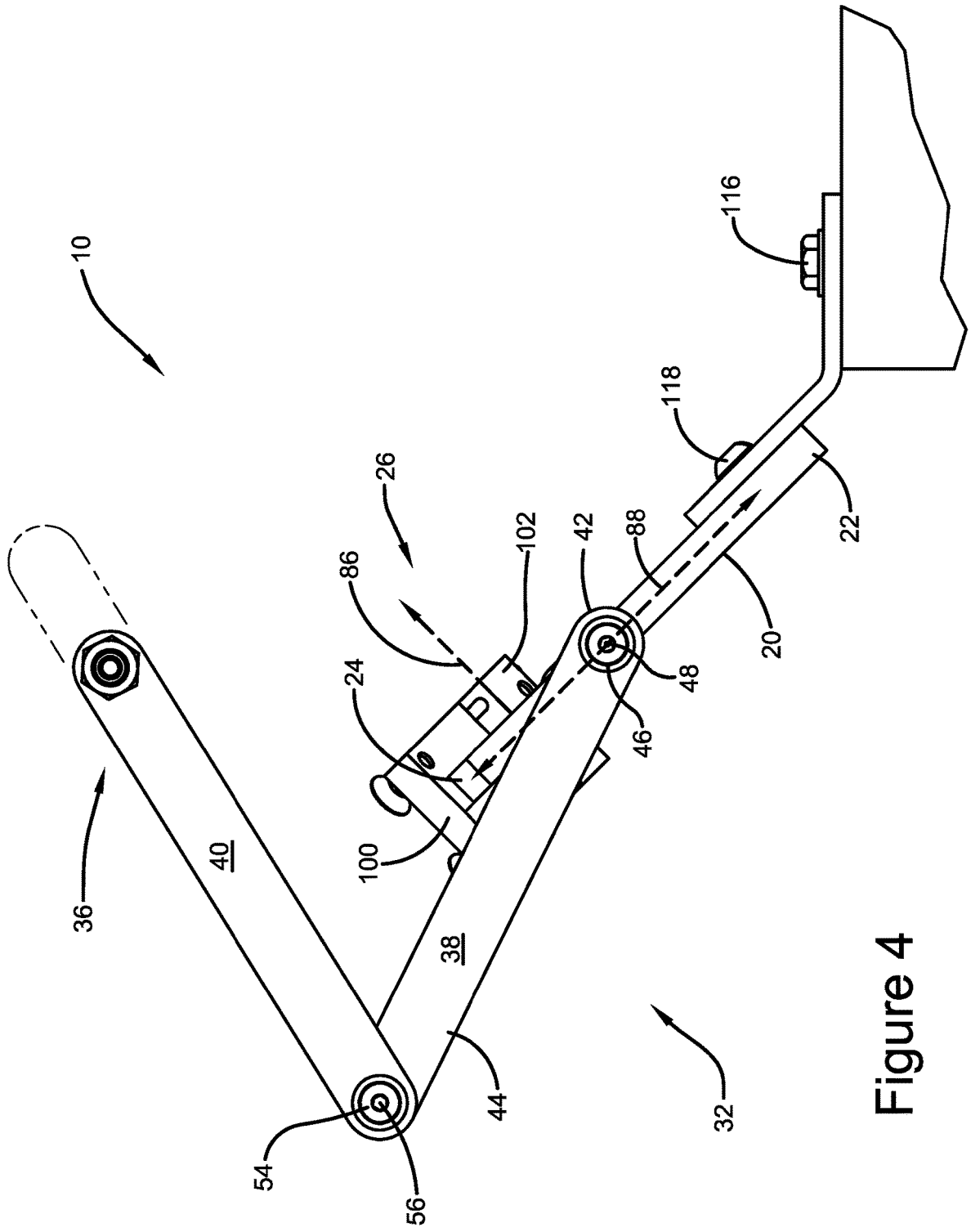
Figure 3



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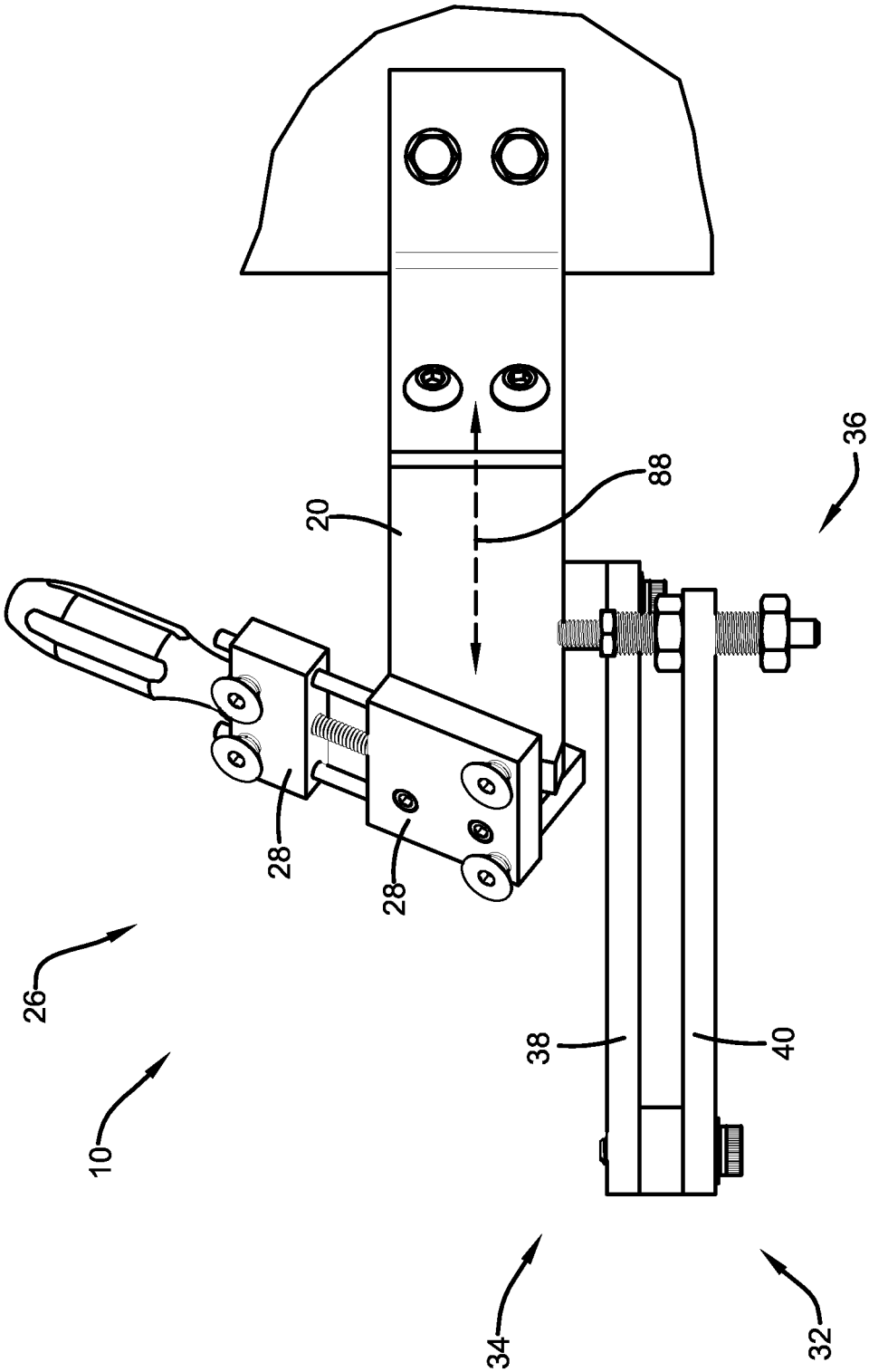

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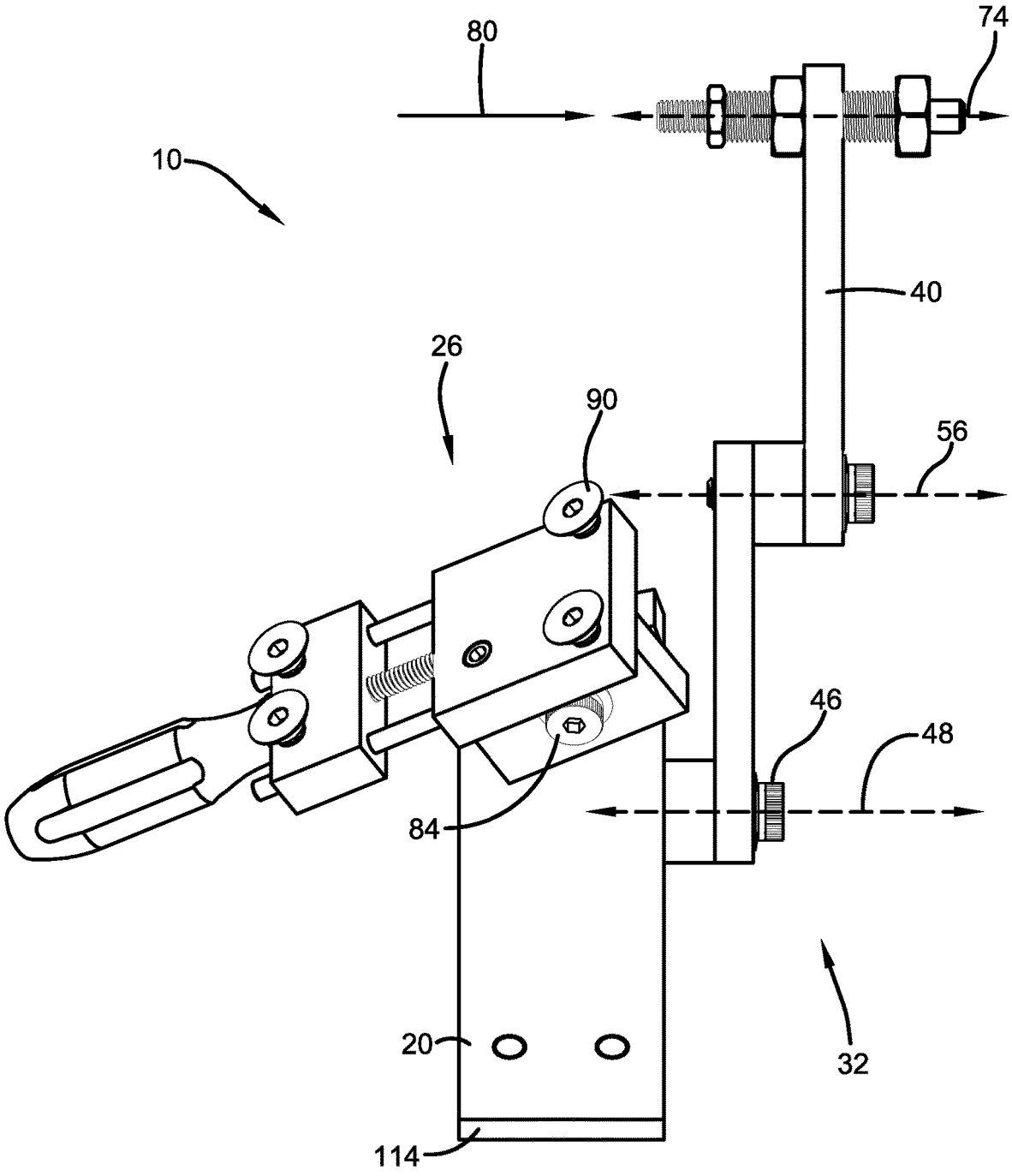

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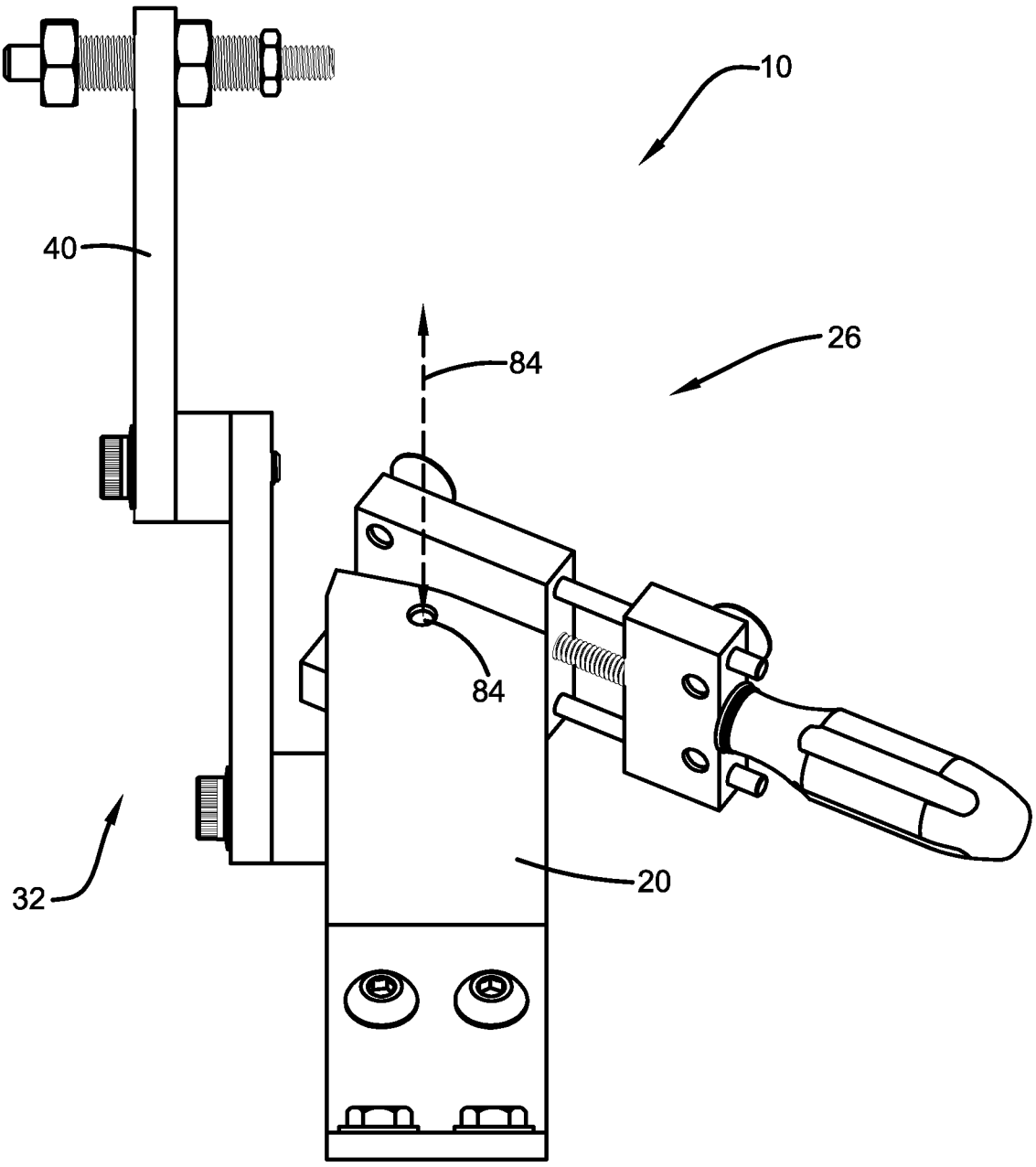

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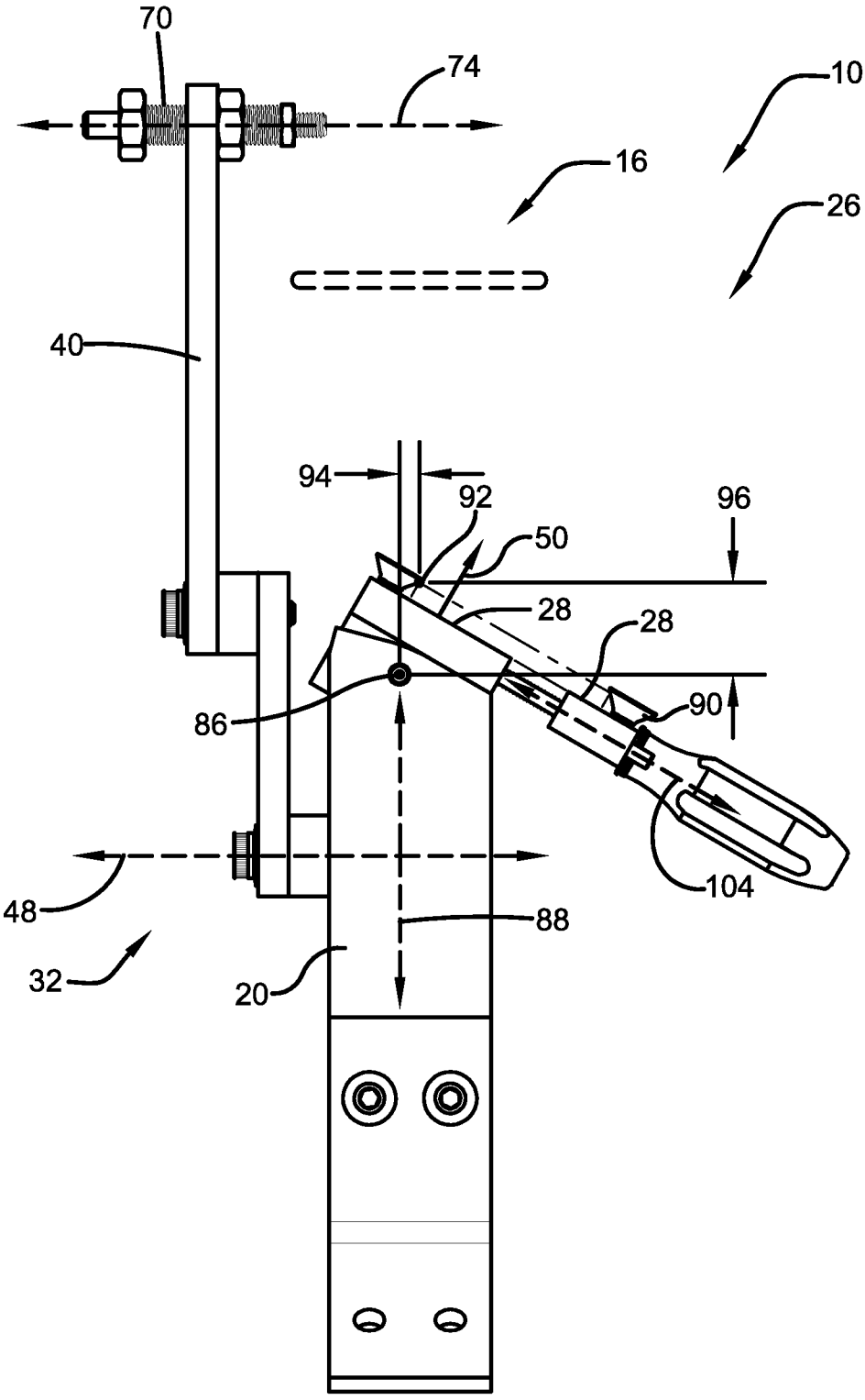

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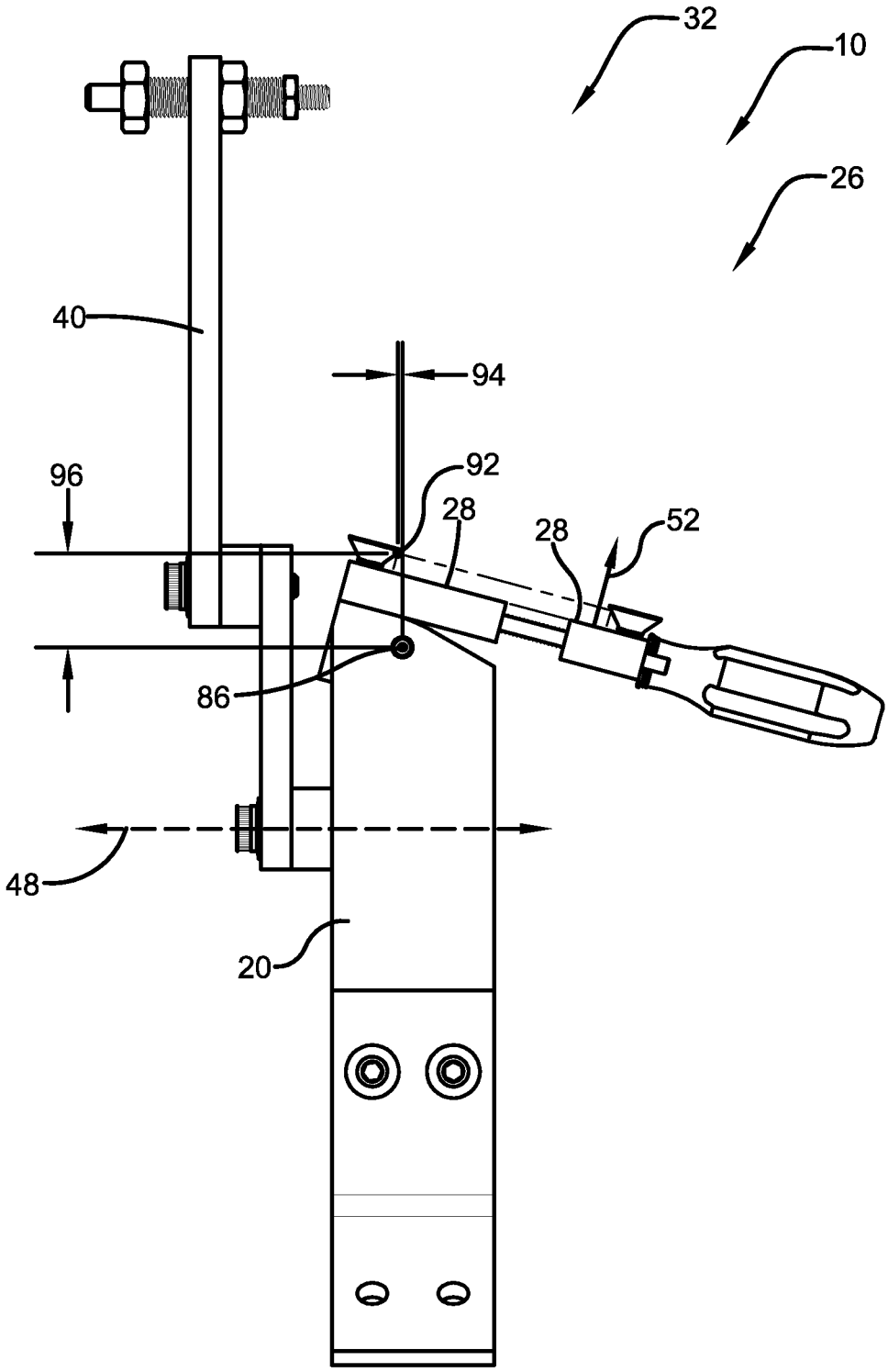

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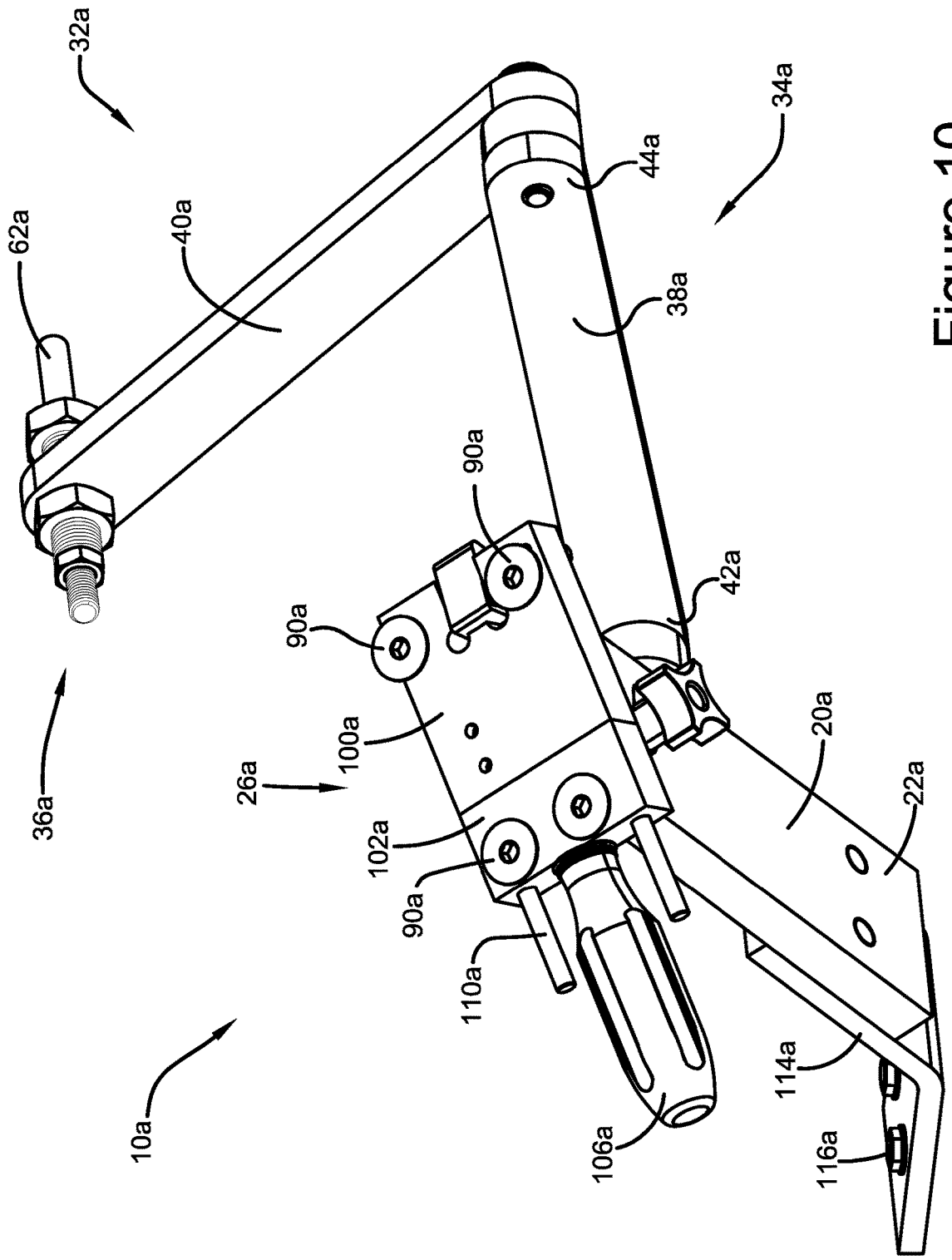
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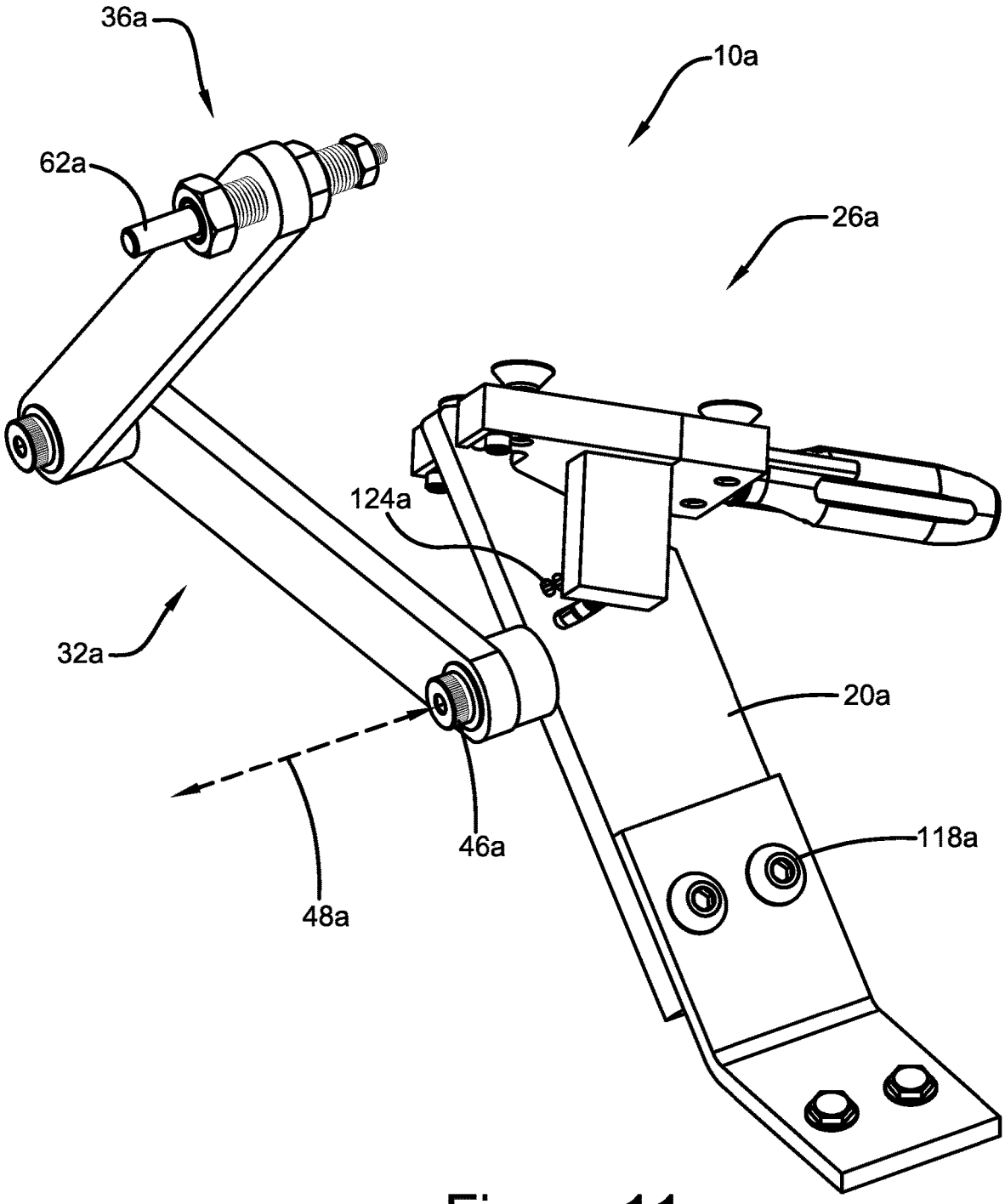
Figure 10



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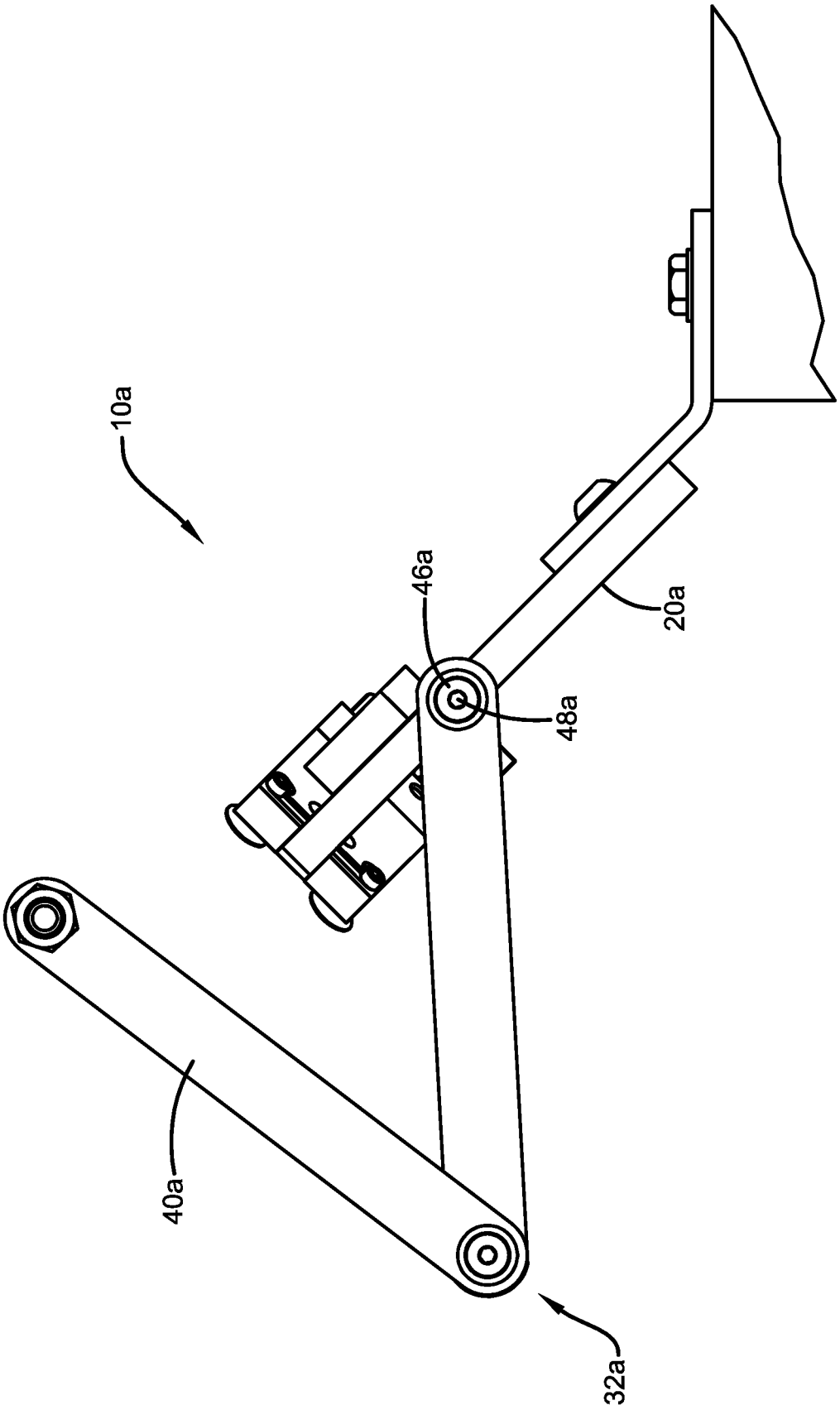


Figure 12

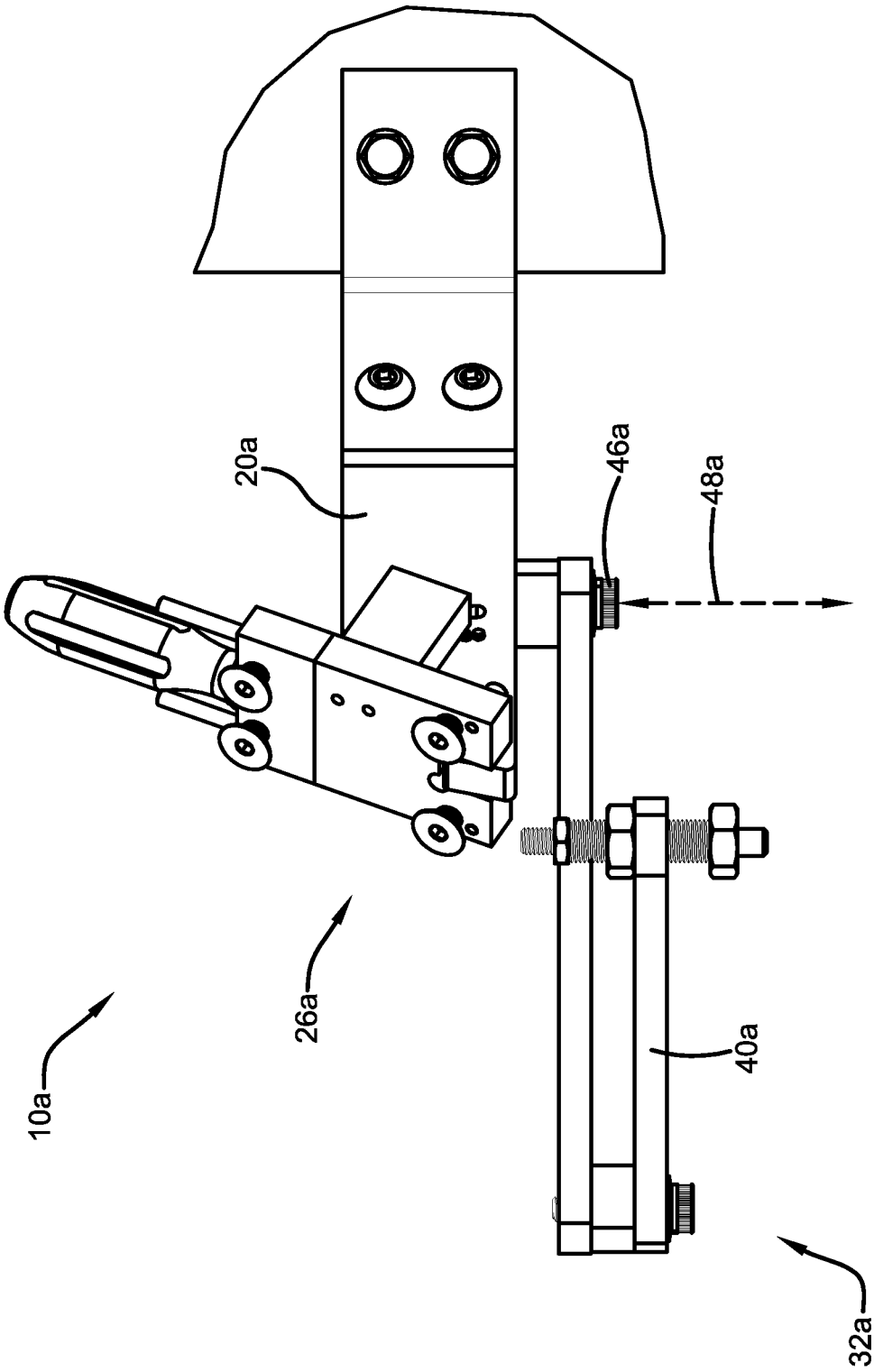


Figure 13

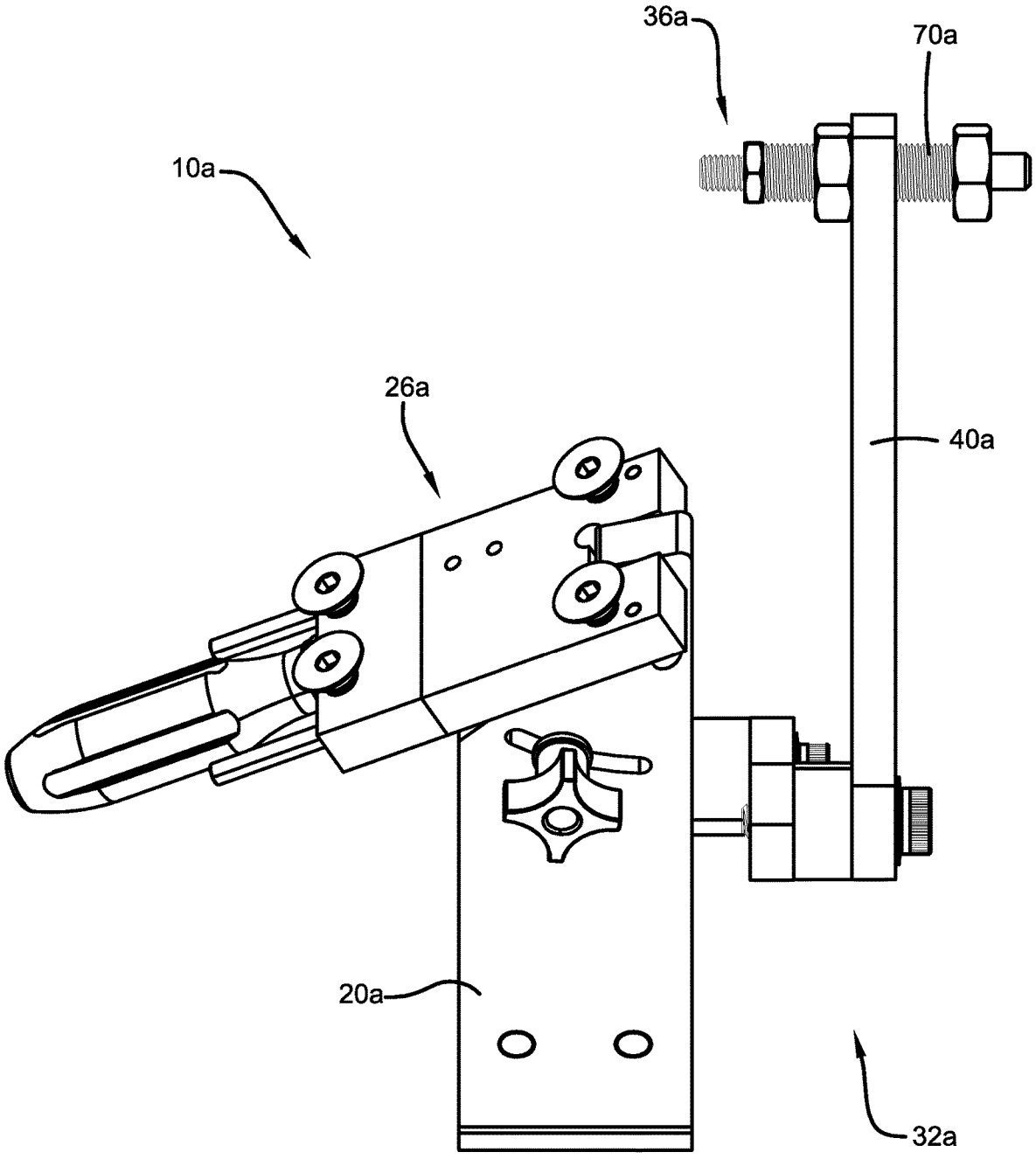
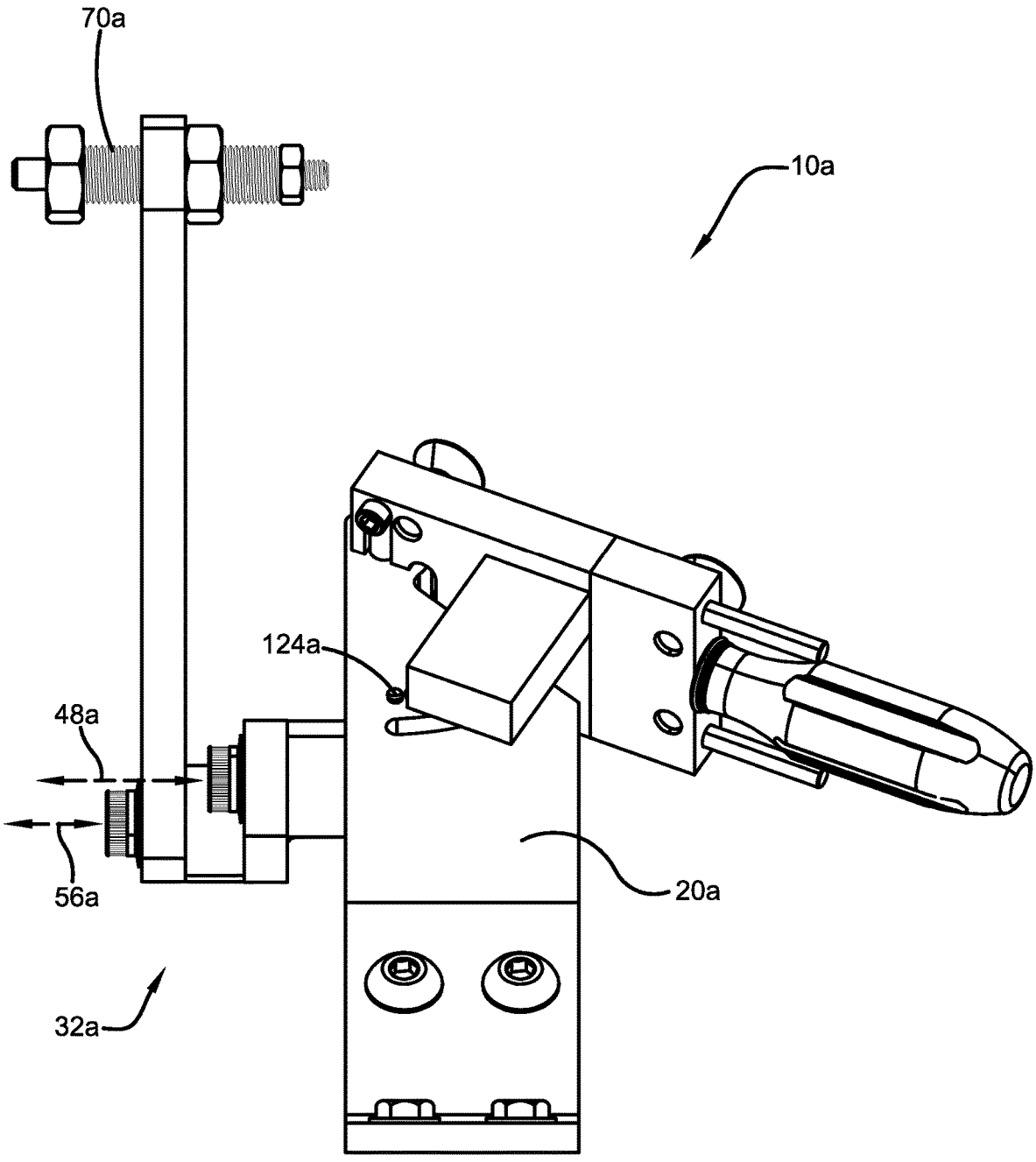


Figure 14



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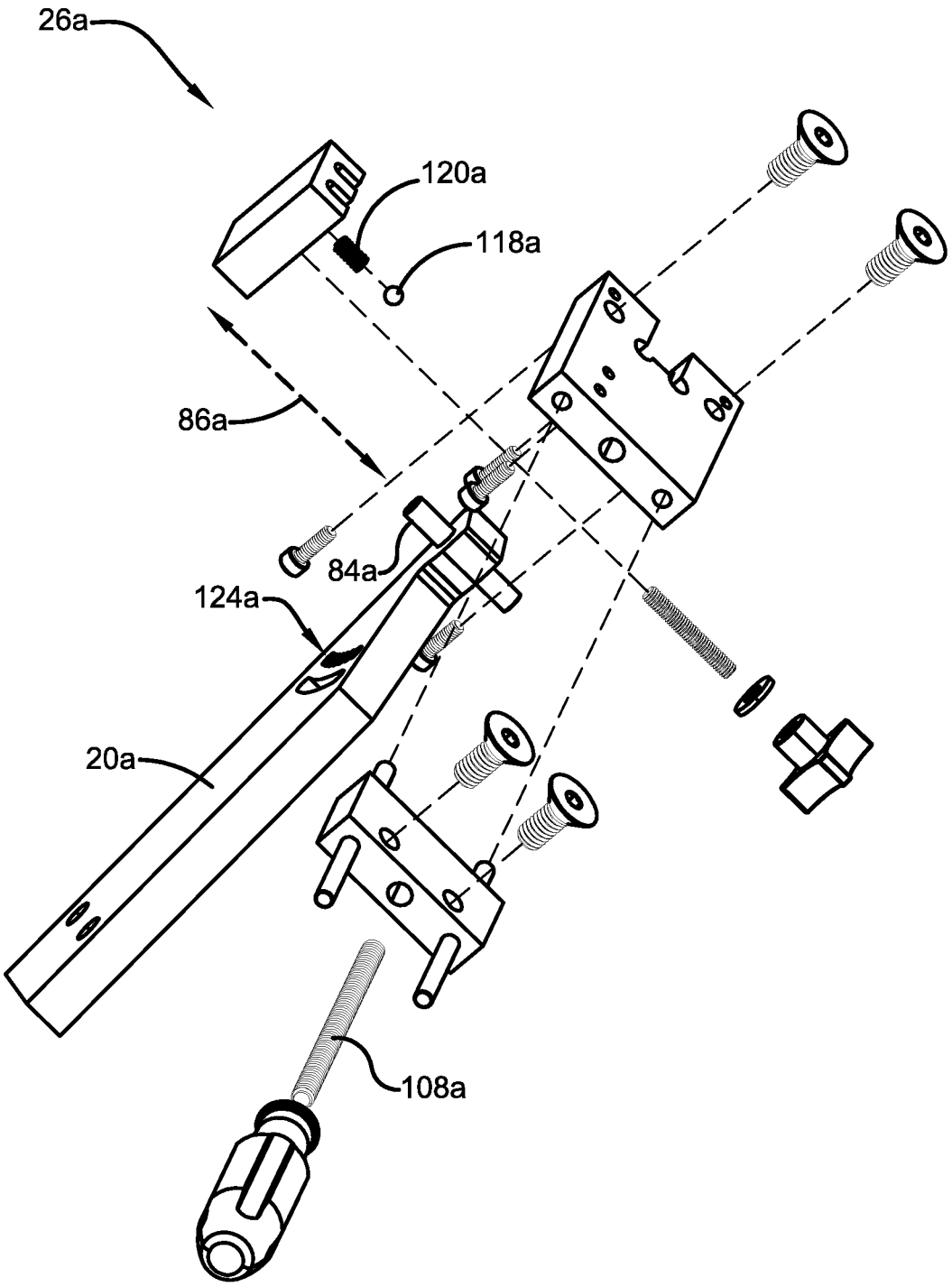

Figure 16

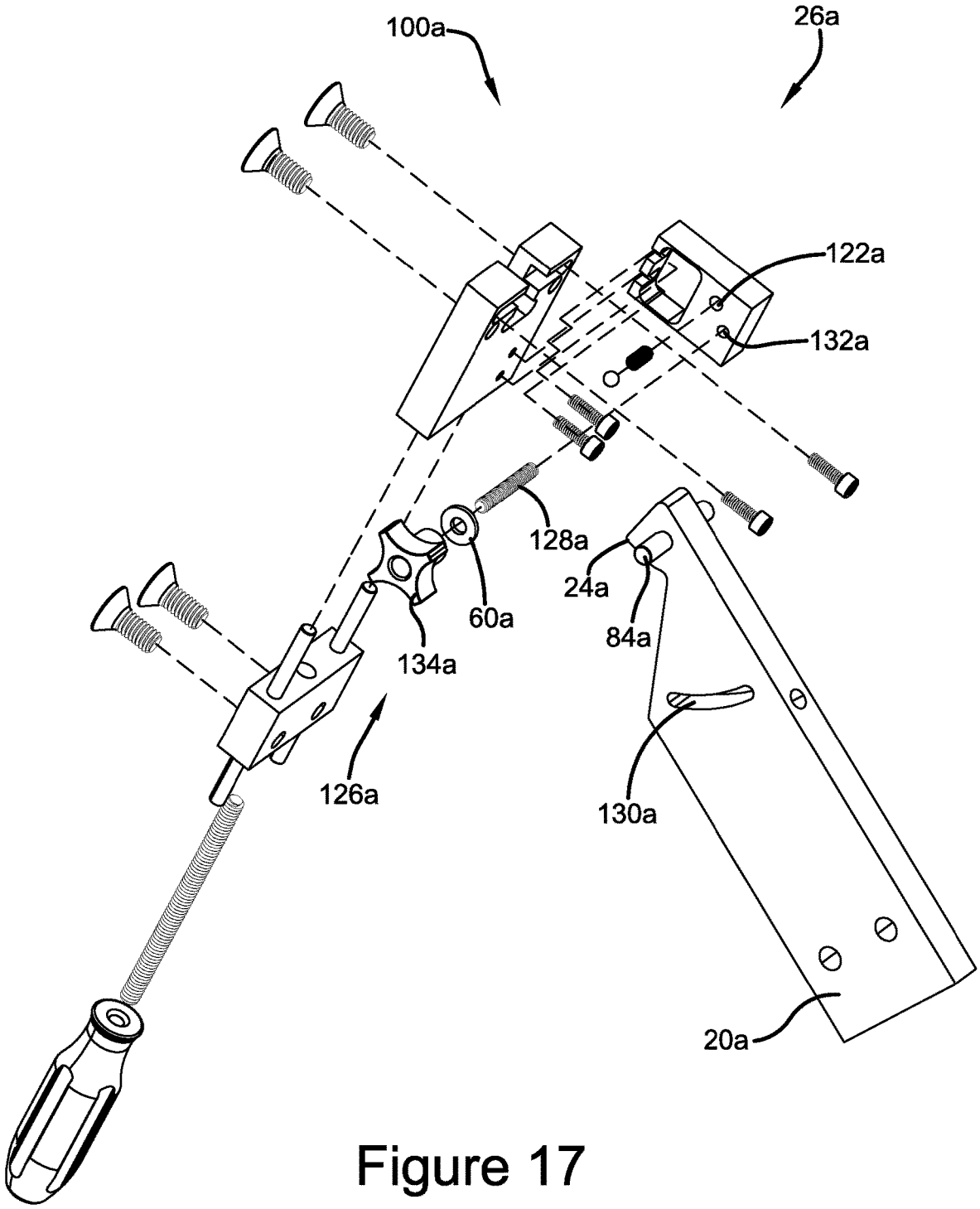

Figure 17

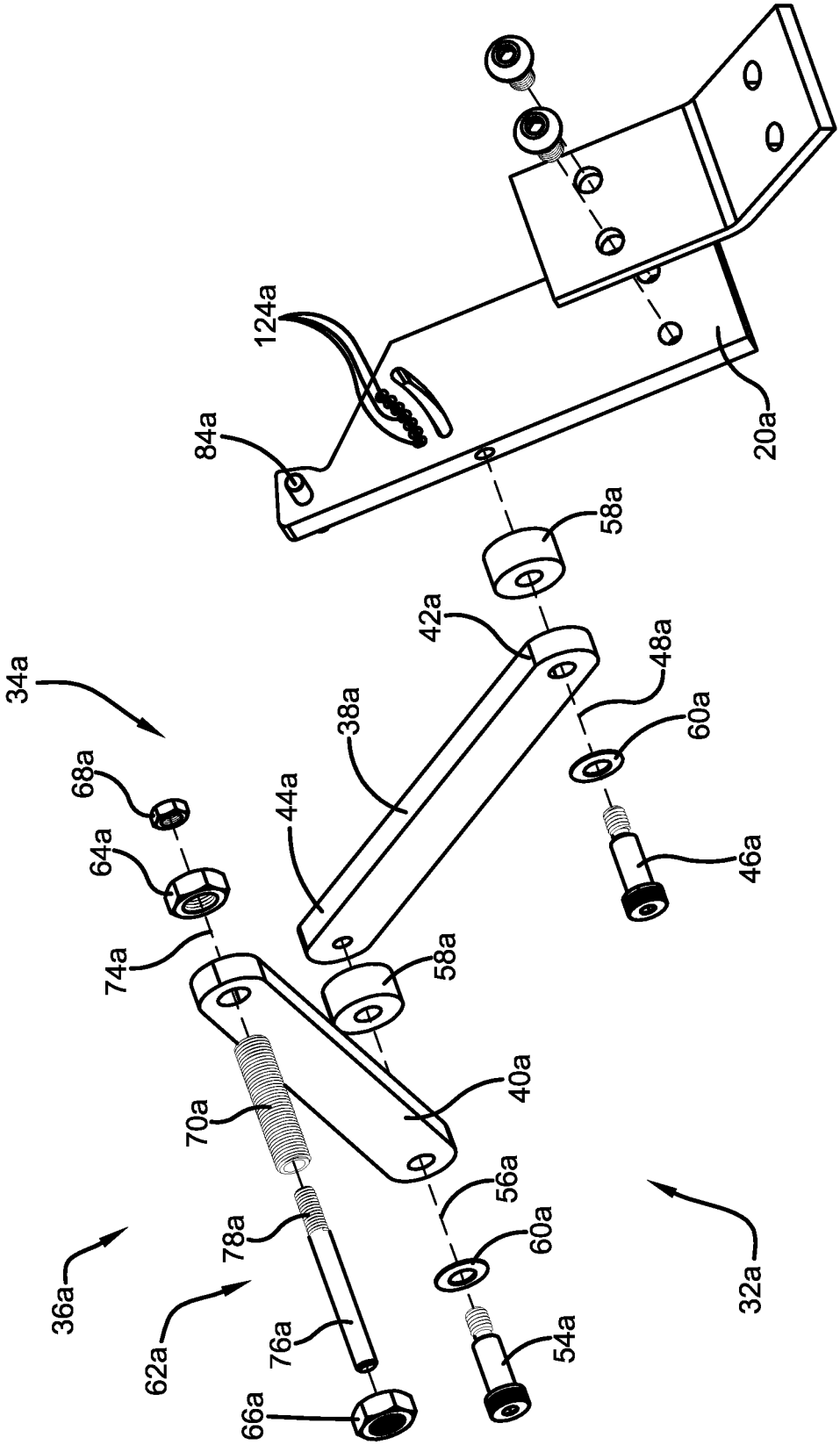
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Figure 18

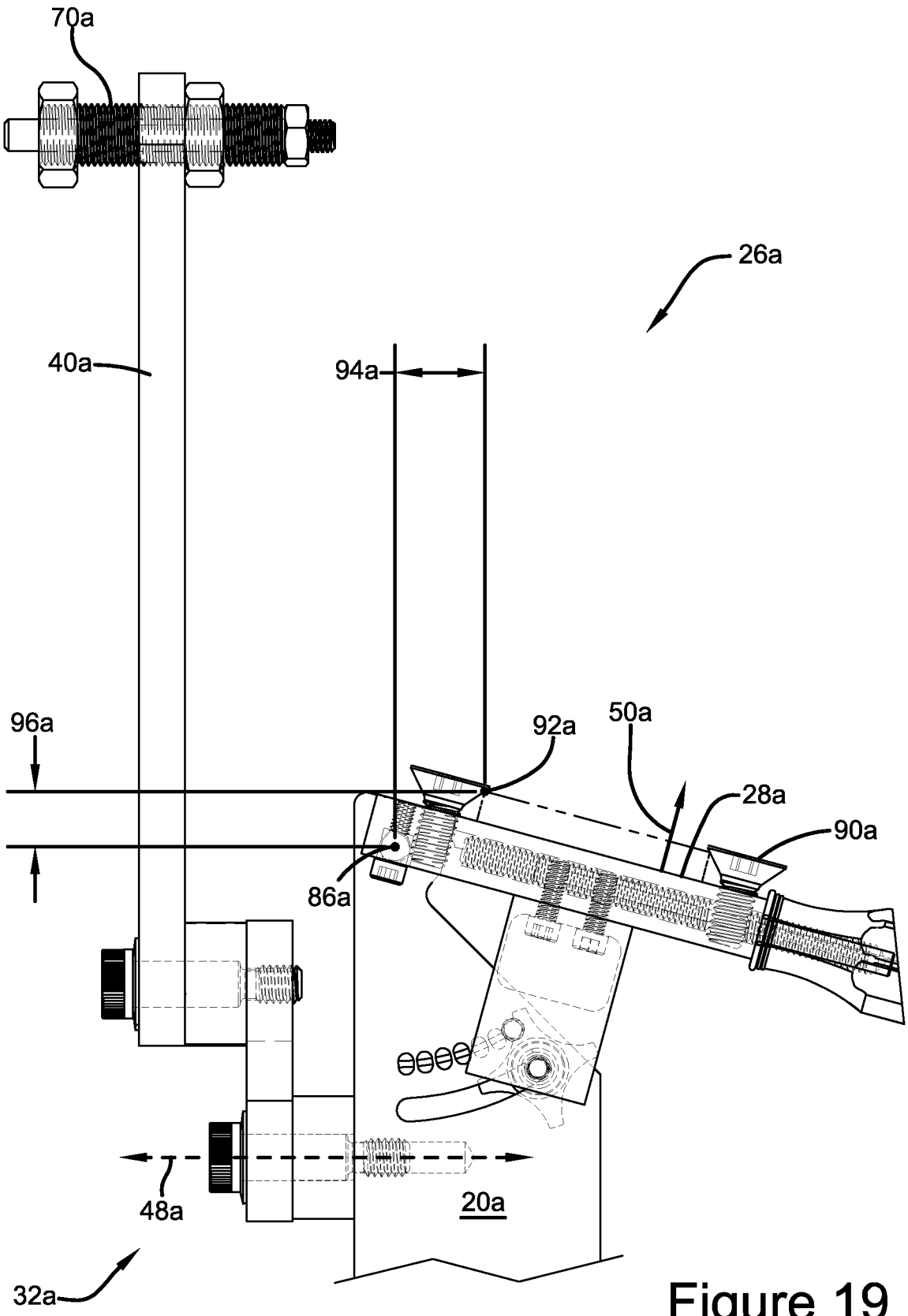

Figure 19

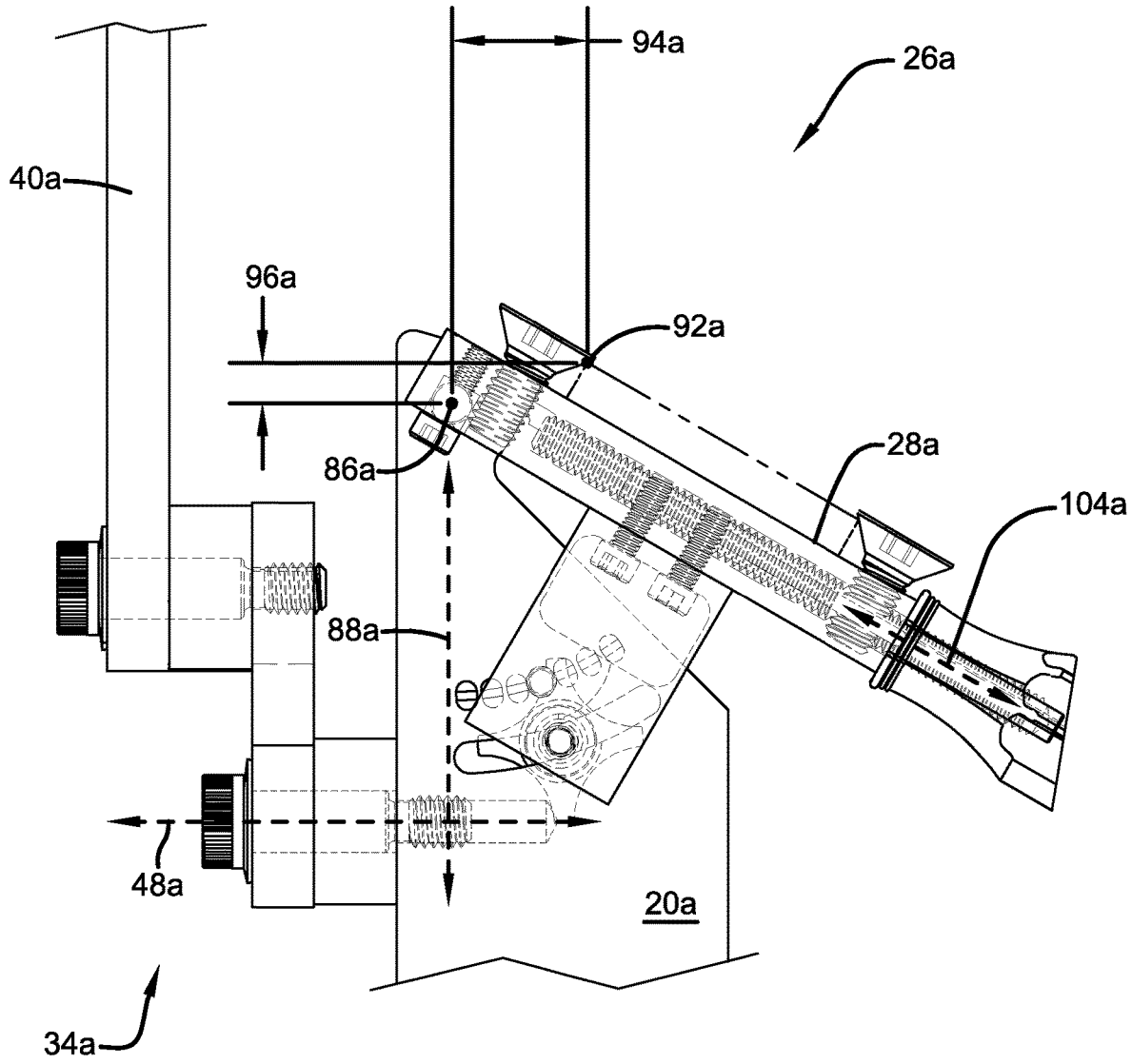

Figure 20

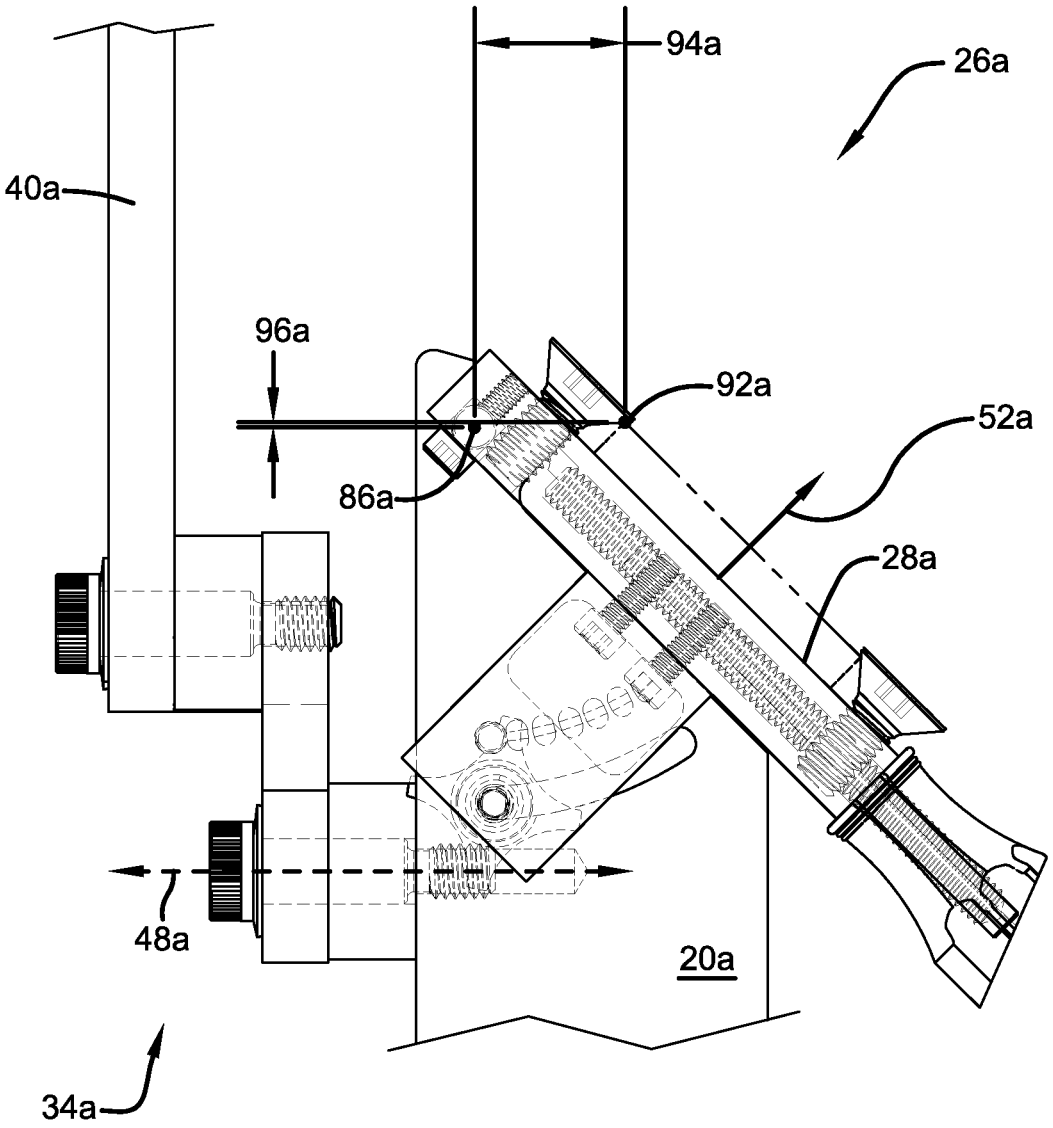

Figure 21

JIG FOR SHARPENING MOWER BLADES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of PCT/2018/20636 for a JIG FOR SHARPENING MOWER BLADES, filed on Mar. 2, 2018, which is hereby incorporated by reference in its entirety. This application also claims the benefit of U.S. Provisional Patent Application Ser. No. 62/468,717 for a JIG FOR SHARPENING MOWER BLADES, filed on Mar. 8, 2017, which is hereby incorporated by reference in its entirety.

BACKGROUND

1. Field

[0002] The present disclosure relates to structures for holding both a work-piece and a tool during a grinding operation and more particularly a mower blade and a grinding tool.

2. Description of Related Prior Art

[0003] U.S. Pat. No. 9,102,031 discloses an apparatus for sharpening blades. The apparatus is for sharpening blades, such as those used for mowing. A rotary grinder is mounted within an extensible, retractable, and rotatable support assembly. Lockable, rotational adjustment of the position of the grinder about three axes, and translational movement along one axis is thereby provided. A spring attached to one end of the assembly counter-balances the weight of the grinder. An adjacent blade holding fixture maintains the workpiece at a predetermined angle for grinding. A toggle clamp, edge alignment keepers, and a registration pin secure the blade in place. An adapter fixture, including a toggle clamp and an alignment recess, attaches to one end of the blade holding fixture. The adapter fixture has an angled shelf to orient and secure smaller, contoured blades requiring a different edge grinding angle. Once the support assembly is adjustably secured, the grinder is moved along the cutting edge of the blade for sharpening.

[0004] The background description provided herein is for the purpose of generally presenting the context of the disclosure. Work of the presently named inventor, to the extent it is described in this background section, as well as aspects of the description that may not otherwise qualify as prior art at the time of filing, are neither expressly nor impliedly admitted as prior art against the present disclosure.

SUMMARY

[0005] A jig assembly is disclosed herein for holding a mower blade and for controlling movement of a grinding tool having a grinding wheel during a sharpening operation on a cutting edge of the mower blade. The jig assembly includes a mast, a fixture portion, and a jig portion. The mast can extend between a first end and a second end. The fixture portion can be mounted to the mast. The fixture portion can include a work-supporting surface extending in a first plane and configured to receive the mower blade. A back surface of the mower blade can rest on the work-supporting surface during the sharpening operation of the cutting edge of the mower blade, which is exposed on a front surface of the mower blade. The jig portion can be pivotally mounted to the mast. The jig portion can include an arm and a tool-seat. The arm can include a plurality of links interconnected to one another. The arm can include at least a first link and a second link movable relative to one another. The first link can extend between a first end and a second end. The first end of the first link can be pivotally connected to the mast with a first pin. The first pin can define an arm pivot axis. The first end of the first link can be rectilinearly fixed relative to the mast at the first pin. The first link and the second link can be interconnected whereby the second link is prevented from rotating in any plane that contains the arm pivot axis. The tool-seat can be disposed on the second link. The grinding wheel can be connected to the second link during the sharpening operation through the tool-seat.

[0006] According to other features, the first link and the second link can be interconnected for one of relative pivoting movement and telescoping rectilinear movement. The first link can be pivotally connected to the second link with a second pin, the second pin can define a link pivot axis, and the arm pivot axis and the link pivot axis can be parallel to one another.

[0007] In other features, the first link and the second link can have different lengths. The arm pivot axis can be coplanar with a vector normal to the first plane. The tool-seat can include a second pin pivotally engaged with the second link. The second pin can define a pitch axis about which the grinding wheel can pivot during the sharpening operation. The pitch axis and the arm pivot axis can be parallel to one another. The second pin can include a first portion of outwardly-facing cylindrical surface that is smooth and a second portion of outwardly-facing cylindrical surface that is threaded. The tool-seat can also include a sleeve defining inwardly-facing surface. The second pin can be received in the inwardly-facing surface.

[0008] According to additional features, the second link and the tool-seat can be engaged with one another such that at least a first portion of the tool-seat is movable in a first rectilinear direction that includes at least a first orthogonal component that is parallel to the arm pivot axis and passes through the second link. The tool-seat further can include a second portion fixed with the first portion during movement the first rectilinear direction. The second portion can extend farther than the first portion in a direction normal to the first rectilinear direction. Movement of the first portion and the second portion in the first rectilinear direction can be limited by a hard stop defined when the second portion directly or indirectly contacts the second link. The first portion and the second portion can be unrestrained in movement in a second rectilinear direction that is opposite to the first rectilinear direction such that the first portion and the second portion are freely separable from the second link. The first portion can be further defined as a second pin having a cylindrical profile. The second portion can be further defined as engaging the second link indirectly, through a third portion of the tool-seat.

[0009] According to other features, the fixture portion can be further defined as pivotally mounted to the mast with a third pin, the third pin defining a fixture pivot axis. The fixture pivot axis can be further defined as transverse to the arm pivot axis. The fixture pivot axis can be further defined as perpendicular to the arm pivot axis. A longitudinal axis can pass through an interior of the mast and the fixture pivot axis can intersect the longitudinal axis within the interior and the arm pivot axis can intersect the longitudinal axis

within the interior. The fixture portion can include at least one stop extending above the work-support surface and limiting movement of the mower blade along the work-supporting surface. A leading edge of the mower blade can rest against the at least one stop during the sharpening operation of the cutting edge of the mower blade. An intersection between the leading edge of the mower blade and the at least one stop during the sharpening operation of the cutting edge of the mower blade can extend along an intersection axis. The intersection axis and the fixture pivot axis can be parallel to one another. The intersection axis moves about the fixture pivot axis during pivoting movement of the fixture portion. The intersection axis can move along an arcuate path in a second plane that is normal to the first plane. The intersection axis and the fixture pivot axis can be spaced a first distance from one another along a third axis normal to both of the intersection axis and the fixture pivot axis. A third plane can contain the fixture pivot axis and can be normal to the arm pivot axis. During the pivoting movement of the fixture portion, the intersection axis can move over a range of distances from the third plane. An absolute value of a distance between endpoints of the range can define a second distance. The second distance can be less than one third of the first distance. The range can extend across the third plane.

[0010] In other features, the fixture portion can include at least one protuberance and a spring biasing the at least one protuberance outward. The mast further can include a plurality of detents spaced along an arc centered on the fixture pivot axis. The at least one protuberance can be selectively positioned in one of the plurality of detents to maintain the fixture portion in one of a plurality of different orientations relative to the mast.

[0011] According to additional features, the fixture portion can include first and second jaws that can be movable relative to one another along a jaw axis that can be parallel to the work-supporting surface. The mast can be unitary and integrally-formed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The detailed description set forth below references the following drawings:

[0013] FIG. **1** is a first perspective view of a first exemplary embodiment of the present disclosure;

[0014] FIG. **2** is a second perspective view of the first exemplary embodiment of the present disclosure;

[0015] FIG. **3** is a third perspective view of the first exemplary embodiment of the present disclosure;

[0016] FIG. **4** is a right-side view of the first exemplary embodiment of the present disclosure;

[0017] FIG. **5** is a top-down view of the first exemplary embodiment of the present disclosure;

[0018] FIG. **6** is a front view of the first exemplary embodiment of the present disclosure;

[0019] FIG. **7** is a rear view of the first exemplary embodiment of the present disclosure;

[0020] FIG. **8** is a fourth perspective view of the first exemplary embodiment of the present disclosure, generally from the rear, wherein a fixture pivot axis is normal to the plane of view and a fixture portion of the embodiment is in a first position;

[0021] FIG. **9** is a fifth perspective view of the first exemplary embodiment of the present disclosure, generally from the rear, wherein a fixture pivot axis is normal to the plane of view and a fixture portion of the embodiment is in a second position;

[0022] FIG. **10** is a first perspective view of a second exemplary embodiment of the present disclosure, generally from the left and front side;

[0023] FIG. **11** is a second perspective view of the second exemplary embodiment of the present disclosure, generally from the right and rear;

[0024] FIG. **12** is a right-side view of the second exemplary embodiment of the present disclosure;

[0025] FIG. **13** is a top-down view of the second exemplary embodiment of the present disclosure;

[0026] FIG. **14** is a front view of the second exemplary embodiment of the present disclosure;

[0027] FIG. **15** is a rear view of the second exemplary embodiment of the present disclosure;

[0028] FIG. **16** is a first exploded view of part of the second exemplary embodiment of the present disclosure;

[0029] FIG. **17** is a second exploded view of part of the second exemplary embodiment of the present disclosure;

[0030] FIG. **18** is a third exploded view of part of the second exemplary embodiment of the present disclosure;

[0031] FIG. **19** is a first perspective view of part of the second exemplary embodiment of the present disclosure, generally from the rear, wherein a fixture pivot axis is normal to the plane of view and a fixture portion of the embodiment is in a first position;

[0032] FIG. **20** is a second perspective view of part of the second exemplary embodiment of the present disclosure, generally from the rear, wherein a fixture pivot axis is normal to the plane of view and a fixture portion of the embodiment is in a second position; and

[0033] FIG. **21** is a third perspective view of part of the second exemplary embodiment of the present disclosure, generally from the rear, wherein a fixture pivot axis is normal to the plane of view and a fixture portion of the embodiment is in a third position.

DETAILED DESCRIPTION

[0034] The present disclosure, as demonstrated by the exemplary embodiments described below, can provide an enhanced jig assembly for sharpening a mower blade. A plurality of different embodiments of the present disclosure is shown in the Figures of the application. Similar features are shown in the various embodiments of the present disclosure. Similar features across different embodiments have been numbered with a common reference numeral and have been differentiated by an alphabetic suffix. Also, to enhance consistency, the structures in any particular drawing share the same alphabetic suffix even if a particular feature is shown in less than all embodiments. Similar features are structured similarly, operate similarly, and/or have the same function unless otherwise indicated by the drawings or this specification. Furthermore, particular features of one embodiment can replace corresponding features in another embodiment or can supplement other embodiments unless otherwise indicated by the drawings or this specification.

[0035] A jig assembly **10** can hold a mower blade **12** and can at least partially control movement of a grinding tool **14** having a grinding wheel **16** during a sharpening operation on a cutting edge **18** of the mower blade **12**. The jig assembly **10** includes a mast **20** extending between a first end **22** and a second end **24**. In the exemplary jig assembly **10**, the mast

20 is unitary and integrally-formed. The exemplary mast **20** is cubic, with rectangular cross-sections in three different orthogonal planes. Thus, embodiments of the present disclosure can include a mast that is simple to manufacture. As will be detailed below, a jig portion and a fixture portion of the jig assembly **10** can both be mounted on a structure that is unitary and integrally-formed. "Integrally-formed" refers to the fact that in the exemplary embodiment the exemplary mast **20** is not formed from substructures that are formed separately and then subsequently joined. The term defines a structural feature since structures that are integrally-formed are structurally different than structures that are comprised of subcomponents formed separately and then subsequently joined. "Integral" means consisting or composed of parts that together constitute a whole and thus encompasses structures of more than one part wherein the parts are either integrally-formed or formed separately and then subsequently joined.

[0036] The jig assembly **10** also includes a fixture portion **26** mounted to the mast **20**. The exemplary fixture portion **26** includes a work-supporting surface **28** extending in a first plane. The work-supporting surface **28** is visible as a line in FIGS. **8** and **9** since the work-supporting surface **28** is normal to the plane of view of FIGS. **8** and **9**. The work-supporting surface **28** can be configured to receive the mower blade **12**. A back surface of the mower blade **12** can rest on the work-supporting surface **28** during the sharpening operation of the cutting edge **18** of the mower blade **12**. The cutting edge **18** is exposed on a front surface **30** of the mower blade **12**.

[0037] The jig assembly **10** also includes a jig portion **32** pivotally mounted to the mast **20**. The exemplary jig portion **32** includes an arm **34** and a tool-seat **36**. The arm **34** can include a plurality of links interconnected to one another. The exemplary arm **34** includes a first link **38** and a second link **40** movable relative to one another.

[0038] The exemplary first link **38** extends between a first end **42** and a second end **44**. The exemplary first end **42** of the first link **38** is pivotally connected to the mast **20** with a first pin **46**. The exemplary first pin **46** defines an arm pivot axis **48**. The first end **42** of the exemplary first link **38** is rectilinearly fixed relative to the mast **20** at the first pin **46**. The exemplary first link **38** and the exemplary second link **40** are interconnected whereby the second link **40** is prevented from rotating in any plane that contains the arm pivot axis **48**. In the exemplary embodiment, the arm pivot axis **48** is coplanar with a vector normal to the first plane. Exemplary vectors are referenced at **50** in FIG. **8** and at **52** in FIG. **9**.

[0039] The exemplary tool-seat **36** is disposed on the second link **40**. The grinding wheel **16** is connected to the second link **40** during the sharpening operation through the tool-seat **36**. In various embodiments of the present disclosure, the tool-seat can be integrally-formed with the arm **34** or mounted on the arm **34** or can include parts that are integrally-formed with the arm **34** and parts that are mounted on the arm **34**.

[0040] In the exemplary embodiment of the present disclosure, the first link **38** and the second link **40** are interconnected for relative pivoting movement. In one or more alternative embodiments of the present disclosure, the first link **38** and the second link **40** could be telescopically engaged together. The exemplary first link **38** is pivotally connected to the second link **40** with a second pin **54**. The second pin **54** defines a link pivot axis **56**. The exemplary arm pivot axis **48** and the exemplary link pivot axis **56** are parallel to one another. The arm **34** can also include other components to enhance pivoting movement, reduce binding and secure structures together, such as bushings **58** and washers **60**.

[0041] The first link **38** and the second link **40** can have different lengths in one or more embodiments of the invention. FIG. **4** shows an alternative second link in phantom that is longer than the links **38**, **40**. Choosing different length allows the pivot angle over which the grinding tool **14** travels during sharpening to change. For example, the greater the distance between the tool-seat **36** and the axis **56**, the shorter the pivot angle required over which to move the grinding tool **14**. Also, choosing different lengths for the links **38**, **40** can allow the jig assembly **10** to more evenly fill product packaging. For example, when the assembly **10** is stored, the link **38** can be positioned to extend toward the end **22** and the link **40** can be sized to extend fully to the end **24**.

[0042] The exemplary tool-seat **36** includes a third pin **62**, nuts **64**, **66**, **68**, and a sleeve **70**. The exemplary sleeve **70** has a threaded exterior and a smooth, cylindrical interior. The exemplary sleeve **70** is received in an aperture **72** defined by the second link **40**. The aperture **72** is spaced from the axis **56** and is centered on an aperture axis **74**. The nuts **64** and **66** can be selectively positioned along the length of the sleeve **70** as desired, to accommodate different configurations of the grinding tool. The nuts **64**, **66** need not be abutting opposite sides of the second link **40** to prevent any rectilinear movement of the sleeve **70** along the axis **74**. In one or more embodiments of the present disclosure, nut **66** can be permanently fixed to sleeve **70** and be used to adjust the combination of **66** and **70** in and out of the aperture **72**.

[0043] The exemplary third pin **62** includes a first portion **76** of outwardly-facing cylindrical surface that is smooth. The exemplary third pin **62** also includes a second portion **78** of outwardly-facing cylindrical surface that is threaded. The cylindrical interior of the sleeve **70** defines an inwardly-facing surface and, in the exemplary embodiment, the third pin **62** received in the inwardly-facing surface. The first portion **76** can freely pivot and rotate in the inwardly-facing surface of the sleeve **70**. Thus, the exemplary third pin **62** is pivotally engaged with the second link **40**.

[0044] Assembly of the grinding tool **14** to the arm **34** can be accomplished as follows. The nut **68** can be threaded on the threaded portion **78**. The distance that the nut **68** is positioned along the length of the threaded portion (along the axis **74**) can be selected as desired, to accommodate different configurations of the grinding tool. The tip of the threaded portion **78** can then be threadingly engaged with a threaded aperture defined by the grinding tool **14**. The third pin **62** can be threaded into the threaded aperture defined by the grinding tool **14** until the nut **68** abuts the grinding tool **14** and prevents further rotation. The exemplary sleeve **70** can then be inserted in the aperture **72**. As set forth above, the nuts **64** and **66** can be selectively positioned along the length of the sleeve **70** as desired, to accommodate different configurations of the grinding tool. The smooth portion of the third pin **62** can then be inserted into the interior of the sleeve **70** until the nut **68** abuts the sleeve **70**, or the nut **68** abuts the nut **64**, or the nut **68** contacts the sleeve **70** or nut

64 and urges the sleeve 70 and nut 64 against the second link 40. The grinding tool 14 can then be operated to perform a guided sharpening operation.

[0045] In the process described above, the second link 40 and the tool-seat 36 are engaged with one another such that at least a first portion of the tool-seat 36 (the third pin 62) is movable in a first rectilinear direction (referenced in FIG. 6 at 80) that includes at least a first orthogonal component that is parallel to the arm pivot axis 48 and passes through the second link 40. In the exemplary embodiment, the first orthogonal component is the only component of the first rectilinear direction 80. However, in other embodiments of the present disclosure, first rectilinear direction may include more than one orthogonal component.

[0046] In addition, the tool-seat 36 includes a second portion (nut 68) fixed with the first portion (the third pin 62) during movement the first rectilinear direction 80, wherein the second portion extends farther than the first portion (the third pin 62) in a direction normal to the first rectilinear direction 80. The movement of the first portion and the second portion in the first rectilinear direction 80 is thus limited by a hard stop defined when the second portion directly or indirectly contacts the second link 40. In the exemplary embodiment, the second portion engages the second link 40 indirectly, through a third portion (sleeve 70). In the exemplary embodiment, the first portion and the second portion are unrestrained in movement in a second rectilinear direction that is opposite to the first rectilinear direction 80 such that the first portion and the second portion are freely separable from the second link 40. Thus, the grinding tool 14 can be easily removed from the arm 34 when the sharpening operation has been completed.

[0047] As set forth above, the nuts 64, 66 can be selectively positioned on the sleeve 70 and nut 68 can be selectively positioned on the third pin 62 as desired in order to laterally position the grinding wheel 16 as desired. FIG. 8 shows one possible desirable position of the grinding wheel 16 in phantom. In many operating environments, the same grinding tool 14 will be used repeatedly with the jig assembly 10 and so adjustment of the nuts 64, 66, 68 will not be required for every sharpening operation.

[0048] The cooperation between the arm 34 and the tool-seat 36 allows the grinding tool 14 to move during the sharpening operation. Movement of the grinding wheel 16 can be defined in three dimensions. The movement can be defined in part or in whole by translational or rectilinear movement. The movement can also be defined in part or in whole by rotation or orbiting. A yaw axis of the grinding wheel 16 is the axis of rotation of the grinding wheel 16. The yaw axis is established by the grinding tool 14. In FIG. 8, the yaw axis would be vertical based on the perspective of FIG. 8 and would appear perpendicular to the axis 74 through a center of the grinding wheel 16. The yaw axis of the grinding wheel 16 and the axis 74 may be perpendicular to and intersect one another, may be transverse but not perpendicular, or may be in different planes in various embodiments of the present disclosure.

[0049] In the exemplary embodiment of the present disclosure, the axis 74 defines a pitch axis of the grinding wheel 16. Rotation of the grinding tool 14 mounted in the tool-seat 36 about the axis 74 can correspond to pitch rotation or pitch orbiting of the grinding wheel 16. Pitch rotation is rotation of the grinding wheel 16 about a lateral axis extending through a center of the grinding wheel 16. Pitch orbiting is movement of the grinding wheel 16 about an axis that is parallel and spaced from the lateral axis that extends through the center of the grinding wheel 16. "Orbiting" does not require movement along a three hundred and sixty degree path. In the exemplary embodiment illustrated in FIG. 8, the grinding wheel 16 can engage in pitch orbiting about the axis 74.

[0050] Another axis for defining movement is a roll axis. The roll axis is perpendicular to the yaw axis and to the pitch axis. The roll axis extends longitudinally relative to the edge of the workpiece to be sharpened, generally along the cutting edge 18. The roll axis and the cutting edge 18 of the mower blade 12 can be collinear when the mower blade 12 is held by the fixture portion 26, can be parallel, can be transverse to one another and coplanar, or can be transverse to one another and contained in the spaced parallel planes. Further, if the cutting edge 26 is curved, the spatial relationship between the cutting edge 18 and the roll axis can be variable. In FIG. 8, the roll axis would extend into the plane of view. In FIGS. 2 and 3, an exemplary and non-limiting roll axis is referenced at 82.

[0051] The exemplary third pin 62 thus defines a pitch axis about which the grinding wheel 16 can pivot during the sharpening operation. The exemplary arm 34 holds the grinding tool 14 so that the grinding wheel 16 does not rotate or orbit about the roll axis. In the exemplary embodiment, the jig portion 32 limits movement of the grinding tool 14 during the sharpening stroke only about the roll axis and in one lateral direction, the one lateral direction 80 limited once the nut 68 is directly or indirectly abutting the second link 40. The operator of the grinding tool 14 can change the pitch by moving the grinding tool 14 about the pitch axis (the axis 74) and can translate along the cutting edge 18. If desired, the operator can apply a relatively low force in the direction 80 to keep the grinding tool 14 resting against the link 40 to maintain the lateral position of the grinding wheel 16.

[0052] The exemplary fixture portion 26 is pivotally mounted to the mast 20 with a fourth pin 84. The exemplary fourth pin 84 defines a fixture pivot axis 86. The exemplary fixture pivot axis 86 is transverse to the arm pivot axis 48. The exemplary fixture pivot axis 86 is perpendicular to and spaced from the arm pivot axis 48. As shown in FIG. 8, a longitudinal axis passes 88 through an interior of the mast 20 and the exemplary fixture pivot axis 86 intersects the longitudinal axis 88 within the interior and the exemplary arm pivot axis 48 intersects the longitudinal axis within the interior.

[0053] The exemplary fixture portion 26 also includes at least one stop extending above the work-support surface and limiting movement of the mower blade 12 along the work-supporting surface 28. The exemplary fixture portion 26 also includes four stops 90. In the exemplary embodiment, a leading edge of the mower blade 12 is urged against two of the stops 90 during the sharpening operation of the cutting edge 18 of the mower blade 12. The mower blade 12 is shown in phantom in FIGS. 8 and 9. FIGS. 8 and 9 show the mower blade 12 supported at different angles. One angle can be used when sharpening a primary cutting edge 12. Another angle can be used when sharpening a secondary cutting edge on the mower blade, such as a mulching cutting edge.

[0054] An intersection between the leading edge of the mower blade 12 and at least one of the stops during the sharpening operation of the cutting edge 18 of the mower blade 12 extends along an intersection axis. An exemplary

intersection axis is referenced at **92** in FIGS. **8** and **9**. In the exemplary embodiment, the intersection axis **92** and the fixture pivot axis **86** are parallel to one another. The exemplary intersection axis **92** moves about the fixture pivot axis **86** during pivoting movement of the fixture portion **26**. The intersection axis **92** moves along an arcuate path in a second plane that is normal to the first plane, the plane of the work-supporting surface **28**. The second plane is the plane of perspective of FIGS. **8** and **9** or parallel to the plane of perspective of FIGS. **8** and **9**.

[0055] The exemplary intersection axis **92** and the exemplary fixture pivot axis **86** are spaced a first distance from one another along a third axis normal to both of the intersection axis **92** and the fixture pivot axis **86**. In FIGS. **8** and **9**, the lateral distance between the axes **86** and **92** is referenced at **94** and the vertical distance between the axes **86** and **92** is referenced at **96**. The "first distance" in the exemplary embodiment is the square root of the sum of distance **94** squared and distance **96** squared. By way of example and not limitation, the "first distance" in FIGS. **8** and **9** can be 0.95 inch.

[0056] A third plane contains the fixture pivot axis **86** and is normal to the arm pivot axis **48**. The third plane thus appears collinear to longitudinal axis **88** in FIGS. **8** and **9**. In the exemplary embodiment, during the pivoting movement of the fixture portion **26**, the intersection axis **92** moves over a range of distances from the third plane. In FIGS. **8** and **9**, these distances are the lateral distances **94**. For the first embodiment, the end points of the range are shown in FIGS. **8** and **9**. By way of example and not limitation, the lateral distance in FIG. **8** can be 0.08 inch from the third plane (positive to the right of the third plane in FIGS. **8** and **9**) and the lateral distance in FIG. **9** can be −0.168 inch from the third plane (negative to the left of the third plane in FIGS. **8** and **9**). The range of the first exemplary embodiment thus extends across the third plane. An absolute value of a distance between endpoints of the range define a "second distance." The second distance is less than one third of the first distance. By way of example and not limitation, using the exemplary values used previously, the "second distance" can therefore be 0.248 inch.

[0057] The ratio disclosed herein between the (i) the distance between the intersection axis **92** and the fixture pivot axis **86** and (ii) the range of lateral movement of the intersection axis relative to the third plane is not a matter of mere design choice. The ratio reflects a principle applied in the present disclosure through structural arrangements in which the intersection axis **92** is maintained in a relatively narrow lateral range during pivoting movement of the fixture portion **26**. This keeps the cutting edge **18** and other edges to be sharpened in generally the same plane as a leading edge of the grinding wheel **16** which is held by the jig portion **32**. In the exemplary embodiment, for example, the primary cutting edge **18** of the mower blade **12** can be sharpened when the fixture portion **26** is in the position shown in FIG. **8**. After sharpening, the fixture portion **26** can be pivoted about the axis **86** to the position shown in FIG. **9**. A secondary cutting edge, such as a mulching cutting edge, of the mower blade **12** can be sharpened when the fixture portion **26** is in the position shown in FIG. **9** without having to adjust or change the position of the grinding tool **14** relative to the second link **40**. In other words, the various adjusting structures of the tool-seat **36** would not require adjustment.

[0058] A further benefit of the disclosed embodiment is enjoyed for mower blades that are counter-rotating. The mower blade **12** shown in FIG. **2** is not a counter-rotated blade. However, if it were, another, primary cutting edge would be defined in the area referenced at **98**. The edges **18** and **98** would generally be along the same roll axis. The arm **34** can be utilized to move the grinding tool **14** along different, sharpening paths for both edges **18** and **98** without having to adjust or change the position of the grinding tool **14** relative to the second link **40** and without having to move the fixture portion **26**.

[0059] The exemplary fixture portion **26** also includes first and second jaws **100**, **102**. Each jaw defines part of the exemplary work-supporting surface **28**. The jaws **100**, **102** are movable relative to one another along a jaw axis **104** that is parallel to the work-supporting surface **28**. The jaw **100** can receive the pin **84** and be attached to the mast **20**. The exemplary fixture portion **26** also includes a handle **106** and a screw **108**. The screw **108** threads into the jaw **100** and can freely rotate within the jaw **102**. The exemplary fixture portion **26** also includes pins **110** that can extend through the jaws **100**, **102** to guide movement of the jaws **100**, **102** relative to one another. The pins **110** can be fixed to the jaw **102** and slide in apertures formed in the jaw **100**, or vice-versa. The mower blade **12** can be located and held at its center section **112** between the stops **90** by turning (tightening) handle **106** which in turn threads screw **108** into the jaw **100** and brings the jaws **100**, **102** closer together. The above described blade holding configuration can hold blades of various length, width and thickness.

[0060] The mast **20** can be releasably mounted to an angled bracket, such as bracket **114**. The bracket **114** can be fixed through fasteners **116** to another structure, such as a work bench or a vehicle. The mast **20** can be selectively fixed through fasteners **118** to the bracket **114**, mounted when in use and removed when not in use.

[0061] Referring now to FIGS. **10-21**, a jig assembly **10***a* can hold a mower blade and can at least partially control movement of a grinding tool having a grinding wheel during a sharpening operation on a cutting edge of the mower blade. The jig assembly **10***a* includes a mast **20***a* extending between a first end **22***a* and a second end **24***a*. In the exemplary jig assembly **10***a*, the mast **20***a* is unitary and integrally-formed. Thus, embodiments of the present disclosure can include a mast that is simple to manufacture. As will be detailed below, a jig portion and a fixture portion of the jig assembly **10***a* can both be mounted on a structure that is unitary and integrally-formed.

[0062] The jig assembly **10***a* also includes a fixture portion **26***a* mounted to the mast **20***a*. The exemplary fixture portion **26***a* includes a work-supporting surface **28***a* extending in a first plane. The work-supporting surface **28***a* is visible as a line in FIGS. **19-21** since the work-supporting surface **28***a* is normal to the plane of view of FIGS. **19-21**. The work-supporting surface **28***a* can be configured to receive the mower blade. A back surface of the mower blade can rest on the work-supporting surface **28***a* during the sharpening operation of the cutting edge of the mower blade. The cutting edge is exposed on a front surface of the mower blade.

[0063] The jig assembly **10***a* also includes a jig portion **32***a* pivotally mounted to the mast **20***a*. The exemplary jig portion **32***a* includes an arm **34***a* and a tool-seat **36***a*. The arm **34***a* can include a plurality of links interconnected to

one another. The exemplary arm **34***a* includes a first link **38***a* and a second link **40***a* movable relative to one another.

[0064] The exemplary first link **38***a* extends between a first end **42***a* and a second end **44***a*. The exemplary first end **42***a* of the first link **38***a* is pivotally connected to the mast **20***a* with a first pin **46**a. The exemplary first pin **46***a* defines an arm pivot axis **48***a*. The first end **42***a* of the exemplary first link **38***a* is rectilinearly fixed relative to the mast **20***a* at the first pin **46***a*. The exemplary first link **38***a* and the exemplary second link **40***a* are interconnected whereby the second link **40***a* is prevented from rotating in any plane that contains the arm pivot axis **48***a*. In the exemplary embodiment, the arm pivot axis **48***a* is coplanar with a vector normal to the first plane. Exemplary vectors are referenced at **50***a* in FIG. **19** and at **52***a* in FIG. **21**.

[0065] The exemplary tool-seat **36***a* is disposed on the second link **40***a*. The grinding wheel **16***a* is connected to the second link **40***a* during the sharpening operation through the tool-seat **36***a*. In various embodiments of the present disclosure, the tool-seat can be integrally-formed with the jig portion **32***a* or mounted on the jig portion **32***a*.

[0066] In the exemplary embodiment of the present disclosure, the first link **38***a* and the second link **40***a* are interconnected for relative pivoting movement. In one or more alternative embodiments of the present disclosure, the first link **38***a* and the second link **40***a* can be telescopically engaged together. The exemplary first link **38***a* is pivotally connected to the second link **40***a* with a second pin **54***a*. The second pin **54***a* defines a link pivot axis **56***a*. The exemplary arm pivot axis **48***a* and the exemplary link pivot axis **56***a* are parallel to one another. The arm **34***a* can also include other components to enhance pivoting movement, reduce binding and secure structures together, such as bushings **58***a* and washers **60***a*.

[0067] The exemplary tool-seat **36***a* includes a third pin **62***a*, nuts **64***a*, **66***a*, **68***a*, and a sleeve **70***a*. The exemplary sleeve **70***a* has a threaded exterior and a cylindrical interior. The exemplary sleeve **70***a* is received in an aperture **72***a* defined by the second link **40***a*. The aperture **70***a* is spaced from the axis **56***a* and is centered on an aperture axis **74***a*. The nuts **64***a* and **66***a* can be selectively positioned along the length of the sleeve **70***a* as desired, to accommodate different configurations of the grinding tool. The nuts **64***a*, **66***a* need not be abutting opposite sides of the second link **40***a* to prevent any rectilinear movement of the sleeve **70***a* along the axis **74***a*.

[0068] The exemplary third pin **62***a* includes a first portion **76***a* of outwardly-facing cylindrical surface that is smooth. The exemplary third pin **62***a* also includes a second portion **78***a* of outwardly-facing cylindrical surface that is threaded. The cylindrical interior of the sleeve **70***a* defines inwardly-facing surface and, in the exemplary embodiment, the third pin **62***a* received in the inwardly-facing surface. The first portion **76***a* can freely pivot and rotate in the inwardly-facing surface of the sleeve **70***a*. Thus, the exemplary third pin **62***a* is pivotally engaged with the second link **40***a*.

[0069] Assembly of the grinding tool **14***a* to the arm **34***a* can be accomplished as follows. The nut **68***a* can be threaded on the threaded portion **78***a*. The distance that the nut **68***a* is positioned along the length of the threaded portion (along the axis **74***a*) can be selected as desired, to accommodate different configurations of the grinding tool. The tip of the threaded portion **78***a* can then be threadingly engaged with a threaded aperture defined by the grinding tool **14***a*. The third pin **62***a* can be threaded into the threaded aperture defined by the grinding tool **14***a* until the nut **68***a* abuts the grinding tool **14***a* and prevents further rotation. The exemplary sleeve **70***a* can then be inserted in the aperture **72***a*. As set forth above, the nuts **64***a* and **66***a* can be selectively positioned along the length of the sleeve **70***a* as desired, to accommodate different configurations of the grinding tool. The smooth portion of the third pin **62***a* can then be inserted into the interior of the sleeve **70***a* until the nut **68***a* abuts the sleeve **70***a*, or the nut **68***a* abuts the nut **64***a*, or the nut **68***a* contacts the sleeve **70***a* or nut **64***a* and urges the sleeve **70***a* and nut **64***a* against the second link **40***a*. The grinding tool **14***a* can then be operated to perform a guided sharpening operation.

[0070] In the process described above, the second link **40***a* and the tool-seat **36***a* are engaged with one another such that at least a first portion of the tool-seat **36***a* (the third pin **62***a*) is movable in a first rectilinear direction (referenced in FIG. **6***a* at **80***a*) that includes at least a first orthogonal component that is parallel to the arm pivot axis **48***a* and passes through the second link **40***a*. In the exemplary embodiment, the first orthogonal component is the only component of the first rectilinear direction **80***a*. However, in other embodiments of the present disclosure, first rectilinear direction may include more than one orthogonal component.

[0071] In addition, the tool-seat **36***a* includes a second portion (nut **68***a*) fixed with the first portion (the third pin **62***a*) during movement the first rectilinear direction **80***a*, wherein the second portion extends farther than the first portion (the third pin **62***a*) in a direction normal to the first rectilinear direction **80***a*. The movement of the first portion and the second portion in the first rectilinear direction **80***a* is thus limited by a hard stop defined when the second portion directly or indirectly contacts the second link **40***a*. In the exemplary embodiment, the second portion engages the second link **40***a* indirectly, through a third portion (sleeve **70***a*). In the exemplary embodiment, the first portion and the second portion are unrestrained in movement in a second rectilinear direction that is opposite to the first rectilinear direction **80***a* such that the first portion and the second portion are freely separable from the second link **40***a*. Thus, the grinding tool **14***a* can be easily removed when the sharpening operation has been completed.

[0072] The exemplary fixture portion **26***a* is pivotally mounted to the mast **20***a* with a fourth pin **84***a*. The exemplary fourth pin **84***a* defines a fixture pivot axis **86***a*. The exemplary fixture pivot axis **86***a* is transverse to the arm pivot axis **48***a*. The exemplary fixture pivot axis **86***a* is perpendicular to and spaced from the arm pivot axis **48***a*. A longitudinal axis passes **88***a* through an interior of the mast **20***a* and the exemplary fixture pivot axis **86***a* intersects the longitudinal axis **88***a* within the interior and the exemplary arm pivot axis **48***a* intersects the longitudinal axis within the interior.

[0073] The exemplary fixture portion **26***a* also includes at least one stop extending above the work-support surface and limiting movement of the mower blade **12***a* along the work-supporting surface **28***a*. The exemplary fixture portion **26***a* also includes four stops **90***a*. In the exemplary embodiment, a leading edge of the mower blade **12***a* rests against two of the stops during the sharpening operation of the cutting edge **18***a* of the mower blade **12***a*. The mower blade **12***a* is shown in phantom in FIGS. **19-21**. FIGS. **19-21** show the mower blade **12***a* supported at different angles. One

angle can be used when sharpening a primary cutting edge **12***a*. Another angle can be used when sharpening a secondary cutting edge on the mower blade, such as a mulching cutting edge. Other angles can be used when different blades are sharpened. FIGS. **19** and **21** show end limits of travel of the fixture portion **26***a* and FIG. **21** shows a position between the end limits of travel.

[0074] An intersection between the leading edge of the mower blade **12***a* and at least one of the stops during the sharpening operation of the cutting edge **18***a* of the mower blade **12***a* extends along an intersection axis. An exemplary intersection axis is referenced at **92***a* in FIGS. **8***a* and **9**. In the exemplary embodiment, the intersection axis **92***a* and the fixture pivot axis **86***a* are parallel to one another. The exemplary intersection axis **92***a* moves about the fixture pivot axis **86***a* during pivoting movement of the fixture portion **26***a*. The intersection axis **92***a* moves along an arcuate path in a second plane that is normal to the first plane, the plane of the work-supporting surface **28***a*. The second plane is the plane of perspective of FIGS. **19-21**.

[0075] The exemplary intersection axis **92***a* and the exemplary fixture pivot axis **86***a* are spaced a first distance from one another along a third axis normal to both of the intersection axis **92***a* and the fixture pivot axis **86***a*. In FIGS. **19-21**, the lateral distance between the axes **86***a* and **92***a* is referenced at **94***a* and the vertical distance between the axes **86***a* and **92***a* is referenced at **96***a*. The "first distance" in the exemplary embodiment is the square root of the sum of distance **94***a* squared and distance **96***a* squared. By way of example and not limitation, the "first distance" in FIGS. **19-21** can be 0.69 inch.

[0076] A third plane contains the fixture pivot axis **86***a* and is normal to the arm pivot axis **48***a*. The third plane thus appears collinear to longitudinal axis **88***a* in FIGS. **19-21**. In the exemplary embodiment, during the pivoting movement of the fixture portion **26***a*, the intersection axis **92***a* moves over a range of distances from the third plane. In FIGS. **19-21**, these distances are the lateral distances **94***a*. For the first embodiment, the end points of the range are shown in FIGS. **19** and **21**. By way of example and not limitation, the lateral distance in FIG. **19** can be 0.657 inch from the third plane and the lateral distance in FIG. **21** can be 0.69 inch from the third plane. An absolute value of a distance between endpoints of the range define a "second distance," wherein the second distance is less than one third of the first distance. By way of example and not limitation, using the exemplary values used previously, the "second distance" or range can therefore be 0.033 inch.

[0077] The exemplary fixture portion **26***a* also includes first and second jaws **100***a*, **102***a*. Each jaw defines part of the work-supporting surface **28***a*. The jaws **100***a*, **102***a* are movable relative to one another along a jaw axis **104***a* that is parallel to the work-supporting surface **28***a*. The jaw **100***a* can receive the pin **84***a* and be attached to the mast **20***a*. The exemplary fixture portion **26***a* also includes a handle **106***a* and a screw **108***a*. The screw **108***a* threads into the jaw **100***a*. The exemplary fixture portion **26***a* also includes pins **110***a* that can extend through the jaws **100***a*, **102***a* to guide movement of the jaws **100***a*, **102***a* relative to one another. The pins **110***a* can be fixed to the jaw **102***a* and slide in apertures formed in the jaw **100***a*, or vice-versa. The mower blade can be located and held at its center section between the stops **90***a* by turning (tightening) handle **106***a* which in turn threads screw **108***a* into the jaw **100***a*. The above described blade holding configuration can hold blades of various length, width and thickness.

[0078] The mast **20***a* can be releasably mounted to an angled bracket, such as bracket **114***a*. The bracket **114***a* can be fixed through fasteners **116***a* to another structure, such as a work bench or a vehicle. The mast **20***a* can be selectively fixed through fasteners **118***a* to the bracket **114***a*, mounted when in use and removed when not in use.

[0079] The fixture portion **26***a* can also include at least one protuberance **118***a* and a spring **120***a* biasing the at least one protuberance **118***a* outward. In the second exemplary embodiment, as best shown in FIGS. **17** and **18**, the at least one protuberance **118***a* is a ball bearing mounted in a blind aperture **122***a* defined in a portion of the jaw **100***a*. The mast **20***a* further comprises a plurality of detents **124***a* is spaced along an arc centered on the fixture pivot axis **86***a*. The mast **20***a* can include markings to indicate the angle of the work-supporting surface **28***a* for each detent **124***a*. The at least one protuberance **118***a* is selectively positioned in one of the plurality of detents **124***a* to maintain the fixture portion **26***a* in one of a plurality of different orientations relative to the mast **20***a*.

[0080] The spring force biasing the protuberance **118***a* can be strong enough to support the weight of the fixture portion **26***a* and the blade, or the assembly **10***a* can include a supplemental locking structure **126***a*. The exemplary lock structure **126***a* includes a threaded shaft **128***a* received in a slot **130***a* in the mast **20***a* and in a threaded aperture **132***a* in the jaw **100***a*. The exemplary lock structure **126***a* also includes a handle **134***a* and a washer **60***a*. After the position of the fixture portion **26***a* has been selected by moving the protuberance **118***a* into the desired detent **124***a*, the handle **134***a* can be tightened to fix the mast **20***a* and jaw **100***a* together. In the second exemplary embodiment, the fixture portion **26***a* can be rotated to positions between fifteen degrees and forty-five degrees, each position spaced from the next by five degrees.

[0081] While the present disclosure has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from the essential scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this present disclosure, but that the present disclosure will include all embodiments falling within the scope of the appended claims. The right to claim elements and/or subcombinations that are disclosed herein as other present disclosures in other patent documents is hereby unconditionally reserved.

What is claimed is:

1. A jig assembly for holding a mower blade and for controlling movement of a grinding tool having a grinding wheel during a sharpening operation on a cutting edge of the mower blade, said jig assembly comprising:

a mast extending between a first end and a second end;

a fixture portion mounted to said mast, said fixture portion including a work-supporting surface extending in a first plane and configured to receive the mower blade, a back surface of the mower blade resting on said work-

supporting surface during the sharpening operation of the cutting edge of the mower blade exposed on a front surface of the mower blade; and

a jig portion pivotally mounted to said mast, said jig portion comprising:

an arm with a plurality of links interconnected to one another, said arm including at least a first link and a second link movable relative to one another, said first link extending between a first end and a second end, said first end of said first link pivotally connected to said mast with a first pin, said first pin defining an arm pivot axis, said first end of said first link rectilinearly fixed relative to said mast at said first pin, said first link and said second link interconnected whereby said second link is prevented from rotating in any plane that contains the arm pivot axis, and

a tool-seat disposed on said second link, the grinding wheel connected to said second link during the sharpening operation through said tool-seat.

2. The jig assembly of claim **1** wherein said first link and said second link are further defined as interconnected for one of relative pivoting movement and telescoping rectilinear movement.

3. The jig assembly of claim **2** wherein said first link is pivotally connected to said second link with a second pin, said second pin defining a link pivot axis, said arm pivot axis and said link pivot axis parallel to one another.

4. The jig assembly of claim **1** wherein said first link and said second link are further defined as having different lengths.

5. The jig assembly of claim **1** wherein said arm pivot axis is coplanar with a vector normal to said first plane.

6. The jig assembly of claim **1** wherein said tool-seat further comprises:

a second pin pivotally engaged with said second link, said second pin defining a pitch axis about which the grinding wheel can pivot during the sharpening operation, said pitch axis and said arm pivot axis parallel to one another.

7. The jig assembly of claim **6** wherein said second pin further comprises:

a first portion of outwardly-facing cylindrical surface that is smooth; and

a second portion of outwardly-facing cylindrical surface that is threaded.

8. The jig assembly of claim **6** wherein said tool-seat further comprises:

a sleeve defining inwardly-facing surface, said second pin received in said inwardly-facing surface.

9. The jig assembly of claim **1** wherein said second link and said tool-seat are engaged with one another such that at least a first portion of said tool-seat is movable in a first rectilinear direction that includes at least a first orthogonal component that is parallel to said arm pivot axis and passes through said second link, said tool-seat further comprising a second portion fixed with said first portion during movement the first rectilinear direction, said second portion extending farther than said first portion in a direction normal to the first rectilinear direction, movement of said first portion and said second portion in the first rectilinear direction limited by a hard stop defined when said second portion directly or indirectly contacts said second link, and said first portion and said second portion are unrestrained in movement in a second rectilinear direction that is opposite to the first rectilinear direction such that said first portion and said second portion are freely separable from said second link.

10. The jig assembly of claim **9** wherein said first portion is a further defined as a second pin having a cylindrical profile.

11. The jig assembly of claim **9** wherein said second portion is further defined as engaging said second link indirectly, through a third portion of said tool-seat.

12. The jig assembly of claim **1** wherein said fixture portion is further defined as pivotally mounted to said mast with a third pin, said third pin defining a fixture pivot axis.

13. The jig assembly of claim **12** wherein said fixture pivot axis is further defined as transverse to said arm pivot axis.

14. The jig assembly of claim **13** wherein said fixture pivot axis is further defined as perpendicular to said arm pivot axis.

15. The jig assembly of claim **12** wherein a longitudinal axis passes through an interior of said mast, said fixture pivot axis intersecting said longitudinal axis within said interior and said arm pivot axis intersecting said longitudinal axis within said interior.

16. The jig assembly of claim **12** wherein said fixture portion further comprises:

at least one stop extending above said work-support surface and limiting movement of the mower blade along said work-supporting surface, a leading edge of the mower blade resting against said at least one stop during the sharpening operation of the cutting edge of the mower blade, an intersection between the leading edge of the mower blade and said at least one stop during the sharpening operation of the cutting edge of the mower blade extending along an intersection axis, and said intersection axis and said fixture pivot axis parallel to one another, wherein said intersection axis moves about said fixture pivot axis during pivoting movement of said fixture portion, said intersection axis moving along an arcuate path in a second plane that is normal to said first plane, wherein said intersection axis and said fixture pivot axis are spaced a first distance from one another along a third axis normal to both of said intersection axis and said fixture pivot axis, wherein a third plane contains said fixture pivot axis and is normal to said arm pivot axis, wherein during the pivoting movement of said fixture portion said intersection axis moves over a range of distances from said third plane, an absolute value of a distance between endpoints of said range defining a second distance, and wherein said second distance less than one third of said first distance.

17. The jig assembly of claim **16** wherein said range extends across said third plane.

18. The jig assembly of claim **12** wherein:

said fixture portion further comprises at least one protuberance and a spring biasing said at least one protuberance outward; and

said mast further comprises a plurality of detents spaced along an arc centered on said fixture pivot axis, said at least one protuberance selectively positioned in one of said plurality of detents to maintain said fixture portion in one of a plurality of different orientations relative to said mast.

19. The jig assembly of claim **12** wherein said fixture portion further comprises:

first and second jaws that are movable relative to one another along a jaw axis that is parallel to said work-supporting surface.

20. The jig assembly of claim **1** wherein said mast is further defined as a unitary and integrally-formed.

21. A jig assembly for holding a mower blade and for controlling movement of a grinding tool having a grinding wheel during a sharpening operation on a cutting edge of the mower blade, the jig assembly comprising:

a mast extending between a first end and a second end;

a fixture portion mounted to said mast, said fixture portion including a work-supporting surface extending in a first plane and configured to receive the mower blade, a back surface of the mower blade resting on said work-supporting surface during the sharpening operation of the cutting edge of the mower blade exposed on a front surface of the mower blade; and

a jig portion pivotally mounted to said mast, said jig portion comprising:

an arm pivotally connected to said mast with a first pin, said first pin defining an arm pivot axis,

a tool-seat disposed on said arm, the grinding wheel connected to said arm during the sharpening operation through said tool-seat, and

wherein said arm and said tool-seat are engaged with one another such that at least a first portion of said tool-seat is movable in a first rectilinear direction that includes at least a first orthogonal component that is parallel to said arm pivot axis and passes through said arm, said tool-seat further comprising a second portion fixed with said first portion during movement the first rectilinear direction, said second portion extending farther than said first portion in a direction normal to the first rectilinear direction, movement of said first portion and said second portion in the first rectilinear direction limited by a hard stop defined when said second portion directly or indirectly contacts said arm, and said first portion and said second portion are unrestrained in movement in a second rectilinear direction that is opposite to the first rectilinear direction such that said first portion and said second portion are freely separable from said arm in the second rectilinear direction.

22. A jig assembly for holding a mower blade and for controlling movement of a grinding tool having a grinding wheel during a sharpening operation on a cutting edge of the mower blade, said jig assembly comprising:

a mast extending between a first end and a second end;

a fixture portion mounted to said mast, said fixture portion including a work-supporting surface extending in a first plane and configured to receive the mower blade, a back surface of the mower blade resting on said work-supporting surface during the sharpening operation of the cutting edge of the mower blade exposed on a front surface of the mower blade;

a jig portion pivotally mounted to said mast, said jig portion comprising:

an arm pivotally connected to said mast with a first pin, said first pin defining an arm pivot axis, and

a tool-seat disposed on said arm, the grinding wheel connected to said arm during the sharpening operation through said tool-seat;

wherein said fixture portion is further defined as pivotally mounted to said mast with a third pin, said third pin defining a fixture pivot axis; and

wherein said fixture portion further comprises at least one stop extending above said work-support surface and limiting movement of the mower blade along said work-supporting surface, a leading edge of the mower blade resting against said at least one stop during the sharpening operation of the cutting edge of the mower blade, an intersection between the leading edge of the mower blade and said at least one stop during the sharpening operation of the cutting edge of the mower blade extending along an intersection axis, and said intersection axis and said fixture pivot axis parallel to one another, wherein said intersection axis moves about said fixture pivot axis during pivoting movement of said fixture portion, said intersection axis moving along an arcuate path in a second plane that is normal to said first plane, wherein said intersection axis and said fixture pivot axis are spaced a first distance from one another along a third axis normal to both of said intersection axis and said fixture pivot axis, wherein a third plane contains said fixture pivot axis and is normal to said arm pivot axis, wherein during the pivoting movement of said fixture portion said intersection axis moves over a range of distances from said third plane, an absolute value of a distance between endpoints of said range defining a second distance, and wherein said second distance less than one third of said first distance.

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