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(54) **Titre : ENSEMBLE CLIQUET DE SECURITE POUR GODET EXCAVATEUR**
(54) **Title: LATCH KEEPER ASSEMBLY FOR EARTH-WORKING BUCKET**

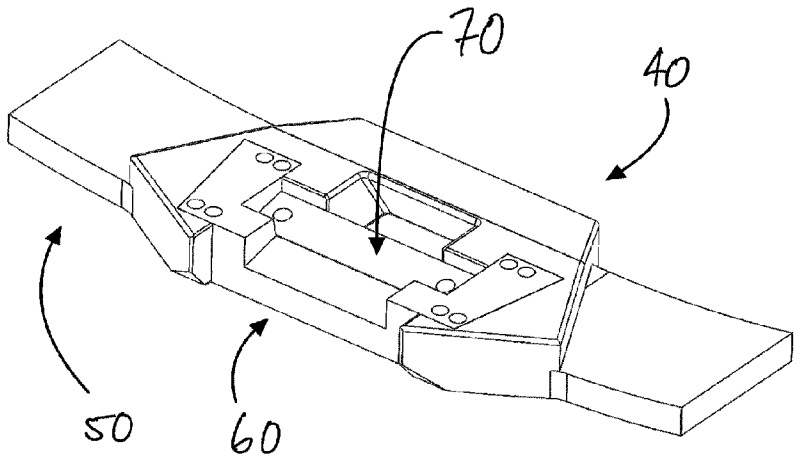

FIG. 5

(57) **Abrégé/Abstract:**
A latch keeper assembly for earth-working bucket, has: a latch keeper securable to a ledge of the earth-working bucket, the latch keeper defining a recess; a member received within the recess of the latch keeper; and a dutchman removably securable to the member. Also, a bucket has: a main body; a door pivotally mounted on the main body; a locking mechanism having a latch bar movable between locked and unlocked positions to selectively lock or unlock the door; and a latch keeper defining a recess for receiving a distal end of the latch bar when the latch bar is in the locked position and when the door is closed, the latch keeper, wherein one of the latch bar and the latch keeper includes rolling elements such that the latch bar is rollingly engaged to the latch keeper in the locked positing of the latch bar.

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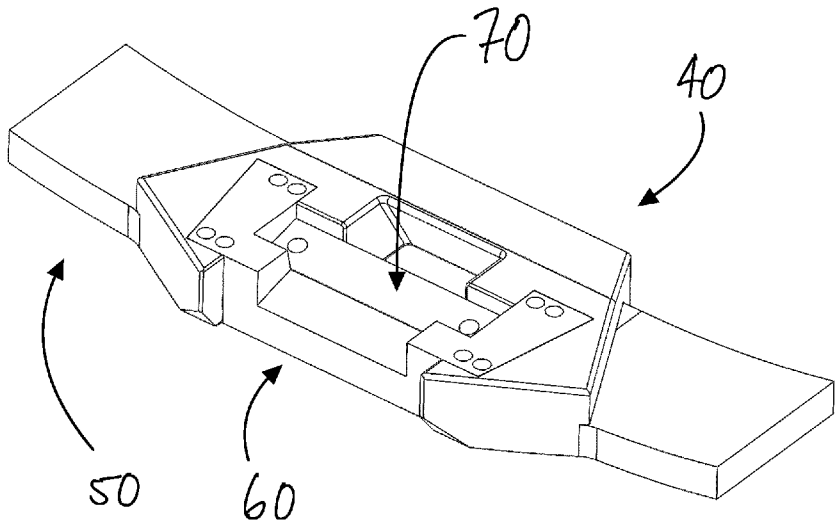

FIG. 5

(57) Abstract: A latch keeper assembly for earth-working bucket, has: a latch keeper securable to a ledge of the earth-working bucket, the latch keeper defining a recess; a member received within the recess of the latch keeper; and a dutchman removably securable to the member. Also, a bucket has: a main body; a door pivotally mounted on the main body; a locking mechanism having a latch bar movable between locked and unlocked positions to selectively lock or unlock the door; and a latch keeper defining a recess for receiving a distal end of the latch bar when the latch bar is in the locked position and when the door is closed, the latch keeper, wherein one of the latch bar and the latch keeper includes rolling elements such that the latch bar is rollingly engaged to the latch keeper in the locked positing of the latch bar.

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LATCH KEEPER ASSEMBLY FOR EARTH-WORKING BUCKET

TECHNICAL FIELD

[0001] The present application relates to excavation equipment such as earth-working buckets, also known as excavation buckets and dippers, and more particularly to door locking mechanisms of such equipment.

BACKGROUND OF THE ART

[0002] Excavation equipment, and in particular earth working buckets such as cable shovel dippers, are used, amongst other applications, for heavy earthwork applications such as mining and excavation. Buckets typically have a leading edge, also known as the lip, that performs a digging action, so as to fill the cavity of the bucket. A closable door is on the trailing end of the bucket, and may be opened to empty the bucket of its content. Due to the weight of the content in the bucket, and the harsh conditions of operation (e.g., moisture, dirt, abrasiveness), known mechanisms to keep the bucket door closed are exposed to wear, and this may hamper the closing action of the door and lead to maintenance, downtime, repairs, etc. In some cases, adjustments of the mechanisms take time. Improvements are sought.

SUMMARY

[0003] In a first aspect of the present disclosure, there is provided a latch keeper assembly for earth-working bucket, comprising: a latch keeper configured to be in a ledge of the earth-working bucket, the latch keeper defining a recess; a member received within the recess of the latch keeper; and a dutchman removably securable to the member.

[0004] Further in accordance with the first aspect, for example, the member is removably securable to the latch keeper within the recess.

[0005] Still further in accordance with the first aspect, for example, the recess is opened on a rear end of the latch keeper, the member closing the recess.

[0006] Still further in accordance with the first aspect, for example, the member is locked within the recess by abutting shoulders.

[0007] Still further in accordance with the first aspect, for example, a top face of the member and a top face of the dutchman are angled.

[0008] Still further in accordance with the first aspect, for example, the top face of the member and the top face of the dutchman are aligned and parallel to one another.

[0009] Still further in accordance with the first aspect, for example, the dutchman has a front face configured to contact a latch in the recess, the front face having rollers protruding from the front face.

[0010] Still further in accordance with the first aspect, for example, the dutchman has a front face configured to contact a latch in the recess, the front face being curved.

[0011] Still further in accordance with the first aspect, for example, the dutchman has a cylindrical portion, with at least one bearing mounted thereon, the at least one bearing configured to contact a latch in the recess,

[0012] Still further in accordance with the first aspect, for example, the at least one bearing is a bearing with rolling elements.

[0013] Still further in accordance with the first aspect, for example, the at least one bearing is a plain bearing.

[0014] Still further in accordance with the first aspect, for example, the at least one bearing is a bushing.

[0015] Still further in accordance with the first aspect, for example, the dutchman has a cylindrical portion, the cylindrical portion configured to contact a latch in the recess.

[0016] Still further in accordance with the first aspect, for example, the dutchman has ends with flats, the flats abutting complementary portions of the member to block rotation of the cylindrical portion.

[0017] Still further in accordance with the first aspect, for example, the member includes support blocks having cavities for receiving the ends with flats.

[0018] Still further in accordance with the first aspect, for example, there is provided a bucket comprising: a main body defining a cavity and an opening for unloading a content of the bucket from the cavity; a door pivotally mounted on the main body, the door movable between a closed position in which the opening is substantially closed by the door and an opened position in which the content may exit the bucket via the opening; a locking mechanism having a latch bar movable

between locked and unlocked positions to selectively lock or unlock the door to close or open the opening; and a latch keeper assembly as described above, the latch keeper assembly cooperating with the latch bar.

[0019] In accordance with a second aspect of the present disclosure, there is provided a bucket comprising: a main body defining a cavity and an opening for unloading a content of the bucket from the cavity; a door pivotally mounted on the main body, the door movable between a closed position in which the opening is substantially closed by the door and an opened position in which the content may exit the bucket via the opening; a locking mechanism having a latch bar movable between locked and unlocked positions to selectively lock or unlock the door to close or open the opening; and a latch keeper defining a recess for receiving a distal end of the latch bar when the latch bar is in the locked position and when the door is closed, the latch keeper, wherein one of the latch bar and the latch keeper includes rolling elements such that the latch bar is rollingly engaged to the latch keeper in the locked positing of the latch bar.

[0020] Further in accordance with the second aspect, for example, the rolling elements are secured to a dutchman of the latch keeper.

[0021] Still further in accordance with the second aspect, for example, the rolling elements are secured to a removable member of the latch keeper.

[0022] Still further in accordance with the second aspect, for example, the rolling elements are secured to the distal end of the latch bar.

[0023] Still further in accordance with the second aspect, for example, the rolling elements are bearings or balls.

DESCRIPTION OF THE DRAWINGS

[0024] Reference is now made to the accompanying figures in which:

[0025] Fig. 1 is a three dimensional view of a bucket in accordance with one embodiment;

[0026] Fig. 2 is a three dimensional view of a door for the bucket of Fig. 1 in accordance with one embodiment;

[0027] Fig. 3 is a cross-sectional view of the door taken along line 3-3 on Fig. 2;

[0028] Fig. 4 is a cross-sectional view of the door of Fig. 2 installed on the bucket of Fig. 1;

[0029] Fig. 5 is a three dimensional view of a latch keeper assembly for the bucket of Fig. 1, in accordance with one embodiment;

[0030] Fig. 6 is a three dimensional exploded view of the latch keeper assembly of Fig. 5;

[0031] Fig. 7 is a three dimensional view of a latch keeper of the latch keeper assembly of Fig. 5 in accordance with one embodiment;

[0032] Fig. 8 is a top view of the latch keeper assembly of Fig. 5;

[0033] Fig. 9 is a three dimensional view of a removable member and dutchman of the latch keeper assembly of Fig. 5;

[0034] Fig. 10 is a bottom three dimensional view of the removable member of Fig. 9;

[0035] Fig. 11 is a cutaway view of the latch keeper assembly of Fig. 5;

[0036] Fig. 12 is a top view of a latch keeper assembly in accordance with another embodiment;

[0037] Fig. 13 is a three dimensional view of a dutchman of one embodiment to be used with the latch keeper assembly of Fig. 12;

[0038] Fig. 14 is a three dimensional view of a dutchman of another embodiment to be used with the latch keeper assembly of Fig. 12;

[0039] Fig. 15 is a top view of a latch keeper assembly in accordance with another embodiment;

[0040] Fig. 16 is a three dimensional view of a removable member of the latch keeper assembly of Fig. 15;

[0041] Fig. 17 is a three dimensional exploded view of the removable member of Fig. 16;

[0042] Fig. 18 is a three dimensional view of a removable member that may be used with the latch keeper assembly of Fig. 15, in accordance with another embodiment;

[0043] Fig. 19 is a cross-sectional view of the door of Fig. 2 installed on the bucket of Fig. 1 with a dutchman in accordance with yet another embodiment;

[0044] Fig. 20 is a top view of the dutchman of Fig. 19 installed on the door of Fig. 2;

[0045] Fig. 21 is a three dimensional view of the dutchman of Fig. 19;

[0046] Fig. 22 is a three dimensional view of a latch keeper assembly in accordance with another embodiment;

[0047] Fig. 23 is an three dimensional exploded view of the latch keeper assembly of Fig. 22;

[0048] Fig. 24 is a three dimensional view of a removable member of the latch keeper assembly of Fig. 22;

[0049] Fig. 25 is a three dimensional view of a shaft for the removable member of Fig. 24;

[0050] Fig. 26 is a cutaway view of the shaft of Fig. 25;

[0051] Fig. 27 is a three dimensional view of a latch keeper assembly in accordance with another embodiment;

[0052] Fig. 28 is a three dimensional view of a removable member of the latch keeper assembly of Fig. 27;

[0053] Fig. 29 is a three dimensional view of a shaft for the removable member of Fig. 28;

[0054] Fig. 30 is a cutaway view of the shaft of Fig. 29; and

[0055] Fig. 31 is a three dimensional view of a shaft that may be used with the removable member of Fig. 24 or 28, in accordance with another embodiment.

DETAILED DESCRIPTION

[0056] Referring to Fig. 1, a bucket is shown at 10. The bucket 10 may be used for excavation, for example as part of a cable shovel dipper of the type generally used on electric-cable shovels to scoop ore, earth, dirt from the ground, and is an example of the numerous types of excavation equipment that may benefit from the configuration described hereinafter for a locking system for a door thereof. Other types of excavation equipment and like earth working buckets include

electric rope shovels, hydraulic face shovels, hydraulic backhoe, loader, dragline, bucket-wheel excavator, etc. However, for simplicity, the present disclosure refers to the bucket 10, although it is understood that other excavation equipment may use the configuration described hereinafter.

[0057] As a general description, the bucket 10 has a body 10A, generally tubular in shape, or hollow as another way to describe the body 10A, having a leading end for excavation, and a trailing end opposite the leading end. The bucket 10 defines an inner cavity 11 for receiving earth or like excavation products, with a lip 12 leading the excavating. The lip 12 is shown generally in Fig. 1, but may have numerous components, such as teeth, shrouds, C-clamps, wear plates, to name a few. Various connectors 13 are provided on a top surface of the bucket 10, to connect the bucket 10 to a handle, to a stick, to an arm, etc, of a cable shovel dipper, crane or like equipment or vehicle. Any appropriate type of connector may be used, with pivot connectors 13 being shown as an example among others.

[0058] Pivot supports 14 may be adjacent to a trailing end of the bucket 10. The pivot supports 14 may be provided on both sides of the bucket 10, and are above a trailing opening 15 of the bucket 10 through which the load of earth in the inner cavity 11 of the bucket 10 may be unloaded. The pivot supports 14 are provided to pivotally support a door 20 (Fig. 2), which door 20 selectively opens the trailing opening 15 and closes the trailing opening 15. The door 20 is closed during the excavating or digging, while the door 20 is allowed to open to unload the content of the bucket 10, by the effect of gravity.

[0059] Still referring to Fig. 1, the bucket 10 may also have a ledge 16 at a bottom trailing edge 10B of the bucket 10. The ledge 16 may be an add-on feature to the bucket 10, or may be an integral part of the bowl of the bucket 10. As will be explained below, the latch component (a.k.a, latch) may be moved to selectively unlock the door 20 to allow an emptying of the bucket 10 or to lock the door 20 in a closed position.

[0060] Referring now to Fig. 2, the door 20 is described in more detail. The door 20 includes two arms 21 secured to a main body 22 of the door 20. The main body 22 has a top edge 22A, a bottom edge 22B and lateral edges 22C, 22D extending from the top edge 22A to the bottom edge 22B. The two arms 21 protrude from the main body 22 of the door 20 beyond the top edge 22A. A single arm 21 could be present, or three or more arms 21 as well. Each of the two arms 21 may be L-shaped and defines an opening 21A at a distal end thereof for receiving a pivot. Each of the distal ends of the two arms 21 is received between two respective ones of the pivot

supports 14 (Fig. 1) of the bucket 10 and a pin or pivot extends through the pivot supports 14 and into the openings 21A of the arms 21. The door 20 is therefore pivotally mounted to the bucket 10 and is pivotable between a closed position in which the opening 15 is closed by the door 20 and an open position in which the opening 15 is accessible. Any suitable means are contemplated to pivotally connect the door 20 to the bucket 10 such as, for instance, hinges. Other configurations are contemplated. For instance, each of the arms 21 may define a fork at its distal end to receive a pivot support between prongs of the fork. The door 20 optionally includes three horizontal ribs 23 secured to the main body 22 and extending between the two lateral edges 22C, 22D of the main body 22 of the door 20. There may be fewer or more of the horizontal ribs 23. Two of the horizontal ribs 23 define a passage 23A therein. The passages 23A of the horizontal ribs 23 are aligned with one another and are sized to slidably receive another component as will be described below. It is understood that the passages 23A need not be defined by the horizontal ribs 23 and that other means may be used to define the passages 23A, such as brackets secured to the main body 22 of the door 20.

[0061] Referring to Figs. 2-4, the door 20 includes a closing mechanism 30 that includes a latch bar 31. The latch bar 31 is slidably movable within the passages 23A defined by the horizontal ribs 23 of the main body 22 of the door 20. The passages 23A are schematically illustrated with dashed lines in Fig. 2. The latch bar 31 may therefore be constrained to movement in one translational degree of freedom (DOF), though some play is possible. A lever bar 32 is pivotally engaged to the latch bar 31 at a fulcrum 32A. A distal end 32B of the lever bar 32 is movable along a first direction D1 toward a top of the main body 22 of the door 20 and along a second direction D2, opposed to the first direction D1, toward a bottom of the main body 22 of the door. The lever bar 32 has a locked position and an unlocked position. In both positions, the lever bar 32 may be in abutment against stoppers secured to the main body 22 of the door 20, to the horizontal ribs 23, or to any other feature of the door 20. The stoppers therefore define upper and lower limits of the movements of the lever bar 32 between its locked and unlocked positions.

[0062] As shown in Fig. 3-4, when the lever bar 32 is lowered into the locked position, the latch bar 31 is moved downwardly until a distal end 31A of the latch bar 31 is engaged to a latch keeper, which is secured to the ledge 16 of the bucket 10 or to a trailing end of the bowl of the bucket 10. Consequently, the door 20 is mechanically blocked from pivoting to its open position by the latch bar 31. An insert 31B, which may be replaceable, may be located at the distal end 31A of the latch bar 31 and may be made of a material being more wear resistant than a material of the latch bar 31. For instance, the insert 31B may be made of a metal, such as a steel (e.g.

AR500), for its abrasion resistance. The insert 31B of the latch bar 31 may be in abutment against a keeper insert, also referred to as a dutchman, secured to the latch keeper as will be discussed below.

[0063] An overlap O taken along a longitudinal axis L of the latch bar 31 is defined between the insert 31B of the latch bar 31 and the dutchman when the latch bar 31 is in the locked position. The overlap O is preferably between 0.75 inch and 1 inch. An overlap O of less than 0.75 inch may be insufficient to keep the door 20 closed whereas an overlap O of more than 1 inch may require too much force to move the latch bar 31 from the locked position to the unlocked position. Nevertheless, it is contemplated to have an overlap O outside this range.

[0064] In some cases, it is required to adjust the overlap O for proper operation of the bucket 10. Shims and or other means may be used. However, adjusting the overlap O may be tedious and may require more than one person. Downtime and profit losses may therefore occur. Furthermore, the dutchman of the latch keeper is subjected to wear and tear with time and must often be replaced. The latch keeper described herein below may at least partially alleviate these drawbacks.

[0065] Referring now to Figs. 5-6, a latch keeper assembly in accordance with one embodiment is shown at 40. The latch keeper assembly 40 includes a latch keeper base 50, a removable member 60, and a latch keeper insert, or dutchman 70. The latch keeper 50 is configured to be secured to the ledge 16 of the bucket 10. The latch keeper base 50 may be permanently secured to the ledge 16 or may be part of the ledge, such as an integral or monolithic part thereof. Alternatively, the latch keeper base 50 may be removable from the ledge 16. The removable member 60 acts as an interface between the latch keeper base 50 and the dutchman 70. In other words, the dutchman 70 is secured to the latch keeper base 50 or ledge 16 via the removable member 60. The dutchman 70 may be made of the same material of the insert 31B of the latch bar 31. The latch keeper base 50 and the removable member 60 are described herein below. Parts of the latch keeper base 50 are numbered with reference numerals in the 50's whereas parts of the removable member 60 are numbered with reference numerals in the 60's.

[0066] Referring now to Figs. 5-7, the latch keeper base 50 is shown in greater detail. The latch keeper base 50 may have wings 51 protruding away from one another from a central body 52, though other segmentations or a single body may be used. The central body 52 and the two wings 51 may therefore be monolithic parts of a same single body. Alternatively, they may be

separate parts secured (e.g., fastened) to one another. The two wings 51 may be used to secure (e.g., fasten, bolt, weld) the latch keeper base 50 to the ledge 16 of the bucket 10 or to the trailing edge of the bowl of the bucket 10. The central body 52 defines a recess 53. The recess 53 may extend from the top of the latch keeper base 50 as shown in Fig. 7. Alternatively, the recess 53 may extend from the bottom of the latch keeper base 50. In the embodiment shown, the recess 53 is sized to accept the removable member 60. Hence, a layout, perimeter and/or geometry of the recess 53 may substantially match that of the removable member 60, for complementary engagement therebetween. The recess 53 extends through the central body 52. Alternatively, the recess 53 may be close-ended. The recess 53 is open on a rear end 50A of the latch keeper base 50 and closed on a front end 50B of the latch keeper base 50. In some embodiments, the recess 53 may be closed at the rear end 50A. The central body 52 includes a top face 52A and an opposed bottom face 52B. The central body 52 has a thickness that extends from the top face 52A to the bottom face 52B. A portion of the top face 52A may be beveled toward the bottom face 52B.

[0067] In the embodiment shown, the recess 53 is bound at its bottom by two abutting plates 54, as an option among others. The removable member 60 may therefore move within the recess 53 relative to the central body 52 until it abuts the two abutting plates 54. The two abutting plates 54 defines apertures 54A, four as shown but more or less are contemplated, that may be used to fasten the removable member 60 to the latch keeper base 50. The recess 53 has a central section 53A that extends through the central body 52. The recess 53 defines lateral sections 53B, two in the embodiment shown, that communicate with the central section 53A. The two lateral sections 53B are bounded at their bottom by the two abutting plates 54.

[0068] The recess 53 may further include a fore section 53C. The fore section 53C may remain free of the removable member 60 and may be sized to accept the distal end 31A (Fig. 3) of the latch bar 31 when the door 20 is closed an when the latch bar 31 is locking the door 20 in its closed position. The removable member 60 may extend into the central section 53A of the recess 53 to close a rear end of the recess 53.

[0069] The central body 52 may define shoulders 52C. Each of the two shoulders 52C is oriented toward a respective one of the two lateral sections 53B of the recess 53. The two shoulders 52C may be used to abut portions of the removable member 60 as will be discussed below, but may be optional. When assembled, the removable member 60 may therefore be constrained vertically by the two abutting plates 54 (and fasteners as a possibility) and laterally

by the two shoulders 52C and by peripheral faces 52D circumscribing the recess 53. The removable member 60 may, in some embodiments, slide into the recess via a rear end of the latch keeper base 50 and locked in place via any suitable means (e.g., keyway, dog and slot, cleats, etc).

[0070] Referring now to Figs. 8-10, the removable member 60 is described in greater detail. The removable member 60 includes a body defining a top face 60A, a bottom face 60B opposed to the top face 60A and peripheral faces 60C extending from the top face 60A to the bottom face 60B. The removable member 60 may optionally defines a central recess 61 that extends from the top face 60A toward the bottom face 60B. The removable member 60, in some embodiments, may be permanently secured to the latch keeper base 50. The peripheral faces 60C include lateral faces 60D. The lateral faces 60D may be non-parallel such that a distance between the lateral faces 60D increases toward the front end 50B of the latch keeper base 50. The lateral faces 60D of the removable member 60 are in abutment against correspondingly angled faces of the latch keeper base 50 and may help preventing movements of the removable member 60 relative to the latch keeper base 50 when the latch bar 31 abuts the dutchman 70 and when the door 20 exerts a force to open. In other words, the cooperation of these non-parallel faces of the latch keeper base 50 and removable member 60 may help in maintaining the door 20 in its closed position without play. This may reduce the shearing risk for the fasteners used to secure the removable member 60 to the latch keeper base 50. Any other suitable shapes of the removable member 60 are contemplated. For instance, the removable member 60 may define shoulders. As shown in Fig. 8, a rear face 60E of the removable member 60 abuts some of the peripheral faces 52D that circumscribe the recess 53 of the latch keeper base 50, which may further help in maintaining the door 20 closed and protect the fasteners from shearing.

[0071] As shown in Fig. 9, the removable member 60 may include a central portion 62 and lateral portions 63 extending away from one another and away from the central portion 62, though there are other configurations that may be used. Each of the two lateral portions 63 is sized to be received within a respective one of the two lateral sections 53B of the recess 53 of the latch keeper base 50 (Fig. 7). Each of the two lateral portions 63 of the removable member 60 may define a shoulder 63A. Each of the shoulders 63A of the removable member 60 abuts a respective one of the two shoulders 52C of the latch keeper base 50. Hence, the removable member 60 may increase a stiffness of the latch keeper base 50 because of the cooperation of the shoulders 63A, 52C that limit lateral deformation of the latch keeper base 50. In other words, a locking engagement may therefore be defined between the removable member 60 and the latch keeper

base 50. This locking engagement may help in preventing the recess from widening. Moreover, the angled lateral faces 60D that abut correspondingly angled faces of the latch keeper base 50 may help in resisting a force exerted by the latch bar 31 on the dutchman 70 and on the removable member 60.

[0072] In the embodiment shown, the two lateral portions 63 of the removable member 60 each define four apertures 63B, although more or less are contemplated. Each of the four apertures 63B is aligned with a respective one of the apertures 54A (Fig. 7) defined through the abutting plates 54 (Fig. 7) of the latch keeper base 50. Fasteners (not shown) may be threadingly engaged through the apertures 54A, 63B to secure the removable member 60 to the latch keeper base 50. It will be appreciated that any other suitable means for securing the removable member 60 to the latch keeper base 50 is contemplated without departing from the scope of the present disclosure. For instance, dog and slot, keyway, cleat, etc may alternatively be used. The central portion 62 of the removable member 60 defines apertures 62A, two in the embodiment shown, that may be used to receive fasteners used to secure the dutchman 70 to the removable member 60. The dutchman 70 may define corresponding apertures 70A in register with the apertures 62A of the removable member 60.

[0073] As shown in Fig. 10, and in the embodiment shown, the bottom face 60B of the removable member 60 is stepped to define two abutting faces 60F that each may contact a respective one of the two abutting plates 54 of the latch keeper base 50. This may enhance a stability of the removable member 60 within the latch keeper base 50, but is an optionally feature.

[0074] Referring now more particularly to Fig. 11, the central portion 62 of the removable member 60 has a top face 62B that is sloped. More particularly, a distance between the top face 62B of the central portion 62 and the bottom face 60B of the removable member 60 increases toward the front end 50B of the latch keeper base 50. This slope of the top face 62B of the removable member 60 may provide a smooth transition and may help the latch bar 31 bounce over the dutchman 70 while opening the door. This may limit rubbing between the latch bar 31 and the top face 70B of the dutchman 70, which may enhance the lifespan of the dutchman 70. The top face 62B may then define a step 62C between front and rear ends of the removable member 60. The step 62C is sized such as to accept the dutchman 70 and such that a top face 70B of the dutchman 70 may be flush with the top face 62B of the central portion 62 of the removable member 60. Hence, the top face 70B of the dutchman and the top face 62B of the central portion 62 may be aligned and parallel to one another, in a coplanar manner. Therefore,

in use, when the door 20 (Fig. 2) is moved toward its closed position, the distal end 31A of the latch bar 31 slides along the top face 62B of the removable member 60 before sliding against the top face 70BA of the dutchman 70. In other words, the dutchman 70 and the central portion 62 of the removable member 60 may work in conjunction to define a substantially continuous gliding surface for guiding the latch bar 31. Once the latch bar 31 passes a trailing edge of the dutchman 70, it may fall by gravity into the fore section 53C of the recess 53 of the latch keeper base 50. At that point, the door 20 may be locked in the closed position by way of the abutment between the distal end 31A of the latch bar 31 and the dutchman 70. To enhance its lifespan, the dutchman 70 may be coated with a wear-resistant coating, such as a carbide-based coating.

[0075] The removable member 60, by being removable from the latch keeper base 50, may allow its periodic replacement over time. Moreover, the removable member 60 and its step 62C for receiving the dutchman 70, may allow periodic replacement of the dutchman 70 that may wear out with time. In an embodiment, the dutchman 70 is replaced more frequently than the removable member 60. Therefore, instead of regularly replacing a large component, a smaller component (i.e., the dutchman 70) is replaced while a bigger component (i.e., the removable member 60) remains on the bucket 10. In some embodiments, protective plate(s) may be secured (e.g., welded) on the latch keeper base 50 and/or on the removable member 60 for added wear resistance. Furthermore, the removable member 60 may allow easy adjustment of a height of the dutchman 70 to vary the overlap O (Fig. 4). The height of the dutchman 70 may be adjusted with shims disposed between the removable member 60 and the dutchman 70, or between the removable member 60 and the latch keeper base 50. Alternatively, or in combination with the shim, the removable member may define recesses of varying depths; the dutchman 70 may be inserted into a selected one of these recesses corresponding to the desired height of the dutchman 70.

[0076] The disclosed latch keeper assembly 40 may allow the replacement the dutchman 70 quickly since it is fastened to the removable member 60. The dutchman 70 may have any other suitable outline, such as, rectangular, trapezoidal, cylindrical, and so on. . The dutchman 70 is a rectangular prism, but may have other geometries as shown herein. The removable member 60 may be quickly replaced since it may be fastened to the latch keeper base 50. The fastening may be done through the latch keeper or directly in the latch keeper. That is, the fastener may extend through the latch keeper via a bore and may have, for instance, a nut located within a cavity defined in an underside of the latch keeper. Alternatively, the removable member 60 may be fastened directly in the latch keeper via threaded bores defined by the latch keeper. In some

embodiments, the removable member 60 may be welded to the latch keeper base 50. The removable member 60 may include two or more sections. The removable member 60 may allow a height adjustment of the dutchman 70. This may allow more flexibility to the closing mechanism 30 of the door 20 since it may not need to provide height adjustment of the latch bar 31. A thickness of the dutchman 70 may be varied, which may allow the system to become fixed without requiring height adjustment capabilities. The removable member 60 may be replaced when its top face 62B becomes worn, due to the removable nature of the removable member 60. The removable member 60 may be installed within the recess 53 of the latch keeper base 50 with some play. This play may help in removing, with slight motion, matter that might adhere to the latch keeper assembly 40 and block the entrance of the fore section 53C of the recess 53 of the latch keeper base 50. In some embodiments, a shock-absorbing material may be disposed between the removable member 60 and the latch keeper base 50. The compression of the shock-absorbing material may create a slight motion while keeping all the components tight against each other such that there is no gap between the components.

[0077] Referring now to Figs. 12-14, another embodiment of a latch keeper assembly is shown at 140. The latch keeper assembly 140 includes the latch keeper base 50 and the removable member 60 described above with reference to Figs. 5-11. Hence, for the sake of brevity, only elements differing from the latch keeper assembly 40 of Figs. 5-11 are described herein below.

[0078] In the embodiment shown, the dutchman 170 has a front face 170A oriented toward the front end 50B of the latch keeper base 50. The front face 170A faces the latch bar 31 when the door 20 is in the closed position. In the embodiment shown, the dutchman 170 includes a plurality of rolling elements depicted as balls or rollers 171 that protrude from the front face 170A. In the present case, 20 rollers 171 are used, but more or less rollers 171 are contemplated. The rollers 171 are shown here as ball rollers, having their own receptacle holding a ball captive therein, as shown in Figs. 13 and 14. Each of the ball rollers may be rollingly received within a socket or recess defined by the dutchman 170, with the dutchman 170 have a cap or like access to the rollers 171 for assembly thereof. These sockets extend inwardly from the front face 170A into a body of the dutchman 170. In a variant, the rollers 171 each have an own socket 171A that holds the rollers 171 captive, with the socket 171A being received in an opening defined in the front face 170A. The sockets 171A may for example be force fitted in the body of the dutchman 170, adhered to the body, etc.

[0079] In use, instead of abutting against the front face 170A of the dutchman 170, the latch bar 31 rollingly engages the rollers 171 thereby decreasing a friction with the dutchman 170 compared to a configuration in which no rollers are used and in which the latch bar 31 is frictionally engaged to the front face 170A of the dutchman 170. Smaller rollers 171 may be present in a greater number, to increase a contact with the latch bar 31, but other size of rollers is contemplated. For instance, the dutchman 270 of Fig. 14 uses bigger ball rollers 271, three in the embodiment shown, but more or less is contemplated. It will be appreciated that, alternatively, the rollers 171 be rollingly engaged to the latch bar 31 instead of to the dutchman 170. In some embodiments, a dutchman with integrated off-the-shelf ball bearings may be used. The ball rollers 271 may come with their own sockets 271A.

[0080] Referring now to Figs. 15-17, another embodiment of a latch keeper assembly is shown at 240. In the present case, the latch keeper assembly 240 is free of a dutchman and includes removable member 260 that is designed to be abutted by the latch bar 31. The latch keeper assembly 240 could be part of a Dutchman configuration as well. The removable member 260 is an assembly including a main body 261, a cover plate 262, and bearings 263. Eleven bearings 263 are shown in the present embodiment, but more or less bearings are contemplated. The bearings may be rolling element bearings (e.g., needle bearings, ball bearings). The bearings 263 are cylindrical bearings in the embodiment shown, such as ball bearings but with other options available, including plain bearings. Although the bearings 263 are shown being disposed axially relative to the shaft longitudinal axis, any other suitable configurations, such as a matrix (e.g., 6 x 2), are contemplated without departing from the scope of the present disclosure.

[0081] As shown more distinctly in Fig. 17, the main body 261 defines an inner cavity 261A, which may be substantially rectangular-shaped, and that is sized for accepting a shaft or support 264 on which the bearings 263 are mounted. The shaft 264 may have a central cylindrical section 264A and square end sections 264B. Dimensions of the square end sections 264B of the shaft 264 may be selected such that the shaft 264 is substantially non-rotatable relative to the main body 261 within the inner cavity 261A thereof. This may ensure that the components that rotate when the removable member 260 is engaged by the latch bar 31 are the bearings 263 and not the shaft 264 within the inner cavity 261A. The central cylindrical section 264A is sized such as to be receivable into inner races of the bearings 263. A tight fit may be provided between the central cylindrical section 264A of the shaft 264 and the bearings 263. Alternatively, the shaft 264 may be rotatable, with roller portions thereon. If one or two faces at the ends of the shaft 264

become worn, the shaft 264 may be rotated 90 degrees for other faces to be used. In a variant, the ends have more than the four end faces shown to allow more orientations to be present.

[0082] In the embodiment shown, the main body 261 includes a plurality of fingers 261B that extends vertically toward a top face 260A of the removable member 260. Slots 261C are defined between the fingers 261B. Each of the slots 261C is sized to accept a respective one of the bearings 263, for the bearings 263 to project through the slots 261C and beyond a plane of the main body 261. In other words, the bearings 263 are axially spaced-apart from one another by the fingers 261B about a longitudinal axis of the shaft 264. This may prevent the bearings 263 from rubbing against one another and may prevent matter from being stuck between two adjacent bearings.

[0083] As shown in Fig. 17, the inner cavity 261A is open at the top face 260A of the removable member 260 to insert the shaft 264 and the bearings 263 mounted thereto. The cover plate 262 is used to lock the shaft 264 and bearings 263 in place into the inner cavity 261A. The cover plate 262 may be welded to the main body 261 of the removable member 260. In other embodiments, the cover plate 262 may be fastened on the main body 261 of the removable member 260.

[0084] As illustrated in Fig. 15, the bearings 263 protrude beyond a plane of the front face 260B of the removable member 260 such that the latch bar 31 abuts against the bearings 263 when the door 20 is in the closed position. The bearings 263 may therefore provide a rolling engagement between the latch bar 31 and the removable member 260, which may help upward and downward movements of the latch bar 31 to close or open the door 20.

[0085] It will be appreciated that this shaft 264 and bearings 263 may, in another embodiment, be integrated directly to the latch keeper such that the removable member 260 is no longer require and may be omitted.

[0086] Referring now to Fig. 18, another embodiment of the removable member is shown at 360. In the embodiment shown, the bearings 263, nineteen being shown but more or less is contemplated, are disposed directly one next to the other into an inner cavity 361A. Hence, this configuration of the removable member 360 differs from the one shown in Fig. 17 by the removal of the fingers 261B. This may allow using more of the bearings 263, which may provide a better load distribution on the latch keeper.

[0087] The configurations of the latch keeper using bearings or rollers may provide a greater lifespan of the latch keeper and, in some embodiments, may remove the need to replace the dutchman periodically.

[0088] Referring now to Figs. 19-21, a dutchman in accordance with another embodiment is shown at 370. The dutchman 370 is removably securable to the ledge 26 via wings 371 that protrude laterally from a body 372 of the dutchman 370. The wings 371 may define apertures for receiving fasteners for securing the dutchman 370 to the ledge 16. Any other suitable fastening means are contemplated without departing from the scope of the present disclosure. Moreover, the wings 371 are optionally as the dutchman 370 may have a uniform cross-section in an embodiment.

[0089] As shown more clearly on Fig. 21, the body 372 of the dutchman 370 includes a top face 372A, a bottom face 372B opposed to the top face 372A, lateral faces 372C that extend from the top face 372A to the bottom face 372B, a front face 372D, and an opposed rear face 372E. The front and rear faces 372D, 372E extend from the top face 372A to the bottom face 372B. In the embodiment shown, the body 372 of the dutchman 370 may have a substantially rectangular profile on its rear portion and have a curved shape or profile on its front portion. In other words, the front face 372D of the body 372 of the dutchman 370 may be curved. It will be appreciated that only a portion of the front face 372D may be curved; the portion being in contact with the insert 31B when the door is closed. The curved shape of the front face 372D may have any suitable shape such as cylindrical, elliptical, and so on.

[0090] The curved shape of the front face 372D may provide a single contact line CL (shown with a dashed line in Fig. 21) between the insert 31B of the latch bar 31 and the dutchman 370. This single contact line CL, as opposed to a contact surface between these two elements, may limit a force required to open the door. In other words, this single contact line CL may limit a friction force between the insert 31B of the latch bar 31 and the dutchman 370. This configuration may ease the unlocking of the door. Stated differently, when the insert 31B is moved upward, the contact surface between the insert 31B and the dutchman 370 may be limited to part of the contact line CL until the insert 31B is above the contact line CL. From that point on, the insert 31B follows the curvature of the front face 372D, and this may further ease the displacement.

[0091] In some embodiments, both of the front and rear faces 372D, 372E may be curved. This may allow to double the lifespan of the dutchman 370 since once one of the faces is worn, the dutchman 370 may be rotated 180 degrees to use the other face (e.g., rear face 372E).

[0092] As shown more particularly on Fig. 19, an apex 372F of the front face 372D, defined as a forward-most point of the front face 372D, may be located closer to the bottom face 372B than the top face 372A. Hence, the dutchman 370 may be non-symmetric relative to a plane intersecting the apex 372F and intersecting the rear face 372E, which plane is perpendicular to the rear face 372E. This is an optional configuration. In some embodiments, the apex 372F may register with the single contact line CL. The apex 372F may be an apex line. In some embodiments, the apex 372F may be centered between the top and bottom faces 372A, 372B and the dutchman 370 may be symmetrical about the plane intersecting the apex 372F and the rear face 372E.

[0093] Referring now to Figs. 22-26, another embodiment of a latch keeper assembly is shown at 440. In the present case, the latch keeper assembly 440 with latch keeper base 450 has a dutchman or the like that includes removable member 460, designed to be abutted by the latch bar 31. The removable member 460 is an assembly including bearings 463, a shaft 464 and support blocks 465 (e.g., having a T shape). Three bearings 463 are shown in the present embodiment, but more or less bearings are contemplated. The bearings 463 are cylindrical bearings in the embodiment shown, such as needle roller bearings (see Fig. 26), but with other options available, including plain bearings, or bearings with other types of roller elements.

[0094] As shown more distinctly in Fig. 23, the latch keeper base 450 includes an inner cavity 451 which may be substantially rectangular-shaped (or may have other shapes), and that is sized for accepting the removable member 460. The shaft 464 may have a central cylindrical section 464A and square end sections 464B receivable in corresponding cavities 465A in support blocks 465, complementary in shape. Other shapes for the end sections 464B may be contemplated, with an object being the blocking of a rotation of the shaft 464. Dimensions of the square end sections 464B of the shaft 464 may be selected such that the shaft 464 is substantially non-rotatable relative to the latch keeper base 450 when the square end sections 464B are received in the cavities 465A of the support blocks 465 and the removable member 460 is received in the inner cavity 451. This may ensure that the components that rotate when the removable member 460 is engaged by the latch bar 31 are the bearings 463 and not the shaft 464. If flats of the end sections 464B become worn, it may be possible to remove the removable member 460, rotate

the shaft 464, and reinstall the assembly. Accordingly, it is considered to have more than the four flats shown for the end sections 464B, such as by having hexagonal, octagonal ends, etc.

[0095] The inner cavity 451 of the latch keeper base 450 is shown to be open at a top face 450A to insert the removable member 460 thereinto. The support blocks 465 may be installed to the inner cavity 451 via fasteners 466, securing the removable member 460 in place. Other fastening means may be contemplated.

[0096] Referring additionally to Figs. 24-26, the central cylindrical section 464A is sized such as to be receivable into inner races of the bearings 463. The bearings 463 may be configured to roll about the central cylindrical section 464A, while the shaft 464 remains static. An end piece or stopper 467 may be received at a distal end of the central cylindrical section 464A to retain the bearings 463 in place.

[0097] In the shown case, the square end sections 464B, and thus the corresponding cavities 465A, are sized differently. Stated differently, the square end section 464B at a first end of the shaft 464 is larger than the square end section 464B at a second end of the shaft 464. The larger of the square end sections 464B may have a width greater than a diameter of the central cylindrical section 464A, while the smaller of the square end sections 464B may have a width smaller or equal to the diameter of the central cylindrical section 464A. As such, the bearings 463 may be easily mountable to the shaft 464 over the smaller of the square end sections 464B, with the end piece or stopper 467 retaining the bearings 463 in place after installation. In other cases, both of the square end sections 464B may be sized to receive the bearings 463. One or both of the square end sections may include an abutment shoulder as well. In a variant, the stopper 467 is an hexagonal nut, but other end pieces may be used.

[0098] When the door 20 is in the closed position, the latch bar 31 may abut against the bearings 463. The bearings 463 may therefore provide a rolling engagement between the latch bar 31 and the removable member 460, which may help upward and downward movements of the latch bar 31 to close or open the door 20. The bearings 463 may roll about the central cylindrical section 464A of the non-rotating shaft 464. Moreover, the presence of bearings 463 may reduce wear of the other components of the removable member 460 and of the latch bar 31, as friction is reduced.

[0099] Referring now to Figs. 27-30, another embodiment of a latch keeper assembly is shown at 540. In the present case, the latch keeper assembly 540 with latch keeper base 550 is

a dutchman that includes removable member 560, designed to be abutted by the latch bar 31. The removable member 560 is an assembly including bushing or sleeve bearing 563 (e.g., with or without rollers, plain bearing being a solution), a shaft 564 and support blocks 565.

[0100] As shown more distinctly in Fig. 27, the latch keeper base 550 includes an inner cavity 551 which may be substantially rectangular-shaped, and that is sized for accepting the removable member 560. The shaft 564 may have a central cylindrical section 564A (see Fig. 30) and square end sections 564B receivable in corresponding cavities 565A in support blocks 565. Other shapes for the end sections 564B may be contemplated, with an object being the blocking of a rotation of the shaft 564. Dimensions of the square end sections 564B of the shaft 564 may be selected such that the shaft 564 is substantially non-rotatable relative to the latch keeper base 550 when the square end sections 564B are received in the cavities 565A of the support blocks 565 and the removable member 560 is received in the inner cavity 551. This may ensure that the component that rotates when the removable member 560 is engaged by the latch bar 31 is the bushing 563 and not the shaft 564. If flats of the end sections 564B become worn, it may be possible to remove the removable member 560, rotate the shaft 564, and reinstall the assembly. Accordingly, it is considered to have more than the four flats shown for the end sections 564B, such as by having hexagonal, octagonal ends, etc.

[0101] The inner cavity 551 of the latch keeper base 550 is shown to be open at a top face 550A to insert the removable member 560 thereinto. The support blocks 565 may be installed to the inner cavity 551 via fasteners 566, securing the removable member 560 in place. Other fastening means may be contemplated.

[0102] Referring additionally to Figs. 28-30, the central cylindrical section 564A is sized such as to be receivable into the inner race of the bushing 563. The bushing 563 may be configured to roll about the central cylindrical section 564A, while the shaft 564 remains static. An end piece or stopper 567 may be received at a distal end of the central cylindrical section 564A to retain the bushing 563 in place. The bushing 563 may have an axial length approximately matching that of the central cylindrical section 564A to limit axial displacement upon installation. Spacers may be installed to minimize such displacement as well and to reduce friction between components.

[0103] In the shown case, the square end sections 564B, and thus the corresponding cavities 565A, are sized differently. Stated differently, the square end section 564B at a first end of the shaft 564 is larger than the square end section 564B at a second end of the shaft 564. The larger

of the square end sections 564B may have a width greater than a diameter of the central cylindrical section 564A, while the smaller of the square end sections 564B may have a width smaller or equal to the diameter of the central cylindrical section 564A. As such, the bushing 563 may be easily mountable to the shaft 564 over the smaller of the square end sections 564B. In other cases, both of the square end sections 564B may be sized to receive the bushing 563. If flats of the end sections 564B become worn, it may be possible to remove the removable member 560, rotate the shaft 564, and reinstall the assembly. Accordingly, it is considered to have more than the four flats shown for the end sections 564B, such as by having hexagonal, octagonal ends, etc.

[0104] When the door 20 is in the closed position, the latch bar 31 may abut against the bushing 563. The bushing 563 may therefore provide a rolling engagement between the latch bar 31 and the removable member 560, which may help upward and downward movements of the latch bar 31 to close or open the door 20. The bushing 563 may roll about the central cylindrical section 564A of the non-rotating shaft 564. The presence of bushing 563 may reduce wear of the other components of the removable member 560 and of the latch bar 31, as friction is reduced.

[0105] Referring to Fig. 31, another embodiment of a shaft 664 is shown. Shaft 664 may, for instance, be installed in removable members 460, 560 of latch keeper assemblies 440, 540. Shaft 664 includes a central cylindrical section 664A and may have square end sections 664B receivable in corresponding cavities 465A, 565A in support blocks 465, 565 in a non-rotatable fashion. In other cases, shaft 664 may be adapted for use in other latch keep assemblies.

[0106] The surface of the central cylindrical section 664A may be resistant to wear, for instance by having a surface coating (as may have all embodiments described herein). When the door 20 is in the closed position, the latch bar 31 may abut against the central cylindrical section 664A. The central cylindrical section 664A may therefore provide a wear-resistant engagement between the latch bar 31 and the removable member 660, which may help upward and downward movements of the latch bar 31 to close or open the door 20. In addition, the non-rotating shaft 664 in the shown case may be indexed at four different position due to the four-sided square end sections 664B. As such, the lifespan of the shaft 664 may be extending by varying the installation position, thereby changing the portion of the central cylindrical section 664A that engages with the latch bar 31. In other cases, other shaped end-sections 664B may be contemplated, which may offer other numbers of index positions. If flats of the end sections 664B become worn, it may be possible to remove the shaft 664, rotate it, and reinstall it. In all embodiments described herein,

the flats those that are generally parallel to an axis of the shaft (and not the axial flats to which the axis is normal). Accordingly, it is considered to have more than the four flats shown for the end sections 664B, such as by having hexagonal, octagonal ends, etc. Fillets or rounded edges may be present in this embodiment, and in all other embodiments described herein where appropriate.

[0107] Referring to Figs. 22-31, by implementing a latch keeper assembly 440, 540 with a non-rotating shaft 464, 564, 664, the number of moving components may be minimized, which may reduce the number of parts that are susceptible to damage. The installation of the removable member 460, 560 may be simplified, as the non-rotating shaft 464, 564, 664 may be inserted directly into the support blocks 465, 565. In addition, any misalignment of the shaft 464, 564, 664 with respect to the support blocks 465, 565 may not affect the performance of the latch keeper assembly 440, 540, as the shaft 464, 564, 664 does not rotate. The shaft 464, 564, 664 may be indexed at various positions, illustratively four unique positions, which may extend the lifespan of the shaft 464, 564, 664. The latch keeper assembly 440, 540 may see an increase in robustness, as the fixed engagement between the shaft 464, 564, 664 and support blocks 465, 565 may limit the leverage effect due to the impact from the door 20.

[0108] The embodiments described in this document provide non-limiting examples of possible implementations of the present technology. Upon review of the present disclosure, a person of ordinary skill in the art will recognize that changes may be made to the embodiments described herein without departing from the scope of the present technology. Yet further modifications could be implemented by a person of ordinary skill in the art in view of the present disclosure, which modifications would be within the scope of the present technology.

CLAIMS

1. A latch keeper assembly for earth-working bucket, comprising:

a latch keeper configured to be in a ledge of the earth-working bucket, the latch keeper defining a recess;

a member received within the recess of the latch keeper; and

a dutchman removably securable to the member.

2. The latch keeper assembly of claim 1, wherein the member is removably securable to the latch keeper within the recess.

3. The latch keeper of claim 1 or 2, wherein the recess is opened on a rear end of the latch keeper, the member closing the recess.

4. The latch keeper of any one of claim 1 to 3, wherein the member is locked within the recess by abutting shoulders.

5. The latch keeper of any one of claims 1 to 4, wherein a top face of the member and a top face of the dutchman are angled.

6. The latch keeper of claim 5, wherein the top face of the member and the top face of the dutchman are aligned and parallel to one another.

7. The latch keeper of any one of claims 1 to 6, wherein the dutchman has a front face configured to contact a latch in the recess, the front face having rollers protruding from the front face.

8. The latch keeper of any one of claims 1 to 7, wherein the dutchman has a front face configured to contact a latch in the recess, the front face being curved.

9. The latch keeper of any one of claims 1 to 7, wherein the dutchman has a cylindrical portion, with at least one bearing mounted thereon, the at least one bearing configured to contact a latch in the recess,

10. The latch keeper of claim 9, wherein the at least one bearing is a bearing with rolling elements.

11. The latch keeper of claim 9, wherein the at least one bearing is a plain bearing.

12. The latch keeper of claim 9, wherein the at least one bearing is a bushing.

13. The latch keeper of any one of claims 1 to 7, wherein the dutchman has a cylindrical portion, the cylindrical portion configured to contact a latch in the recess.

14. The latch keeper of any one of claims 9 to 13, wherein the dutchman has ends with flats, the flats abutting complementary portions of the member to block rotation of the cylindrical portion.

15. The latch keeper of claim 14, wherein the member includes support blocks having cavities for receiving the ends with flats.

16. A bucket comprising:

a main body defining a cavity and an opening for unloading a content of the bucket from the cavity;

a door pivotally mounted on the main body, the door movable between a closed position in which the opening is substantially closed by the door and an opened position in which the content may exit the bucket via the opening;

a locking mechanism having a latch bar movable between locked and unlocked positions to selectively lock or unlock the door to close or open the opening; and

a latch keeper assembly according to any one of claims 1 to 15, the latch keeper assembly cooperating with the latch bar.

17. A bucket comprising:

a main body defining a cavity and an opening for unloading a content of the bucket from the cavity;

a door pivotally mounted on the main body, the door movable between a closed position in which the opening is substantially closed by the door and an opened position in which the content may exit the bucket via the opening;

a locking mechanism having a latch bar movable between locked and unlocked positions to selectively lock or unlock the door to close or open the opening; and

a latch keeper defining a recess for receiving a distal end of the latch bar when the latch bar is in the locked position and when the door is closed, the latch keeper,

wherein one of the latch bar and the latch keeper includes rolling elements such that the latch bar is rollingly engaged to the latch keeper in the locked positing of the latch bar.

18. The bucket of claim 17, wherein the rolling elements are secured to a dutchman of the latch keeper.

19. The bucket of claim 17, wherein the rolling elements are secured to a removable member of the latch keeper.

20. The bucket of claim 17, wherein the rolling elements are secured to the distal end of the latch bar.

21. The bucket of any one of claims 17 to 20, wherein the rolling elements are bearings or balls.

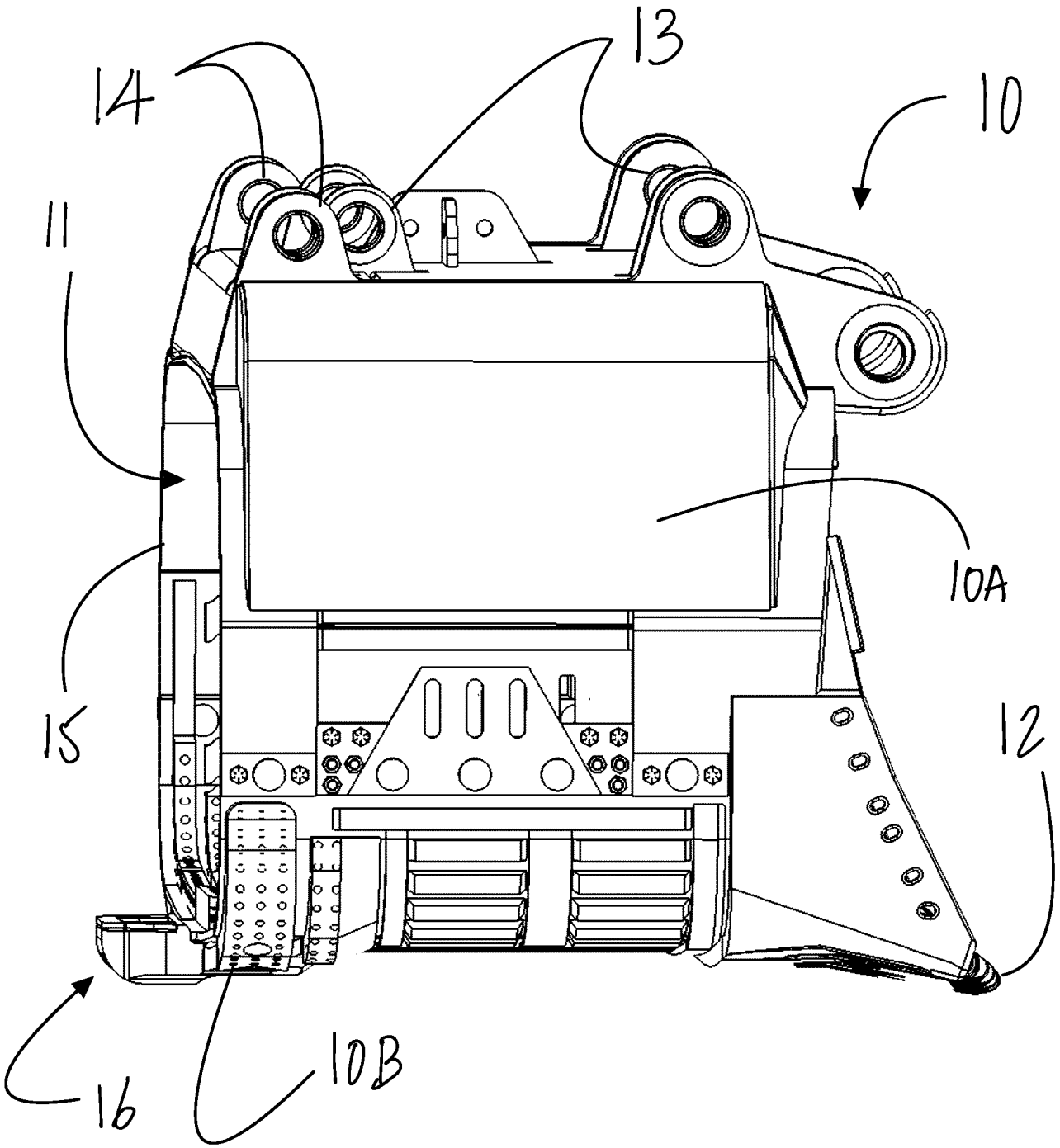

FIG. 1

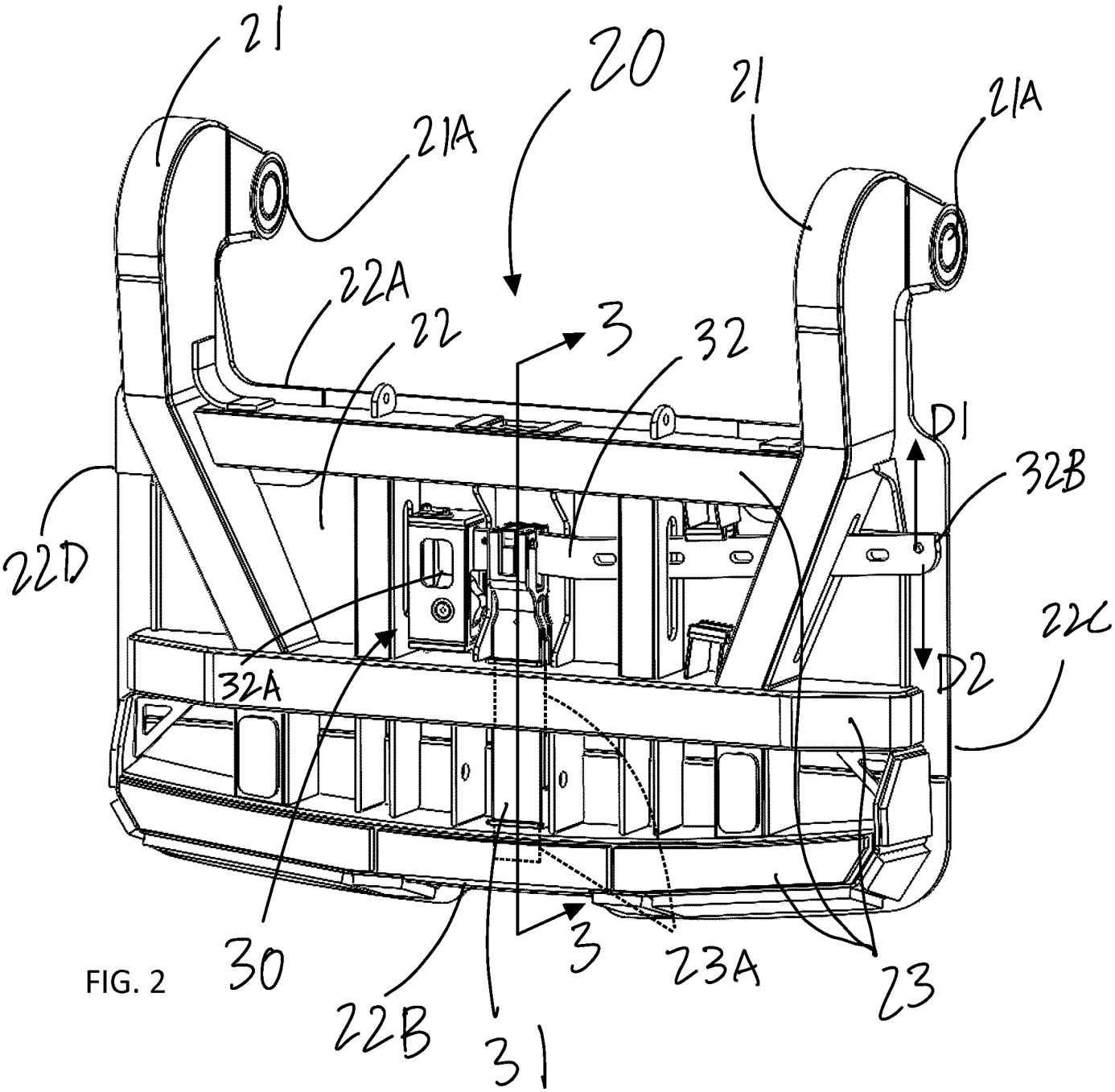

FIG. 2

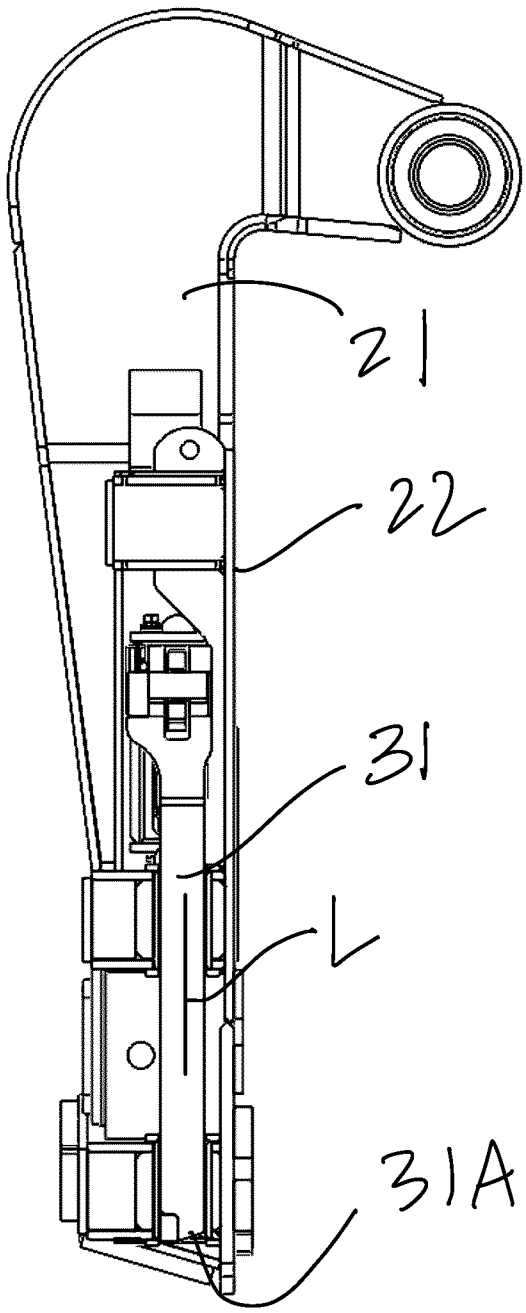

FIG. 3

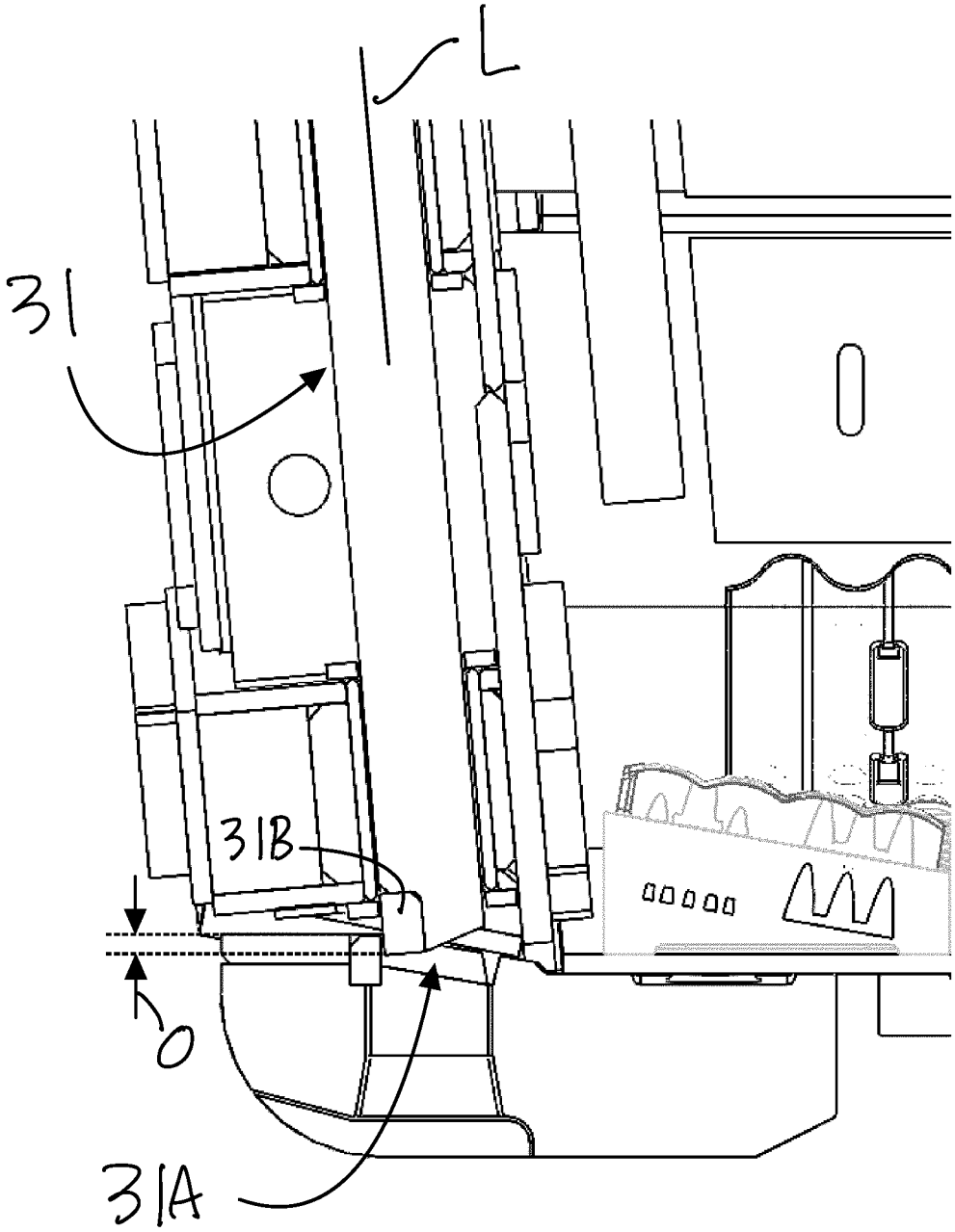

FIG. 4

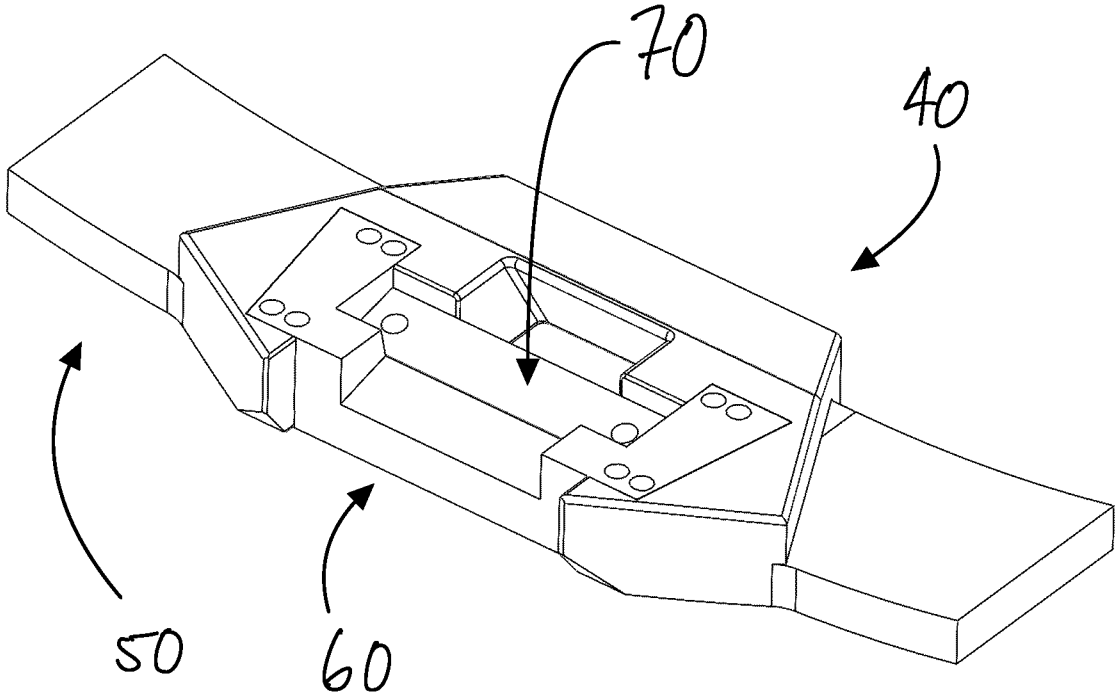

FIG. 5

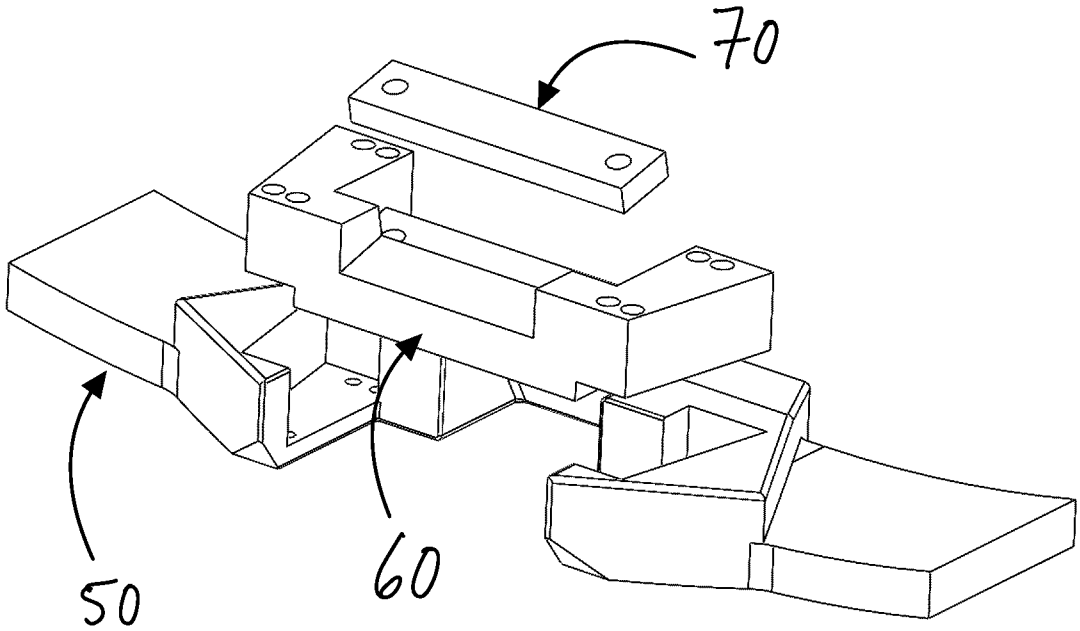

FIG. 6

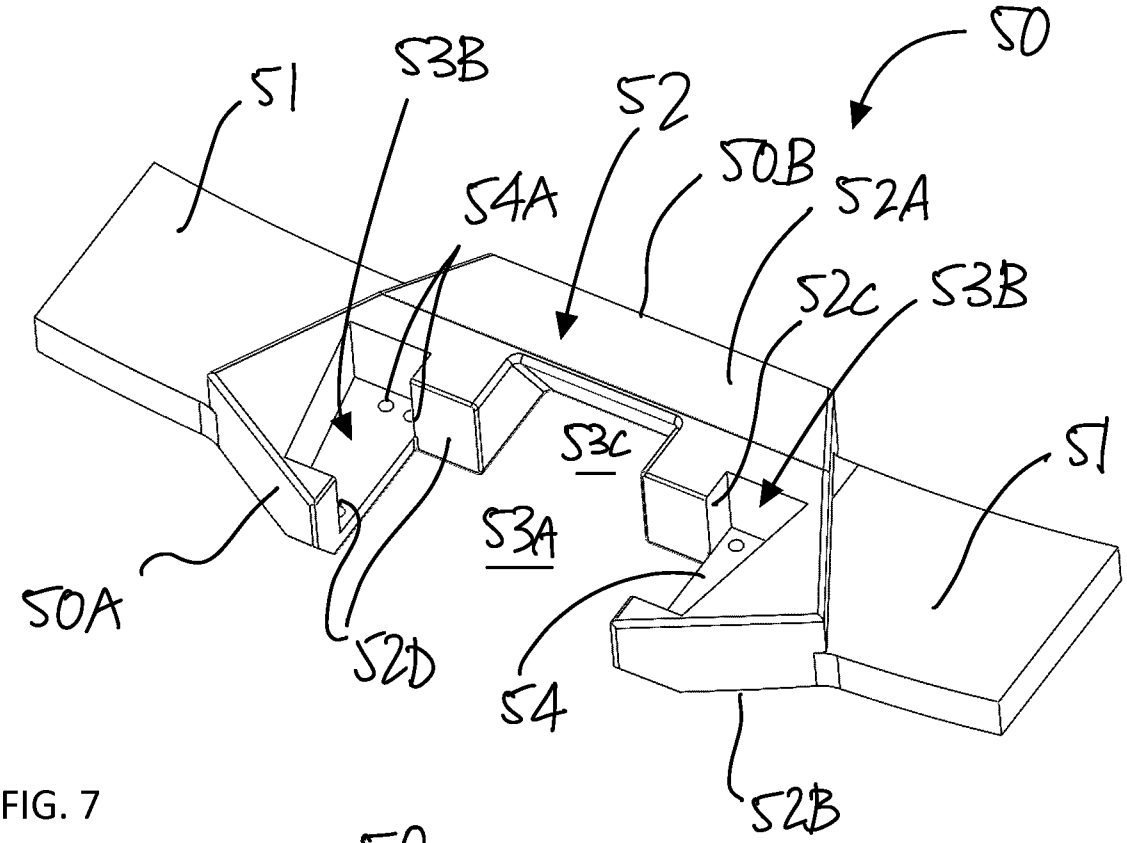
50
51
53B
52
50B
52A
54A
52C
53B
53C
51
53A
50A
52D
54
52B

FIG. 7

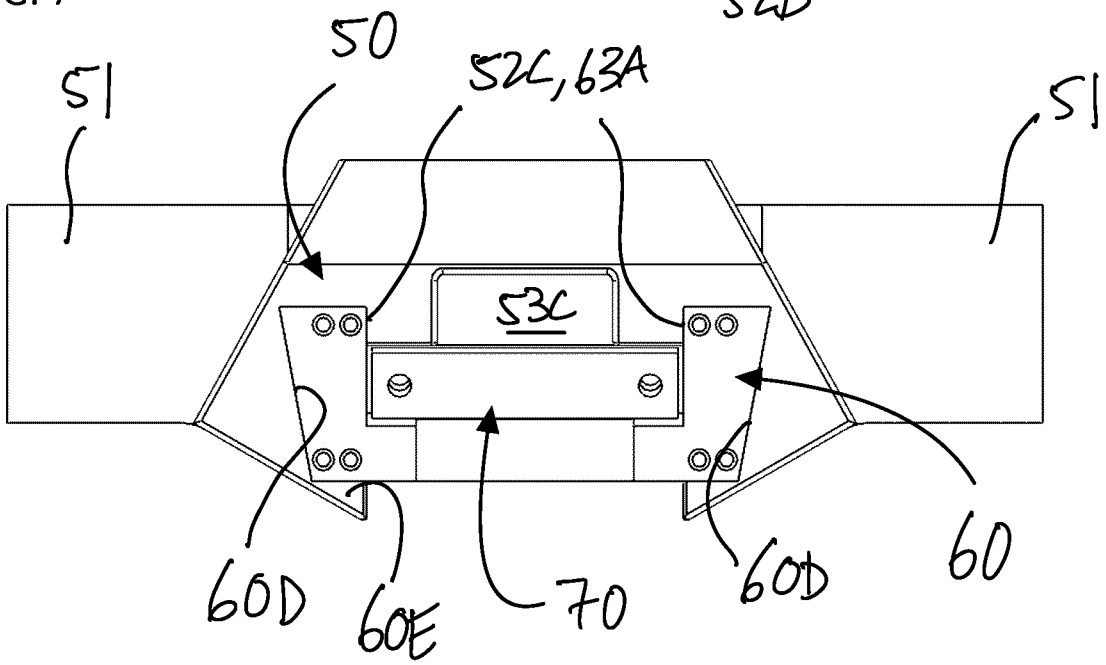
50
51
52C, 63A
51
53C
60D
60E
70
60D
60

FIG. 8

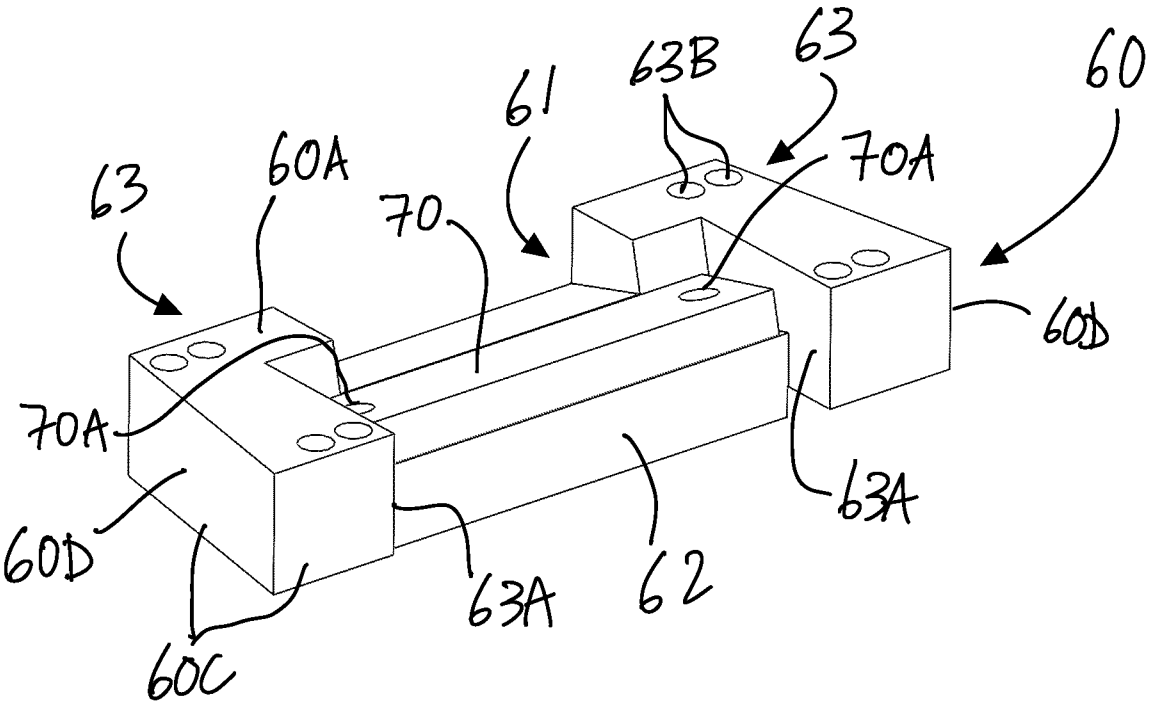
63B
63
60
61
60A
70A
63
70
60D
70A
60D
63A
63A
62
60C

FIG. 9

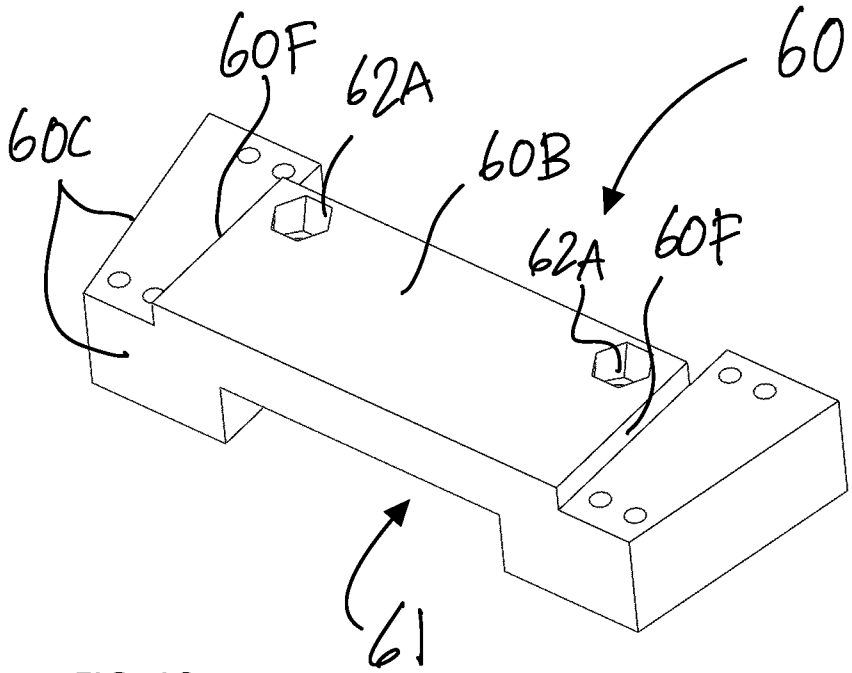
60F
62A
60
60C
60B
62A
60F
61

FIG. 10

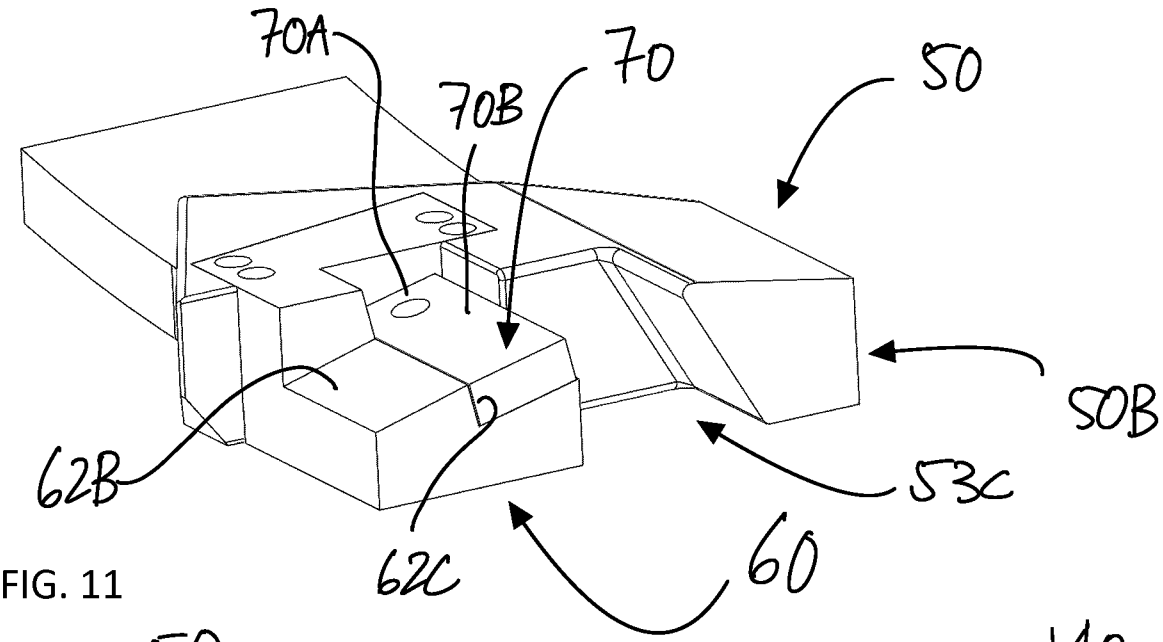

FIG. 11

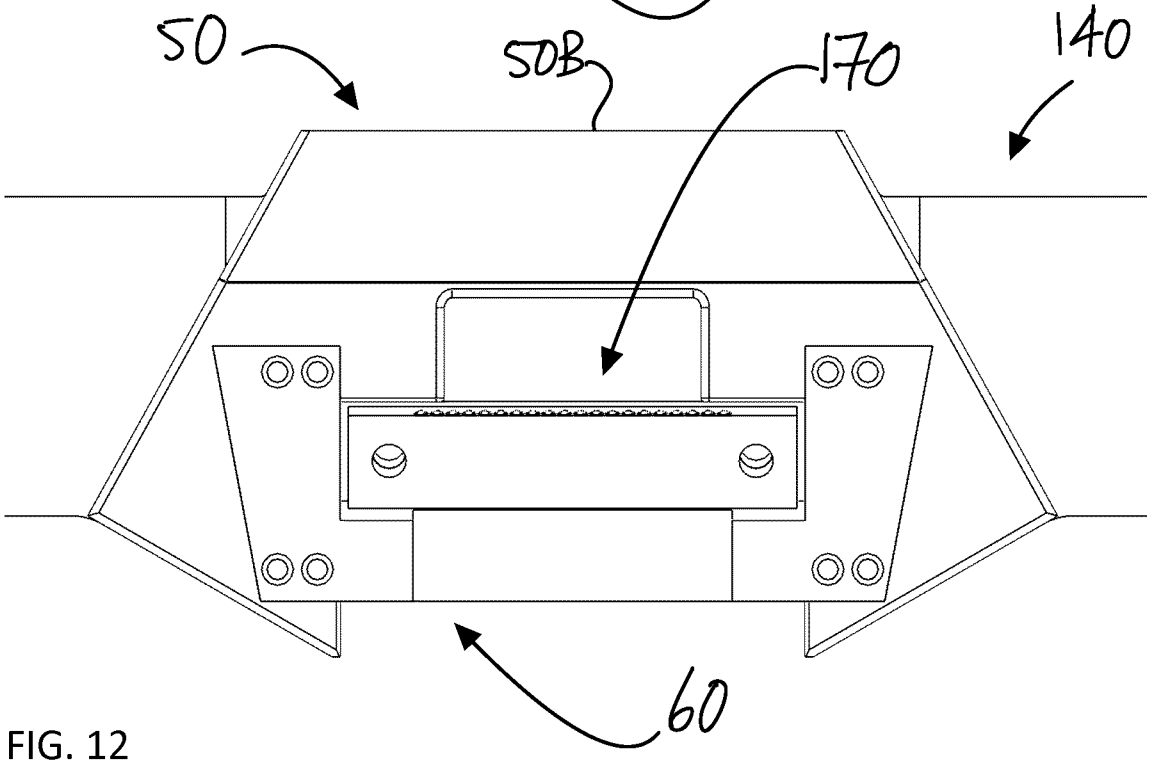

FIG. 12

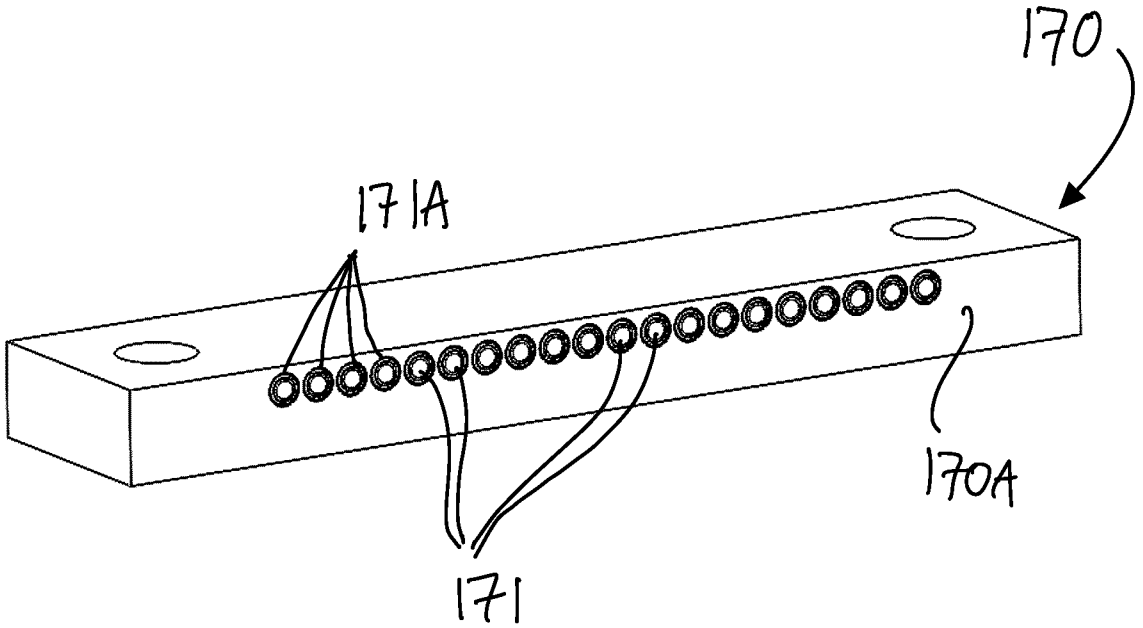

FIG. 13

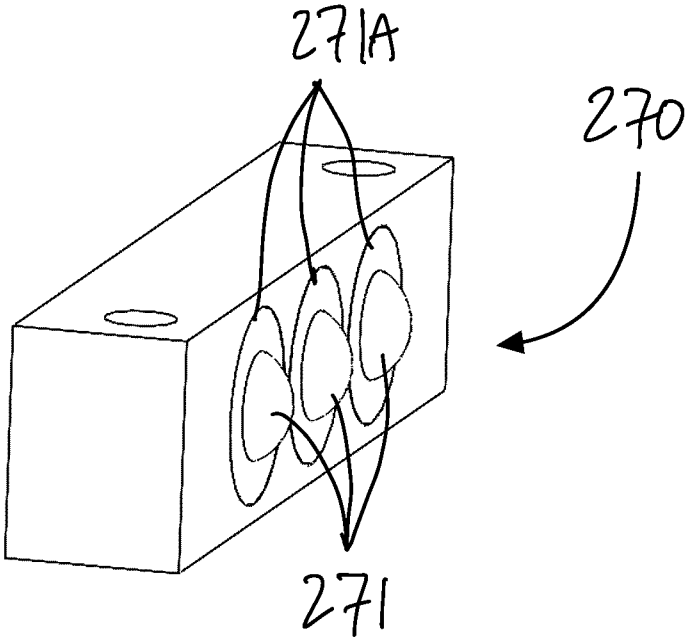

FIG. 14

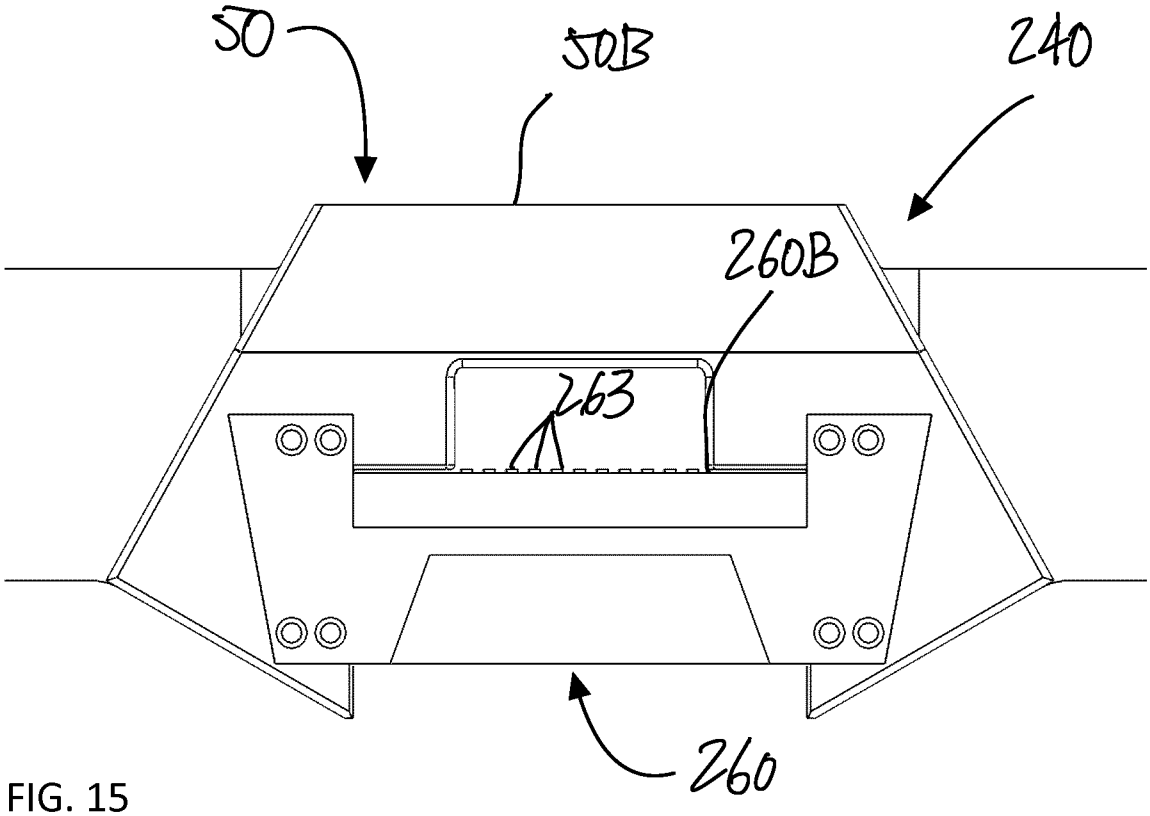

FIG. 15

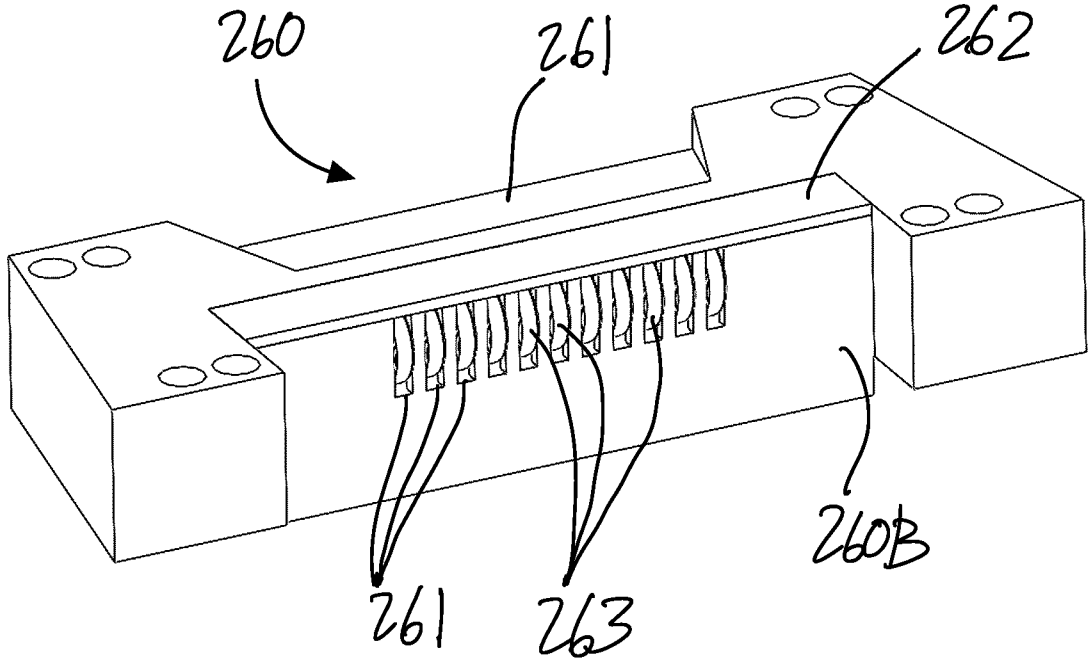

FIG. 16

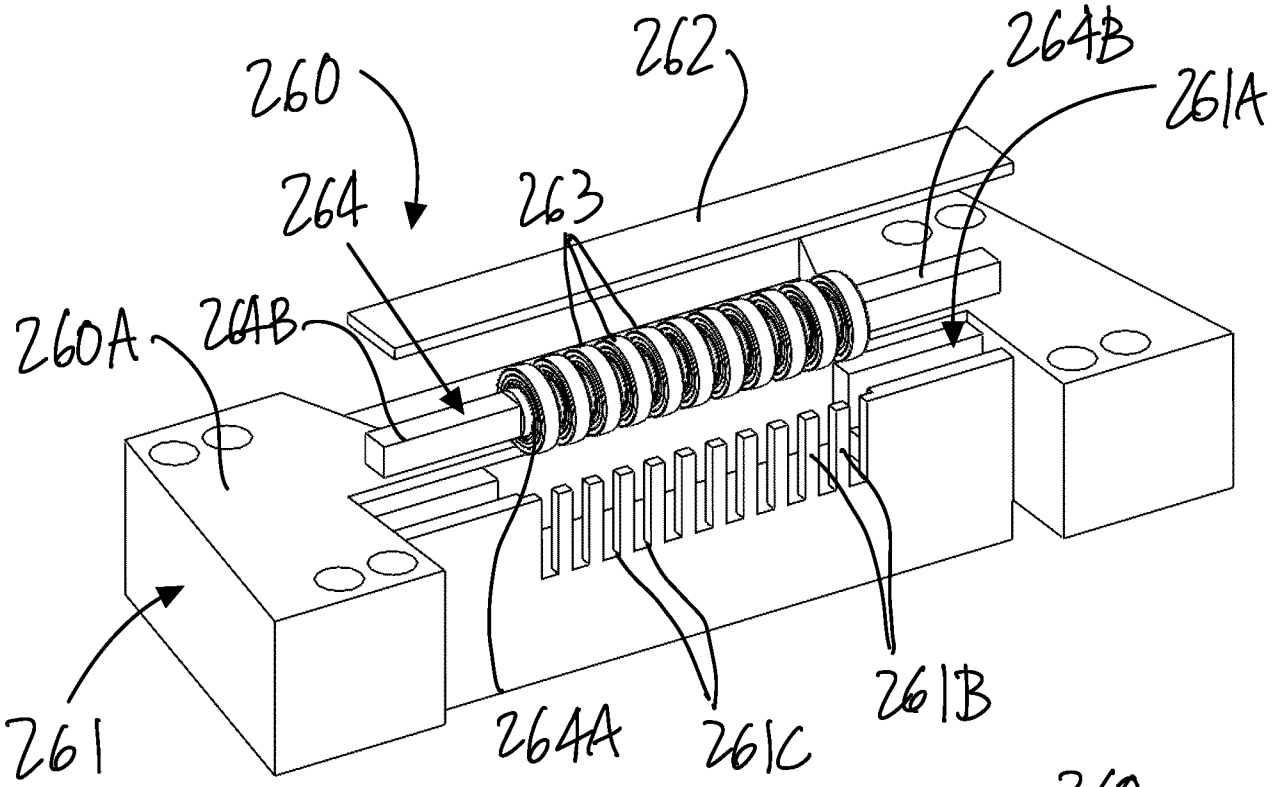
260
262
264B
261A
264
263
260A
264B
261
264A
261C
261B

FIG. 17

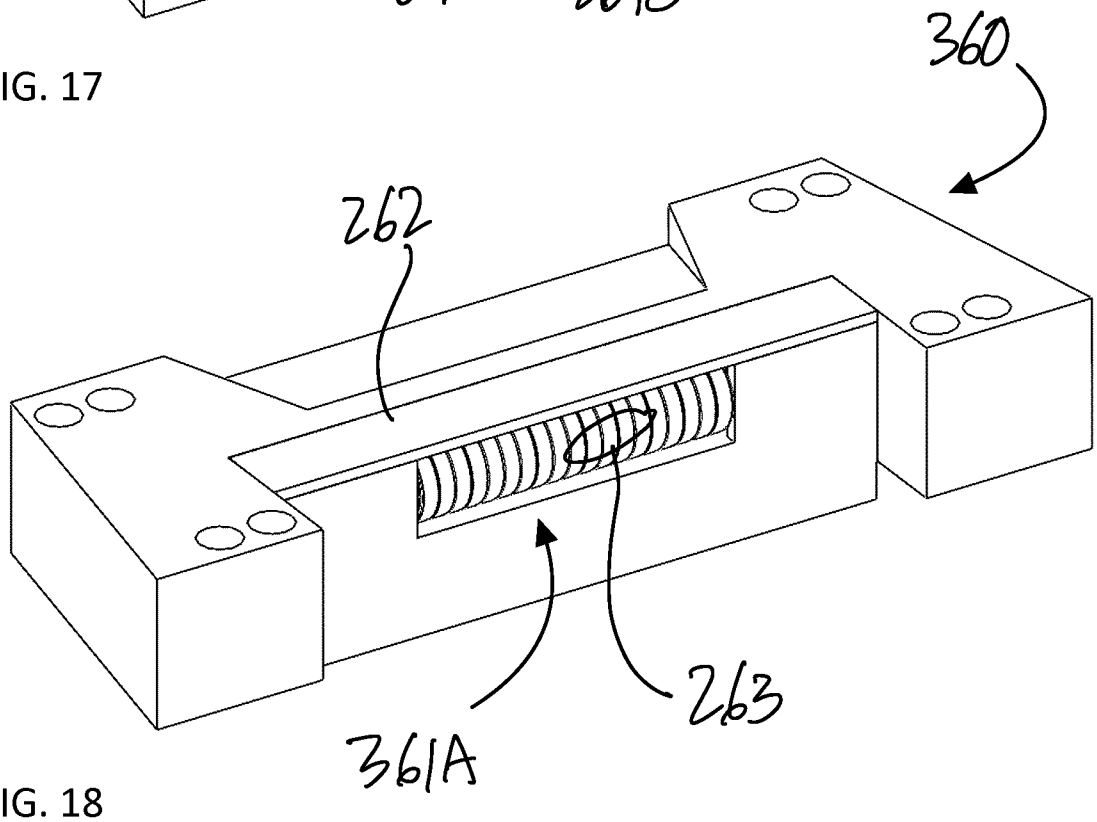
360
262
263
361A

FIG. 18

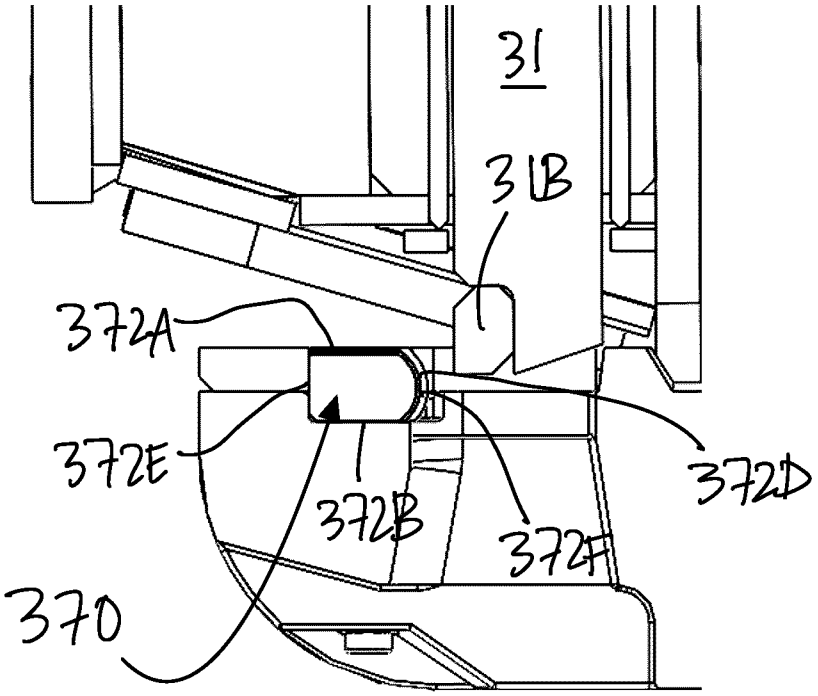

FIG. 19

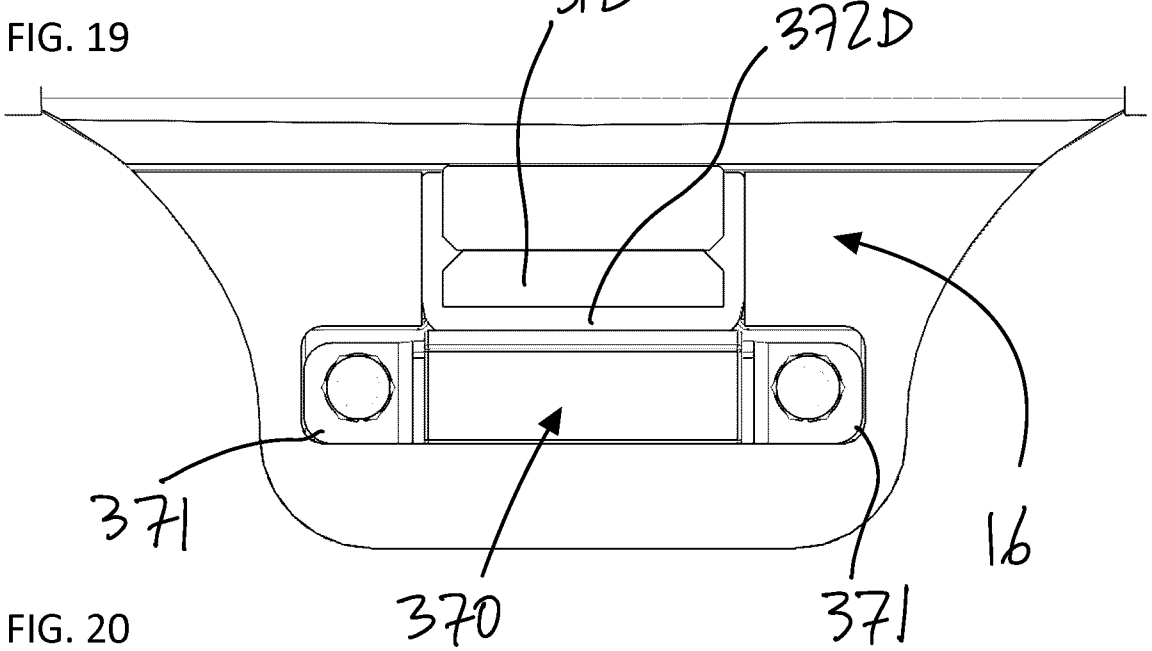

FIG. 20

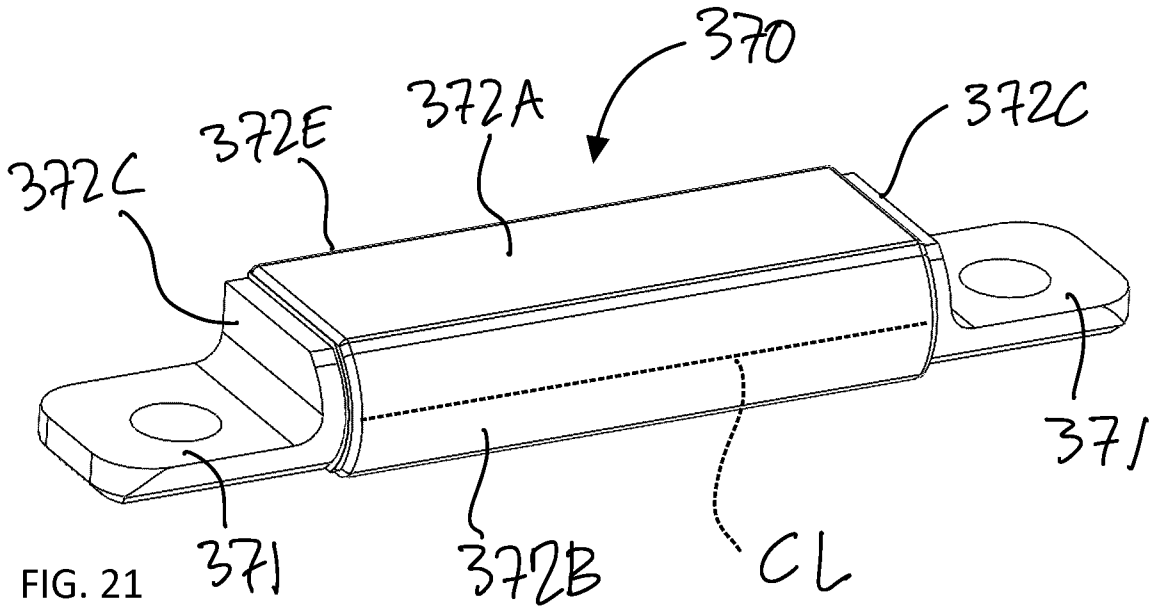

FIG. 21

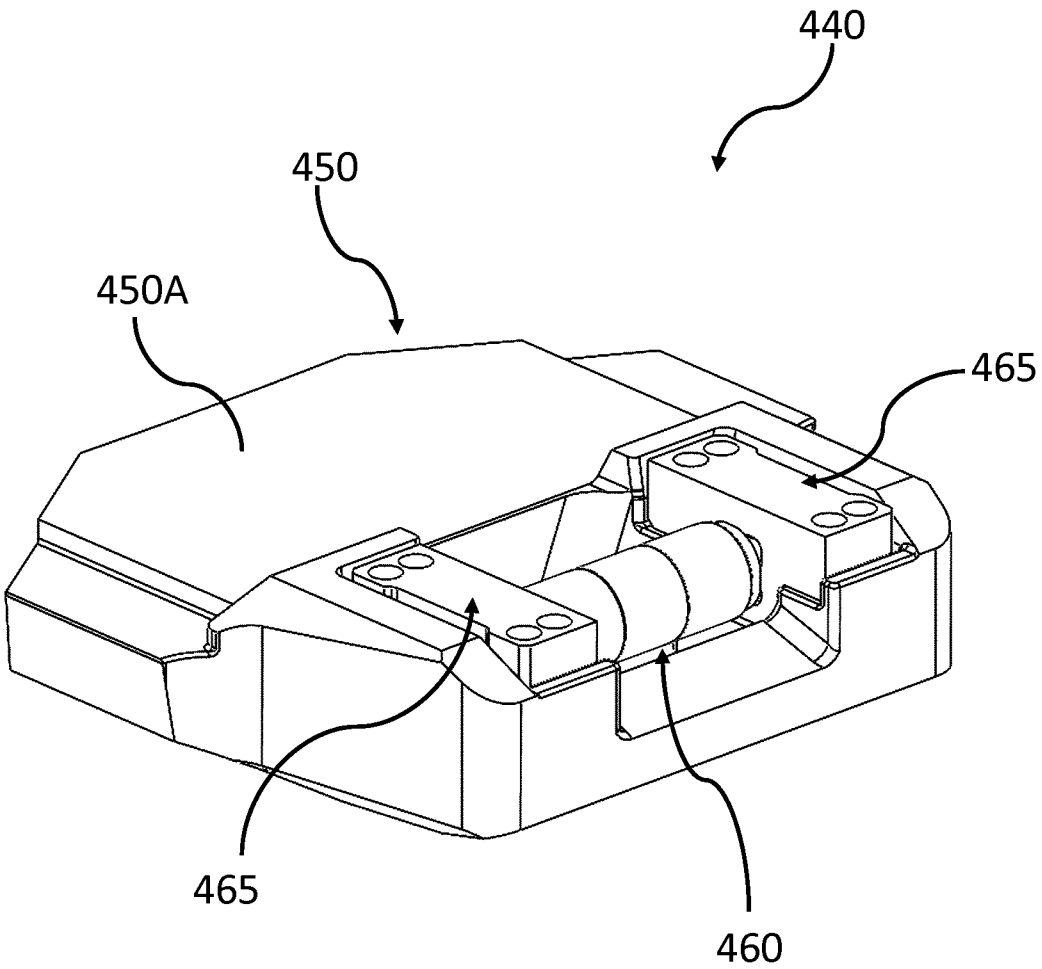

FIG. 22

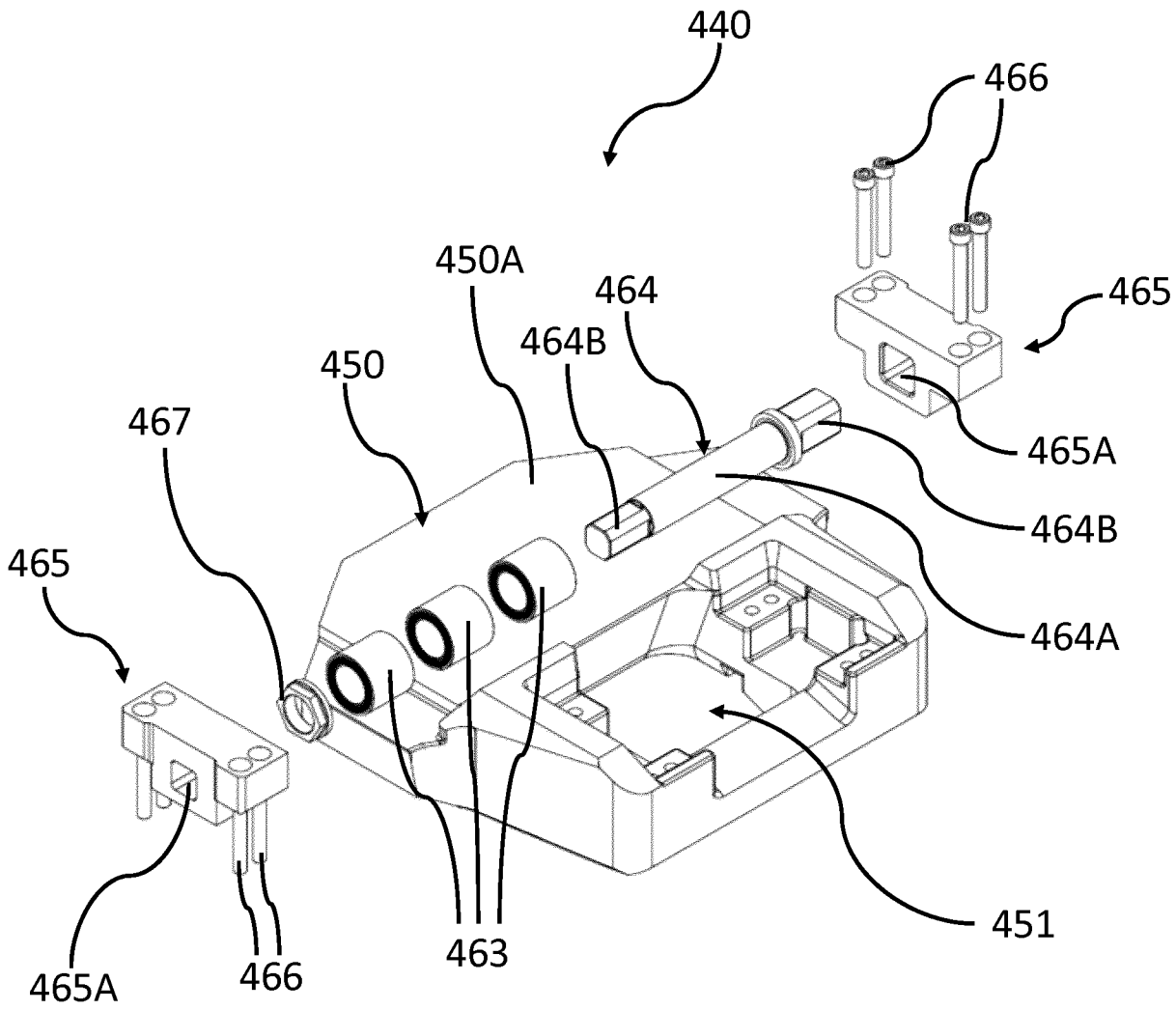
440
466
450A
464
465
464B
450
467
465A
464B
465
464A
451
463
465A
466

FIG. 23

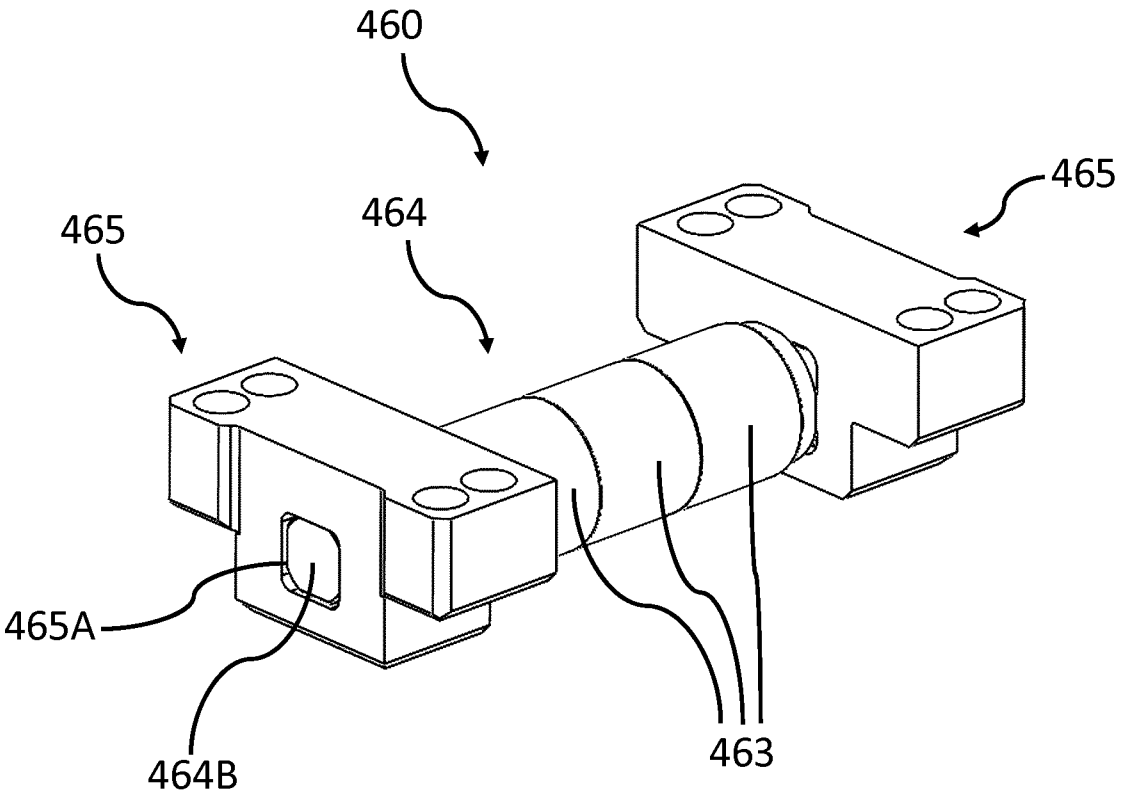

FIG. 24

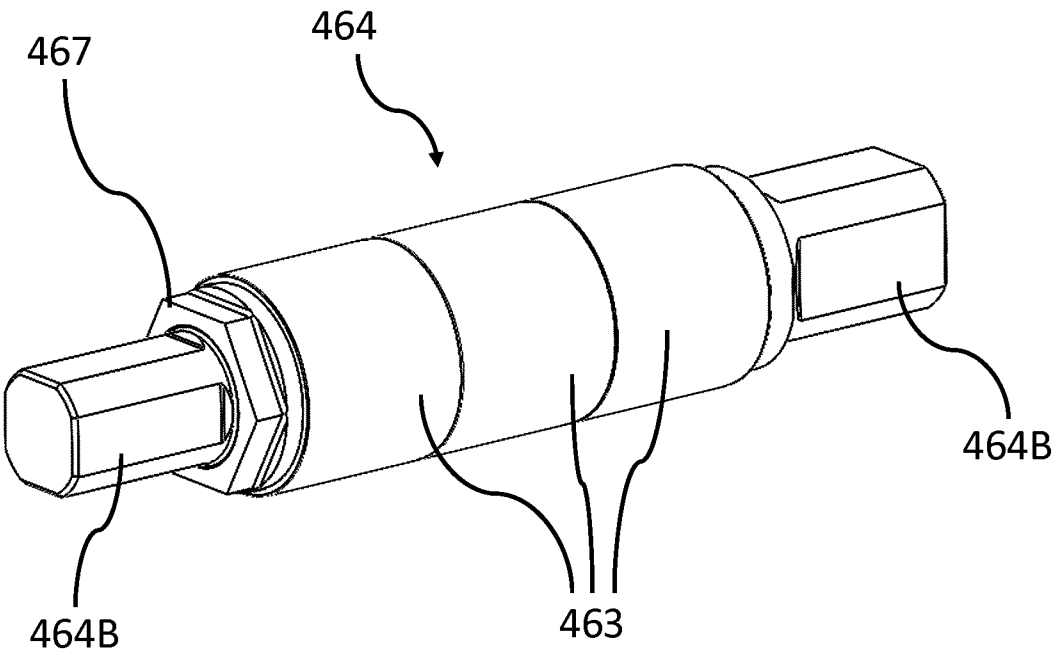

FIG. 25

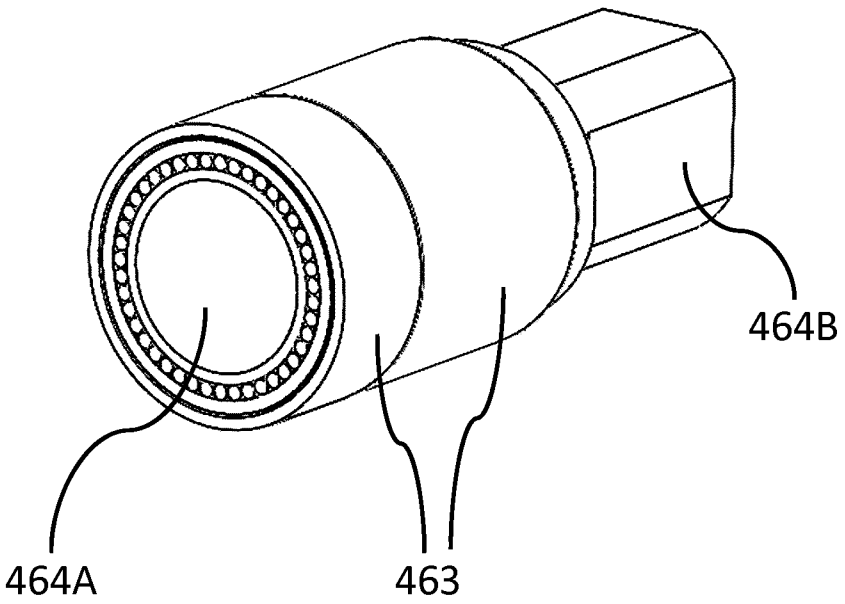

FIG. 26

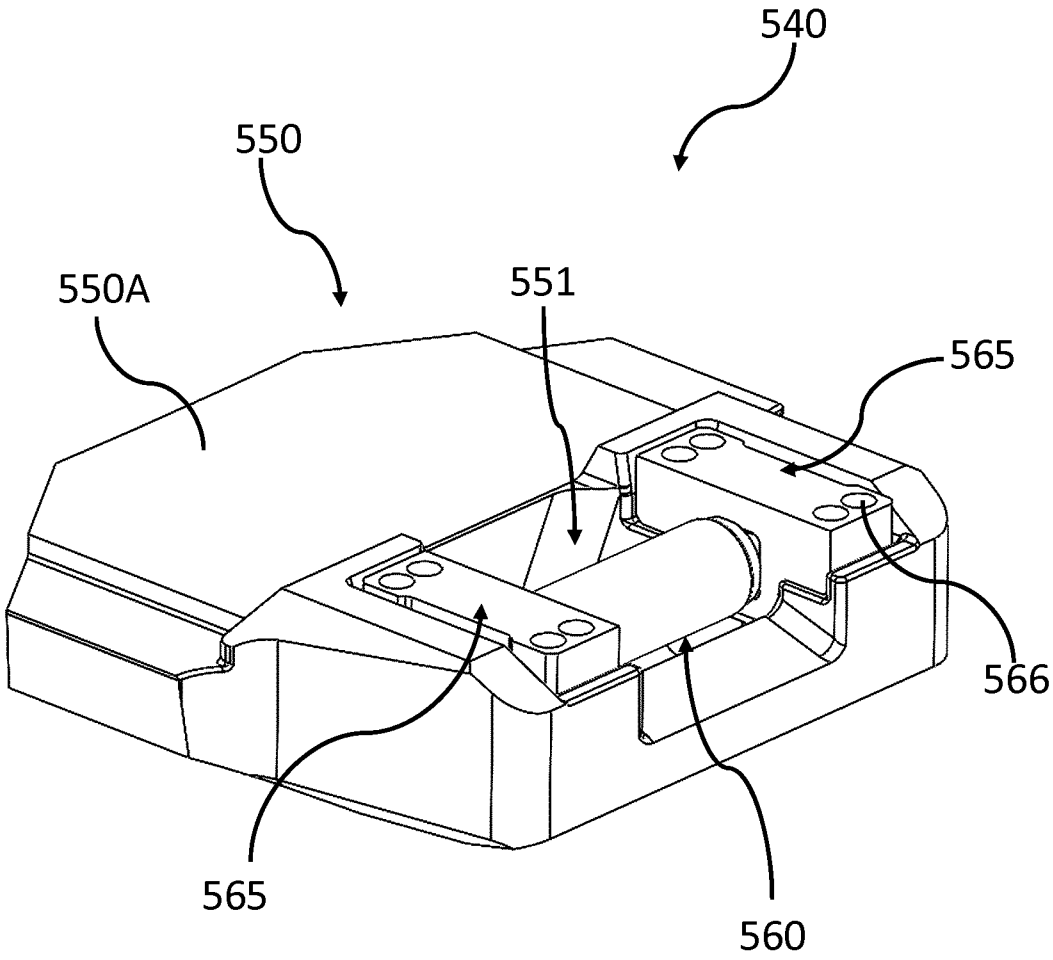

FIG. 27

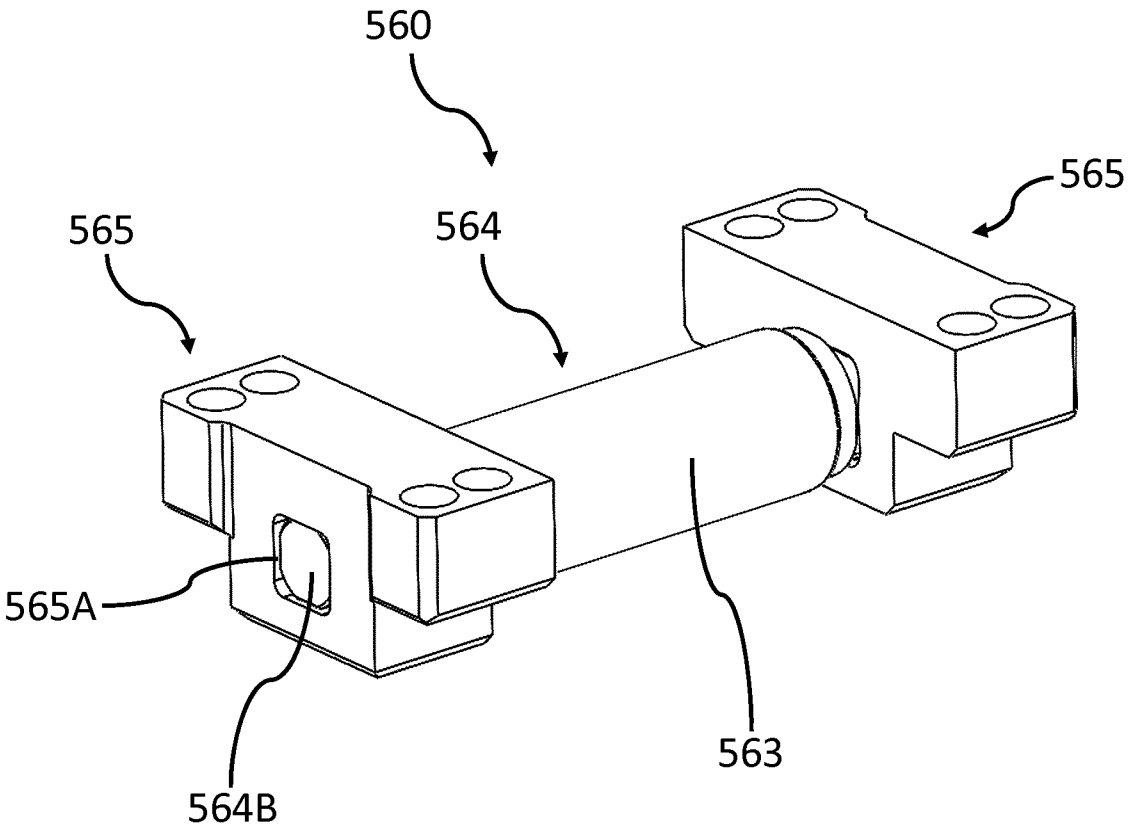

FIG. 28

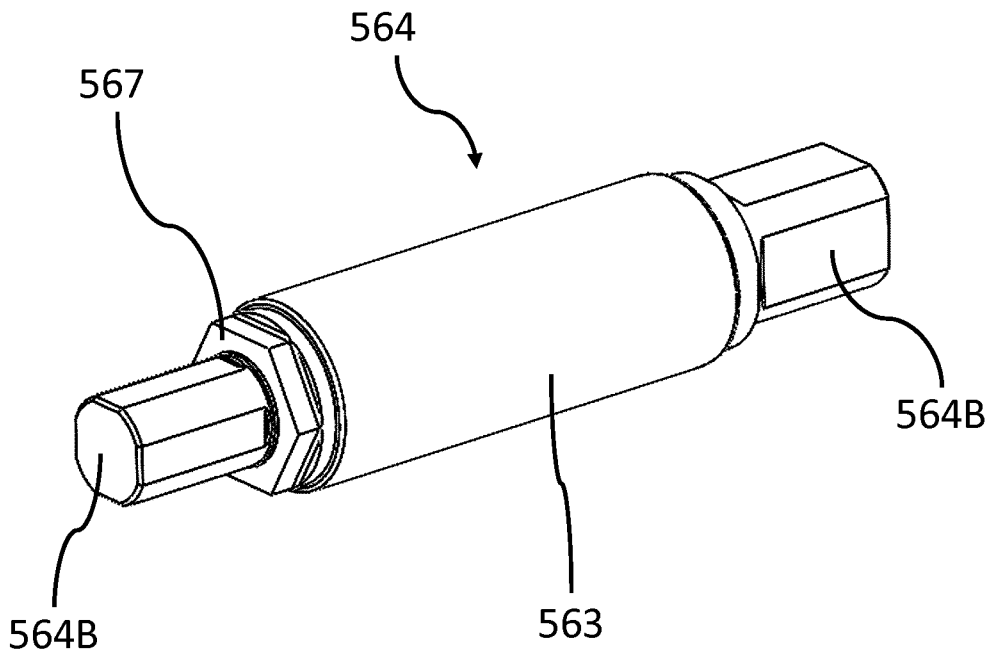

FIG. 29

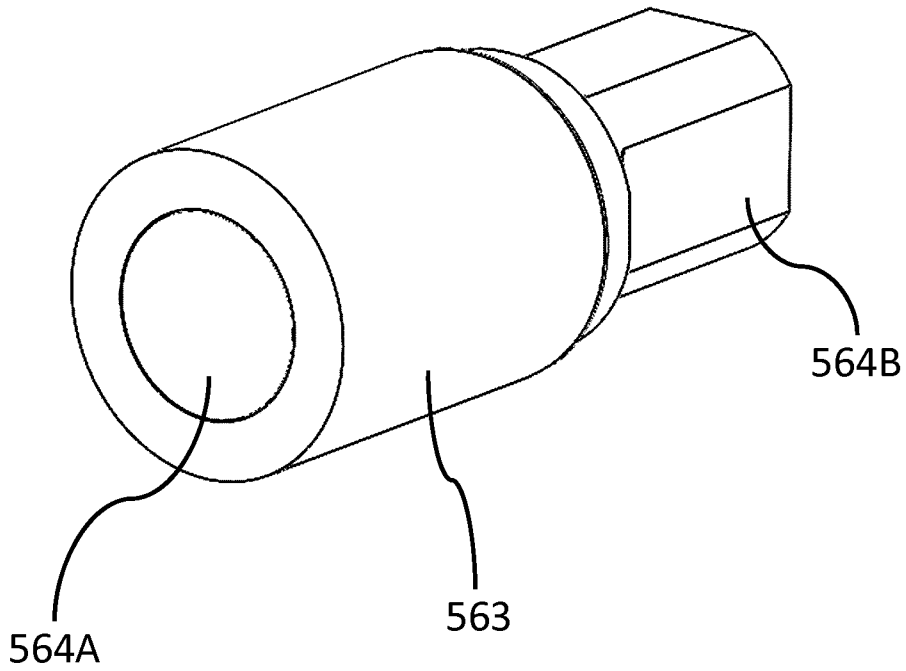

FIG. 30

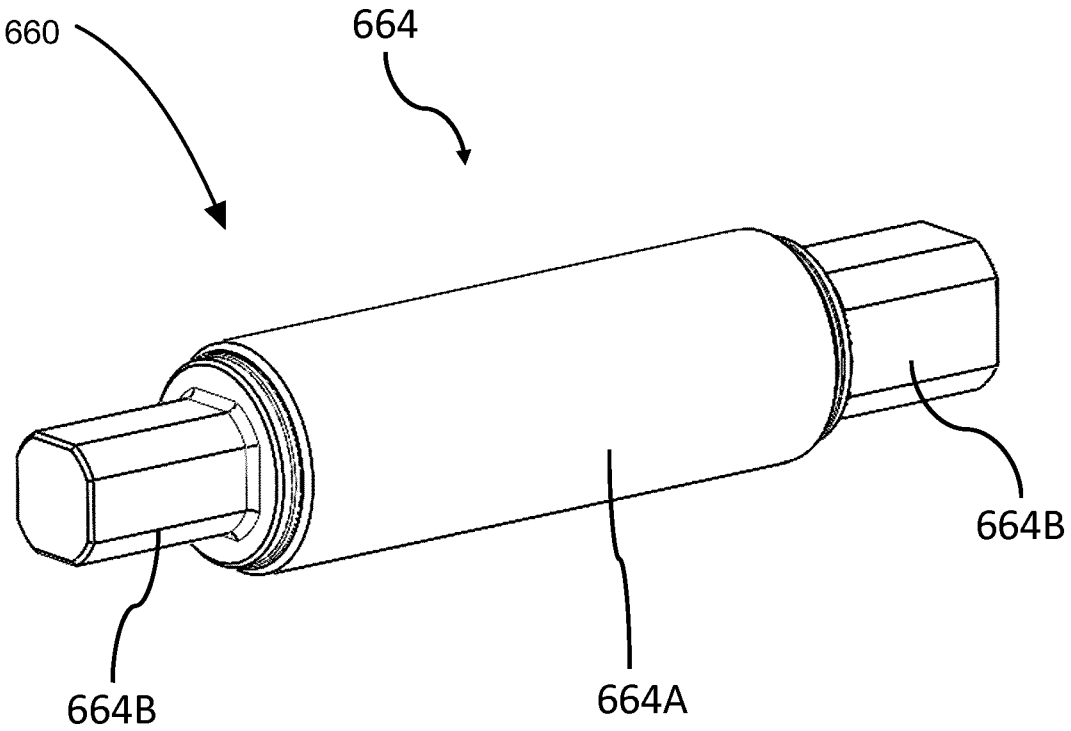

FIG. 31

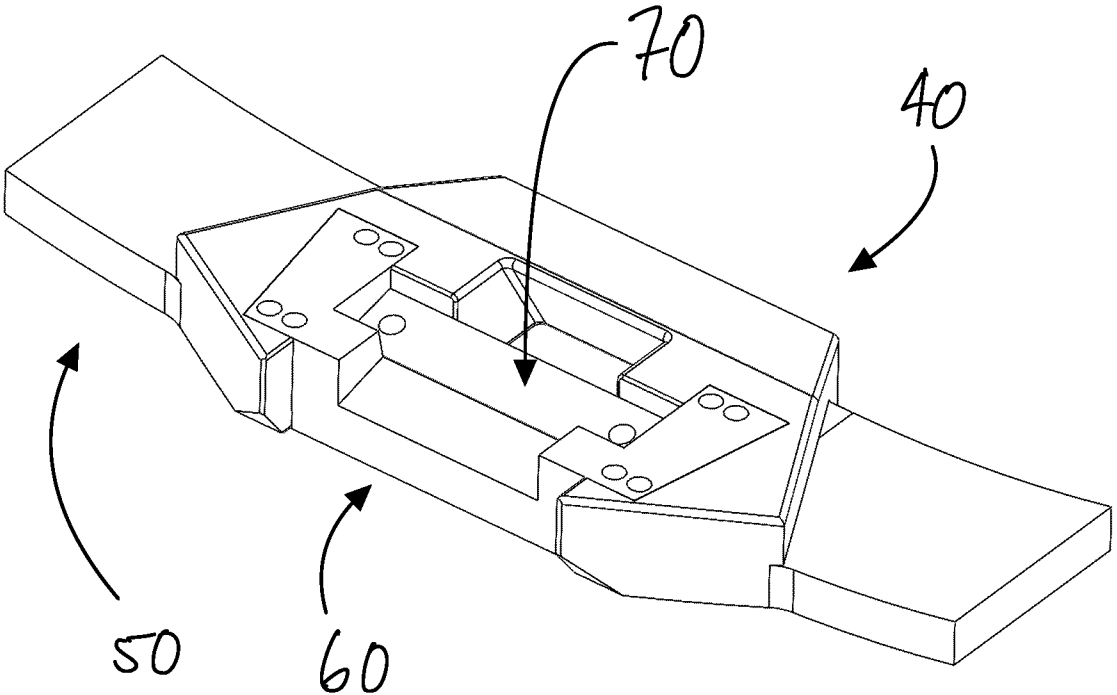

FIG. 5