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(72) Inventeurs/Inventors:
MASCARENHAS, NOEL, US;
KRAKORA, KEVIN, US;
BELL, ROGER L., US

(73) Propriétaire/Owner:
MITSUBISHI CATERPILLAR FORKLIFT AMERICA INC., US

(74) Agent: KIRBY EADES GALE BAKER

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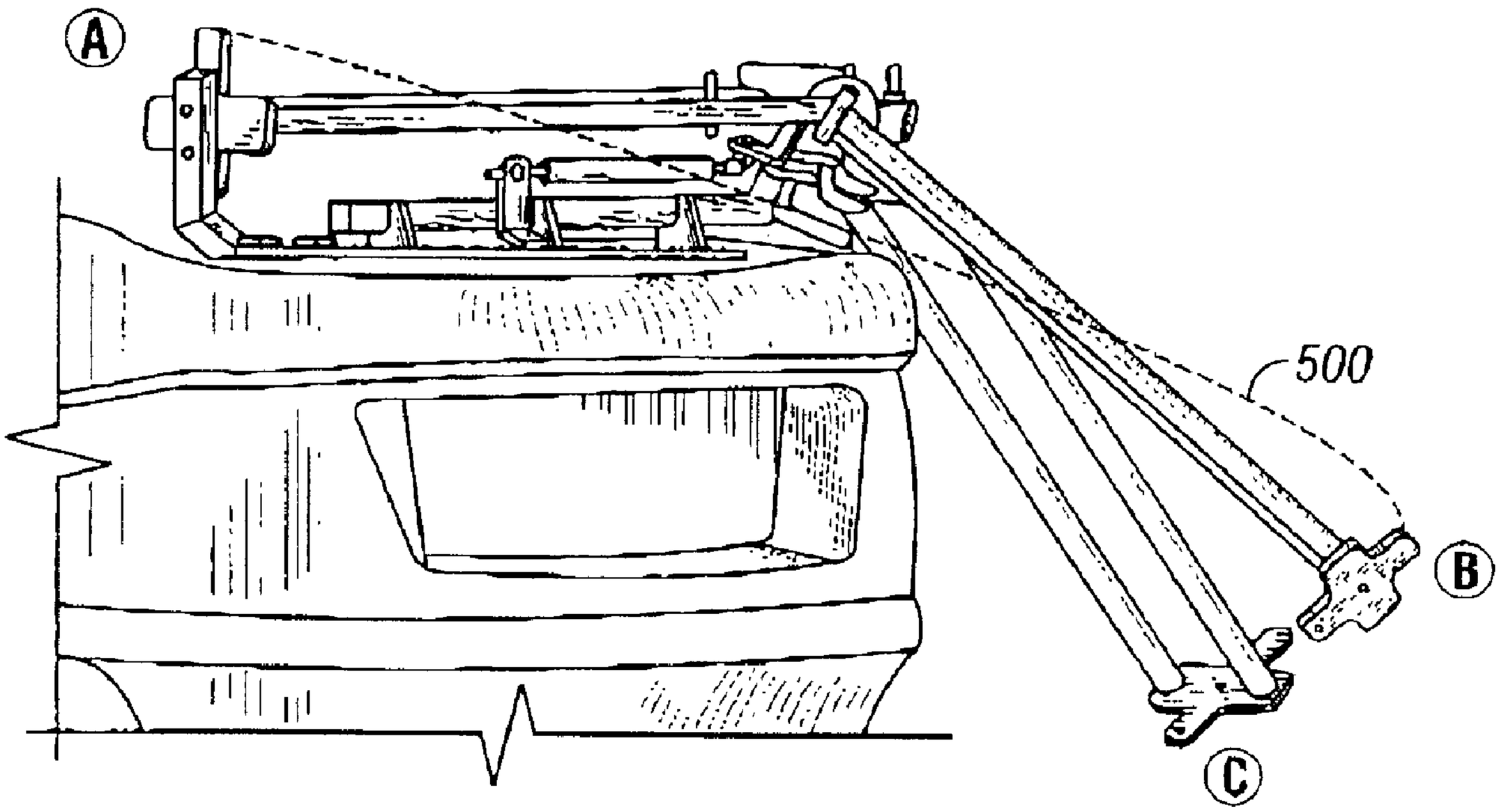
(54) Title: SWING DOWN FUEL TANK BRACKET



(57) Abrégé/Abstract:
A swing down tank bracket for supporting a fuel tank mounted onto a vehicle includes a frame immovably mounted onto a vehicle, a cradle operatively connected to the frame and arranged to support a fuel tank, a hinge that pivotally connects a first end of the cradle to a first end of the frame, and a latch having a first portion disposed on a second end of the frame and a second portion disposed on a second end of the cradle. The first portion of the latch is releasably engaged with the second portion of the latch so that alter the latch is disengaged, the cradle is rotationally maneuverable between a retracted position and an extended position in a single stage. The cradle may be maneuvered between the retracted position and the extended position by simultaneously rotating outwardly and downwardly in relation to the vehicle. In some embodiments, a gas spring device, connected between the cradle and the frame, retards and assists the motion of the rotating cradle in a manner that requires minimal effort on the part of the operator in

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loading and unloading the fuel tank from the vehicle. Another device may be included to latch the cradle in the extended position in order to provide stability when loading/unloading a fuel tank.

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(71) Applicant *(for all designated States except US)*: **MITSUBISHI CATERPILLAR FORKLIFT AMERICA INC.** [US/US]; 2121 West Sam Houston Parkway North, Houston, TX 77043-2305 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **MASCARENHAS, Noel** [US/US]; 2121 W. Sam Houstan Parkway N., Houston, TX 77043-2305 (US). **KRAKORA, Kevin** [US/US]; 2121 W. Sam Houston Parkway N., Houston, TX 77043-2305 (US). **BELL, Roger, L.** [US/US]; 2121 W. Sam Houston Parkway N., Houston, TX 77043-2305 (US).

(74) Agents: **OSHA, Jonathan, P.** et al.; Osha & May L.L.P., 1221 McKinney Street, Suite 2800, Houston, TX 77010 (US).

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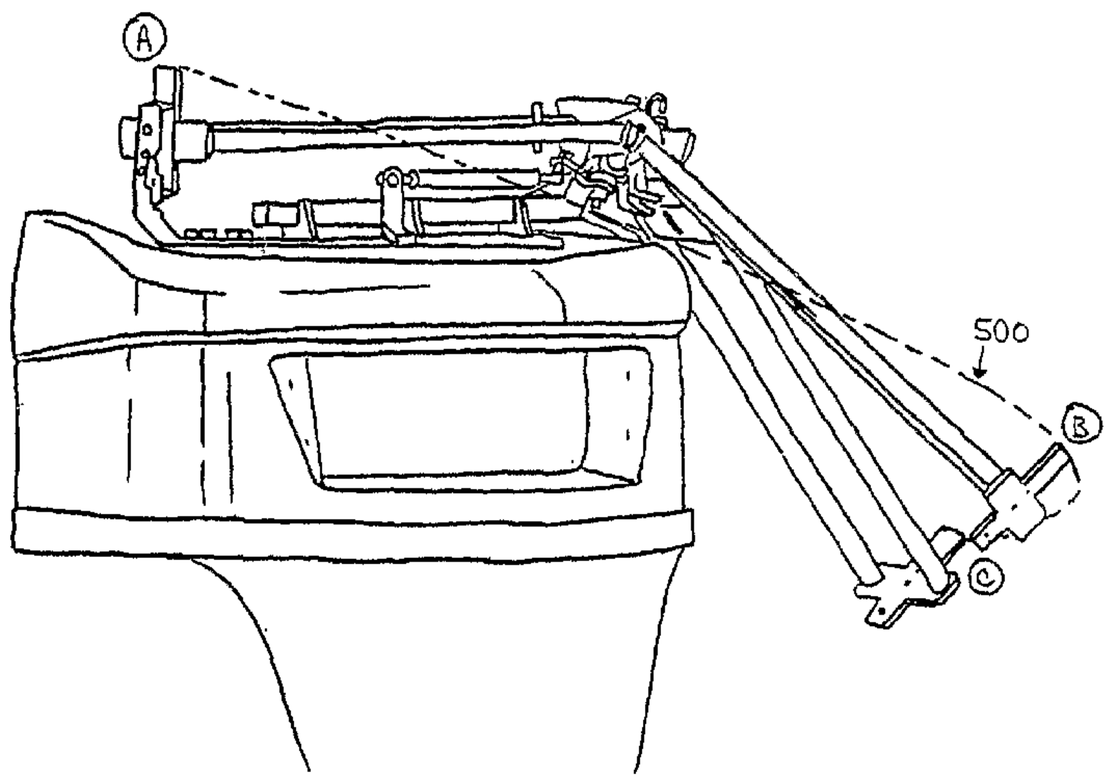
(54) Title: SWING DOWN FUEL TANK BRACKET



(57) **Abstract:** A swing down tank bracket for supporting a fuel tank mounted onto a vehicle includes a frame immovably mounted onto a vehicle, a cradle operatively connected to the frame and arranged to support a fuel tank, a hinge that pivotally connects a first end of the cradle to a first end of the frame, and a latch having a first portion disposed on a second end of the frame and a second portion disposed on a second end of the cradle. The first portion of the latch is releasably engaged with the second portion of the latch so that alter the latch is disengaged, the cradle is rotationally maneuverable between a retracted position and an extended position in a single stage. The cradle may be maneuvered between the retracted position and the extended position by simultaneously rotating outwardly and downwardly in relation to the vehicle. In some embodiments, a gas spring device, connected between the cradle and the frame, retards and assists the motion of the rotating cradle in a manner that requires minimal effort on the part of the operator in loading and unloading the fuel tank from the vehicle. Another device may be included to latch the cradle in the extended position in order to provide stability when loading/unloading a fuel tank.

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

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SWING DOWN FUEL TANK BRACKET

Background of Invention

Technical Field

[0001] Embodiments described herein relate generally to a vehicle having a fuel tank attached thereto. More specifically, embodiments described herein relate to a swing down tank bracket to support and attach a fuel tank to a vehicle, in which portions of the swing down tank bracket are moveable.

Description of the Related Prior Art

[0002] Forklift trucks come in many sizes and capacities and are typically powered using batteries, gasoline, diesel fuel, or liquid propane. Typically, forklift trucks powered by liquid propane ("LP") fuel are equipped with a removable fuel tank, which generally is constructed from steel or aluminum and weighs from 33.5 lbs when empty to 88 lbs when full. The fuel tank is typically secured to the forklift truck on a fuel tank bracket mounted on or near a counterweight at the truck's rear. The tank bracket ensures that the fuel tank remains relatively immobile during truck operation.

[0003] This placement often means that the tank bracket is positioned at or above an operator's chest level and up to an arm's length away. Thus, to load a fuel tank onto or off of the tank bracket, the operator is required to lift the fuel tank up above the counterweight and reach over part of the length of the counterweight. Because a full or substantially full fuel tank can be quite heavy, loading and unloading a fuel tank can be dangerous and may subject an operator to injury. In order to relieve some of the burden on the operator, some tank brackets are designed to provide an operator with assistance in the loading and unloading of the fuel tank.

[0004] Generally, a tank bracket designed to provide operator assistance includes a frame mounted on the forklift truck and a cradle pivotally connected to the frame via one or more pivots. The frame secures the tank bracket to the forklift truck, and the cradle supports the fuel tank. Typically, the cradle is maneuverable between two positions. In the first position, referred to herein as a "retracted position," the fuel tank is immovably locked onto the forklift truck by a latching mechanism. Typically, when the tank bracket is in the retracted position, the cradle lies inside the truck's body frame above the counterweight.

In the second position, referred to herein as an "extended" position, the fuel tank may be more easily loaded onto and unloaded off of a forklift truck. Typically, when a tank bracket is in an extended position, the cradle lies outside the truck's body frame to the rear or a side of the counterweight.

[0005] To maneuver the cradle between the retracted and extended positions, the cradle is pivotally rotated using one or more stages. For example, a cradle moved from a retracted position to an extended position using one stage is typically rotated in a plane substantially parallel to the top surface of the counterweight about a single pivot using a single rotational motion. A tank bracket having a cradle moved to an extended position using a single stage is referred to as a "single stage" tank bracket. A cradle moved from a retracted position to an extended position using two stages may be rotated in a horizontal plane that is substantially parallel to the counterweight's top surface about a first pivot using a first motion and then rotated in a vertical plane that is substantially parallel to the counterweight's rear surface about a second pivot using a second motion. A tank bracket having a cradle moved to an extended position in two stages is referred to as a "two-stage" tank bracket.

[0006] Figures 1–3 show typical tank brackets designed to provide loading and unloading assistance. Figures 1 and 2 show typical designs for a single stage tank bracket, and Figure 3 shows a typical design for a two-stage tank bracket.

[0007] Figure 1 shows a diagram of a forklift truck (100) equipped with a prior art tank bracket (106). The tank bracket (106), which is mounted on forklift truck's counterweight (104), includes a frame (108) attached to the forklift truck (100), a cradle (110) rotatably connected to the frame (108) via a pivot (112), and a strap (114) connected to the cradle (110). A fuel tank (102) is disposed within the cradle (110), and the strap (114) is engaged around an uncovered portion of the fuel tank's circumference so that the fuel tank (102) does not fall out of the cradle (110). Further, the cradle (110) is shown in an

extended position, and, accordingly, sits behind the counterweight (104) and outside the truck's body frame.

[0008] To maneuver the cradle to the retracted position, the cradle (110) is rotated about the pivot (112) such that the cradle (110) moves inward to a position above the counterweight (104) and inside the truck's body frame. Note that, in this tank bracket (106), the cradle (110) is rotated between the retracted and extended positions using a single motion. Because the cradle (110) may be rotated from the retracted position to the extended position using a single outward motion, tank bracket (106) is often referred to as a "swing out" fuel tank bracket.

[0009] Figure 2 shows a diagram of a forklift truck (200) equipped with another prior art tank bracket (206). The tank bracket (206) includes a frame (208) mounted on the truck's head guard (216) just above a counterweight (204). As shown in Figure 2, the frame (208) is actually a pair of brackets, where a first bracket (218) is mounted on a left side of the head guard (216) and a second bracket (220) is mounted on a right side of the head guard (216). Further, a cradle (210) is rotatably connected to the first bracket (218) via a pivot (212), and a strap (214) connected to the cradle (210) is engaged around a fuel tank (202). In the view shown, the cradle (210) is in an extended position.

[0010] To maneuver the cradle (210) to the retracted position, the cradle (210) is rotated inward about the pivot (212) to a position above the counterweight (204) and inside the forklift truck's body frame. The cradle (210) is locked to the frame's second bracket (220) via a latching mechanism. Note that, in this tank bracket (206), the cradle (210) is rotated between the retracted and extended positions using a single motion. Because the cradle (210) may be rotated to the extended position using a single outward motion, the tank bracket (206) is often referred to as a "swing out" fuel tank bracket.

[0011] The tank brackets shown in Figures 1 and 2 reduce the reach required to install a fuel tank, thereby reducing the difficulty of installing a tank and reducing risk to the operator.

[0012] Figure 3 shows a diagram of a forklift truck (300) equipped with a prior art two-stage tank bracket (306) designed to reduce both a height and a reach required to install a fuel tank. The tank bracket (306) includes a frame (308), a cradle (310), and a strap (316). As shown in Figure 3, the frame (308) is actually a pair of brackets, where a first bracket (322) is mounted on a left side of the truck's head guard (320) just above a counterweight (304) and a second bracket (324) is mounted on a right side of the head guard (320) just above the counterweight (304). The cradle (310) supports a mounted fuel tank (302) and is rotatably connected to the second bracket (324) via a first pivot (312) and a second pivot (314). The strap (316) is connected to the cradle (310) and engaged around the fuel tank (302). In the view shown, the cradle (310) is in an extended position.

[0013] To maneuver the cradle (310) into a retracted position, the cradle is rotated using two motions. In a first motion, an operator rotates the cradle (310) upward about a second pivot (314) to a position above and substantially parallel to the top surface of the counterweight (304) and outside the truck's body frame. After the first motion, the cradle (310) is locked such that it may not rotate about the second pivot (314). Then, in a second motion, the operator rotates the cradle (310) inward across the counterweight's top surface to a position inside the truck's body frame. At the end of the second motion, the cradle (310) is locked to the frame's first bracket (322).

[0014] The tank bracket (306) shown in Figure 3 also includes gas springs (318) (only one is visible in Figure 3) that are connected to the frame (308) and the cradle (310). The pair of gas springs (318) is used to support a portion of the weight of the cradle (310) and fuel tank (302) when the cradle (310) is rotated downwardly. Thus, although a motion for maneuvering the cradle

(310) about the first pivot (312) is manual, when the cradle (310) is maneuvered about the second pivot (314), the gas springs (314) help support the combined cradle (310) and fuel tank (302) weight. Note that, because the cradle (310) may be rotated to the extended position using two separate motions, an outward motion and then a downward motion, the tank bracket (306) is often referred to as a "swing out, swing down" fuel tank bracket.

[0015] As described above, the tank bracket (306) shown in Figure 3 requires two stages to maneuver between the retracted and extended positions. In each of these stages, the cradle (310) moves in either a vertical direction or a horizontal direction.

[0016] What is still needed, therefore, is a tank bracket that makes the loading and unloading of a fuel tank much easier for an operator.

Summary of Invention

[0017] According to one aspect of the present invention, a single stage, swing down fuel tank bracket comprises a frame immovably mounted onto a forklift truck; a cradle operatively connected to the frame and arranged to support a fuel tank; a hinge that pivotally connects a first end of the cradle to a first end of the frame; a latch having a first portion mounted on a second end of the frame and a second portion mounted on a second end of the cradle, wherein the second portion of the latch is releasably engaged with the first portion of the latch; wherein, after the latch is disengaged, the cradle is rotationally maneuverable between a retracted position and an extended position in a single stage, wherein, when the cradle is maneuvered between the retracted position and the extended position, the cradle moves simultaneously outwardly and downwardly in relation to a counterweight of the forklift truck.

[0018] According to another aspect of the present invention, a swing down fuel tank bracket comprises means for immovably mounting the tank bracket onto a

forklift truck; means for supporting a fuel tank disposed on the tank bracket; means for rotationally maneuvering the means for supporting with respect to the means for immovably mounting; and means for releasably engaging the means for supporting to the means for immovably mounting, wherein, upon disengagement of the means for releasably engaging, the means for supporting is maneuvered between a retracted position and an extended position using the means for rotationally maneuvering in a single stage, and wherein, when the means for supporting is maneuvered from the retracted position to the extended position, the means for supporting moves along a three-dimensional trajectory in a direction that is outward and downward in relation to the forklift truck.

[0019] Other aspects and advantages of the invention will be apparent from the following description and the appended claims.

Brief Description of Drawings

[0020] Figure 1 shows a diagram of a forklift equipped with a prior art tank bracket.

[0021] Figure 2 shows a diagram of a forklift truck equipped with an alternative prior art tank bracket.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A single stage, swing down tank bracket, comprising:

a frame immovably mounted onto a vehicle;

a cradle operatively connected to the frame and arranged to support a fuel tank;

a hinge that pivotally connects a first end of the cradle to a first end of the frame; and

a latch having a first portion disposed on a second end of the frame and a second portion disposed on a second end of the cradle, wherein the first portion of the latch is releasably engaged with the second portion of the latch,

wherein, after the latch is disengaged, the cradle is rotationally maneuverable between a retracted position and an extended position in a single stage,

wherein, the cradle may be maneuvered between the retracted position and the extended position by simultaneously rotating outwardly and downwardly in relation to the vehicle.

2. The swing down tank bracket of claim 1, wherein the vehicle is a forklift truck.

3. The swing down tank bracket of claim 2, wherein in the retracted position, the cradle is positioned substantially parallel to the frame.

4. The swing down tank bracket of claim 2, wherein in the retracted position, the cradle is positioned substantially parallel to an upper surface of a counterweight of the forklift truck, and wherein, in an extended position, the cradle is positioned at an angle to a side surface of the counterweight.

5. The swing down tank bracket of claim 1, further comprising:

a gas spring, wherein a first end of the gas spring is operatively connected to the frame; and

a pivot screw operatively connecting a second end of the gas spring to the first end of the cradle,

wherein, while the cradle is maneuvered from the retracted position to the extended position, the gas spring resists the motion of the cradle.

6. The swing down tank bracket of claim 5, wherein the gas spring provides a near full assist for maneuvering the cradle from the extended position to the retracted position when a full fuel tank is positioned in the cradle, and further comprising a second latch for selectively latching the cradle in the extended position.

7. The swing down tank bracket of claim 1, further comprising a set of straps operatively coupled to the cradle and arranged to be releasably engaged around a circumference of the fuel tank.

8. The swing down tank bracket of claim 1, wherein the cradle comprises an alignment pin arranged to fit into an opening in a rim of the fuel tank.

9. The swing down tank bracket of claim 1, further comprising a dampener operatively connected the frame and the cradle, wherein, after the latch is disengaged, the cradle can be mechanically maneuvered from the retracted position to the extended position without operator assistance.

10. The swing down tank bracket of claim 1, wherein, in an extended position, the cradle is positioned at an angle about 40 degrees outward from a side surface of the vehicle.

11. A swing down tank bracket, comprising:

means for immovably mounting the tank bracket onto a forklift truck;

means for supporting a fuel tank disposed on the tank bracket;

means for rotationally maneuvering the means for supporting with respect to the means for immovably mounting; and

means for releasably engaging the means for supporting and the means for immovably mounting,

wherein, upon disengagement of the means for releasably engaging, the means for supporting is maneuvered between a retracted position and an extended position using the means for rotationally maneuvering in a single stage, and

wherein, when the means for supporting is maneuvered from the retracted position to the extended position, the means for supporting moves in a direction that is outward and downward in relation to the forklift truck.

12. The swing down tank bracket of claim 11, further comprising:

means for balancing a rotation of the means for supporting,

wherein, upon disengagement of the means for releasably engaging, the means for balancing resists a motion of the means for supporting such that the means for supporting is maneuvered with minimal operator assistance.

13. The swing down tank bracket of claim 12, wherein the means for balancing moves along a trajectory substantially similar to a trajectory traversed by the means for supporting while the means for supporting is maneuvered from a retracted position to an extended position.

14. The swing down tank bracket of claim 12, wherein the means for supporting comprises means for securing the tank bracket to the means for supporting.

15. The swing down tank bracket of claim 12, further comprising:

means for damping the rotation of the means for supporting,

wherein, upon disengagement of the means for releasably engaging, the means for damping retards a motion of the means for supporting.

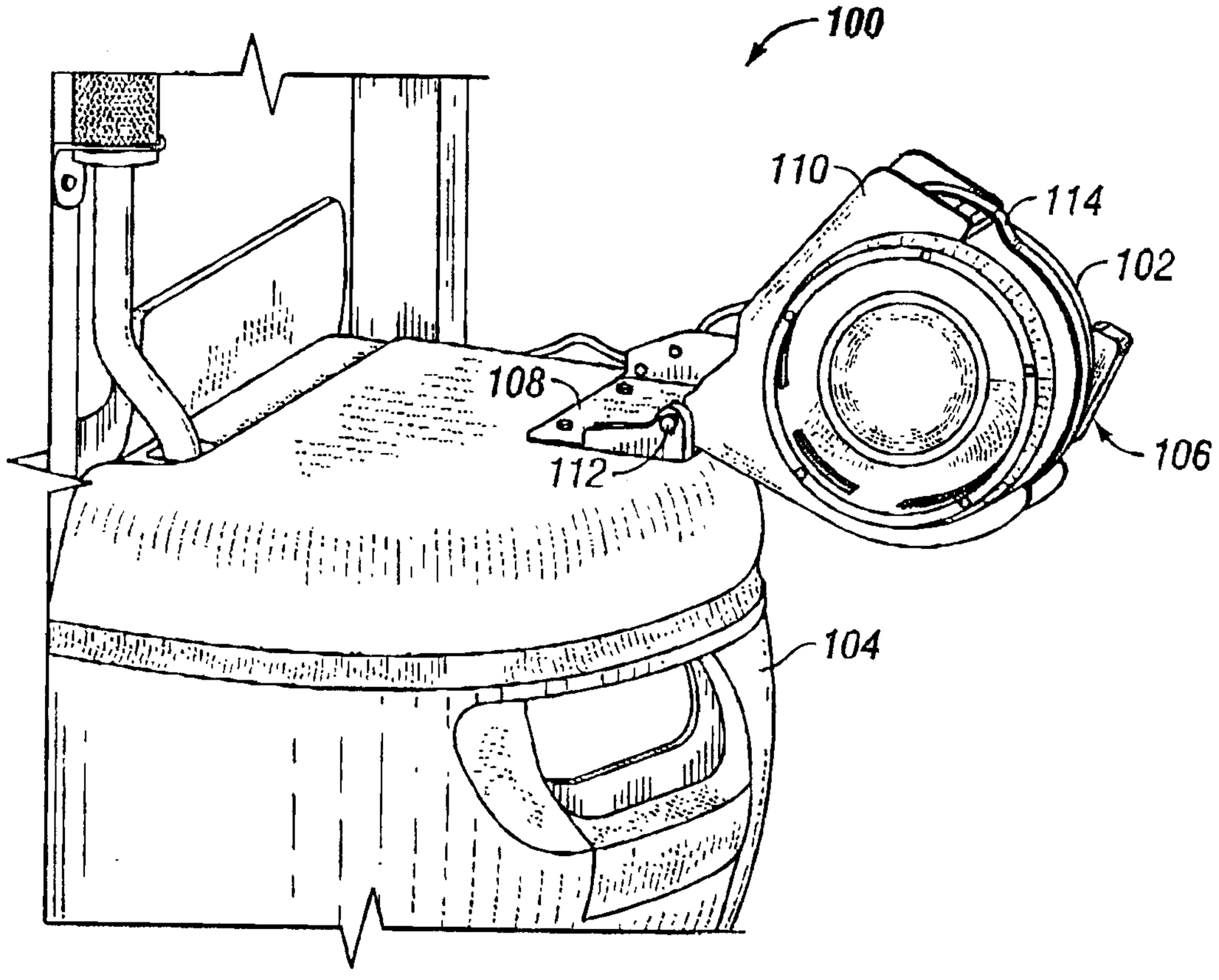

FIG. 1
(Prior Art)

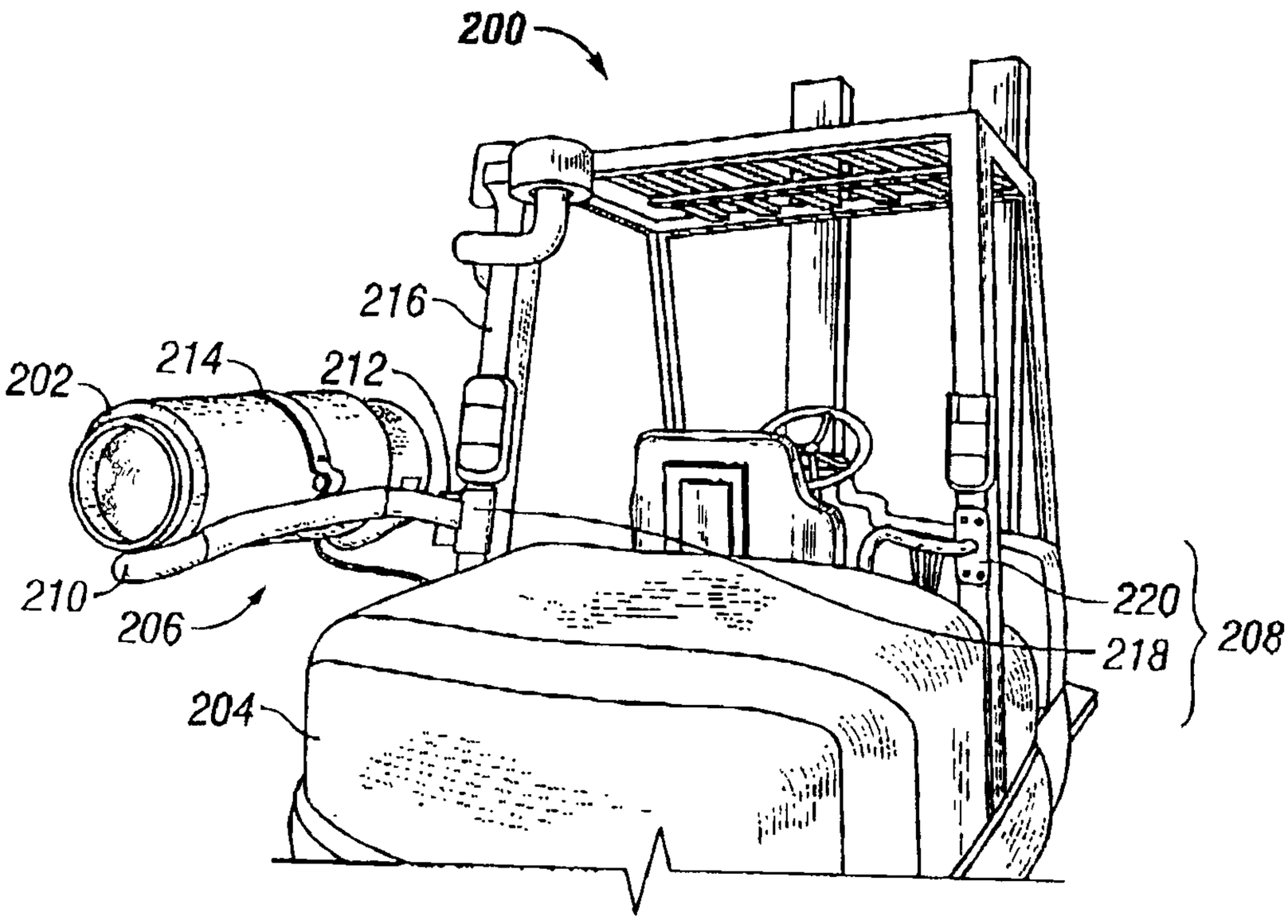

FIG. 2
(Prior Art)

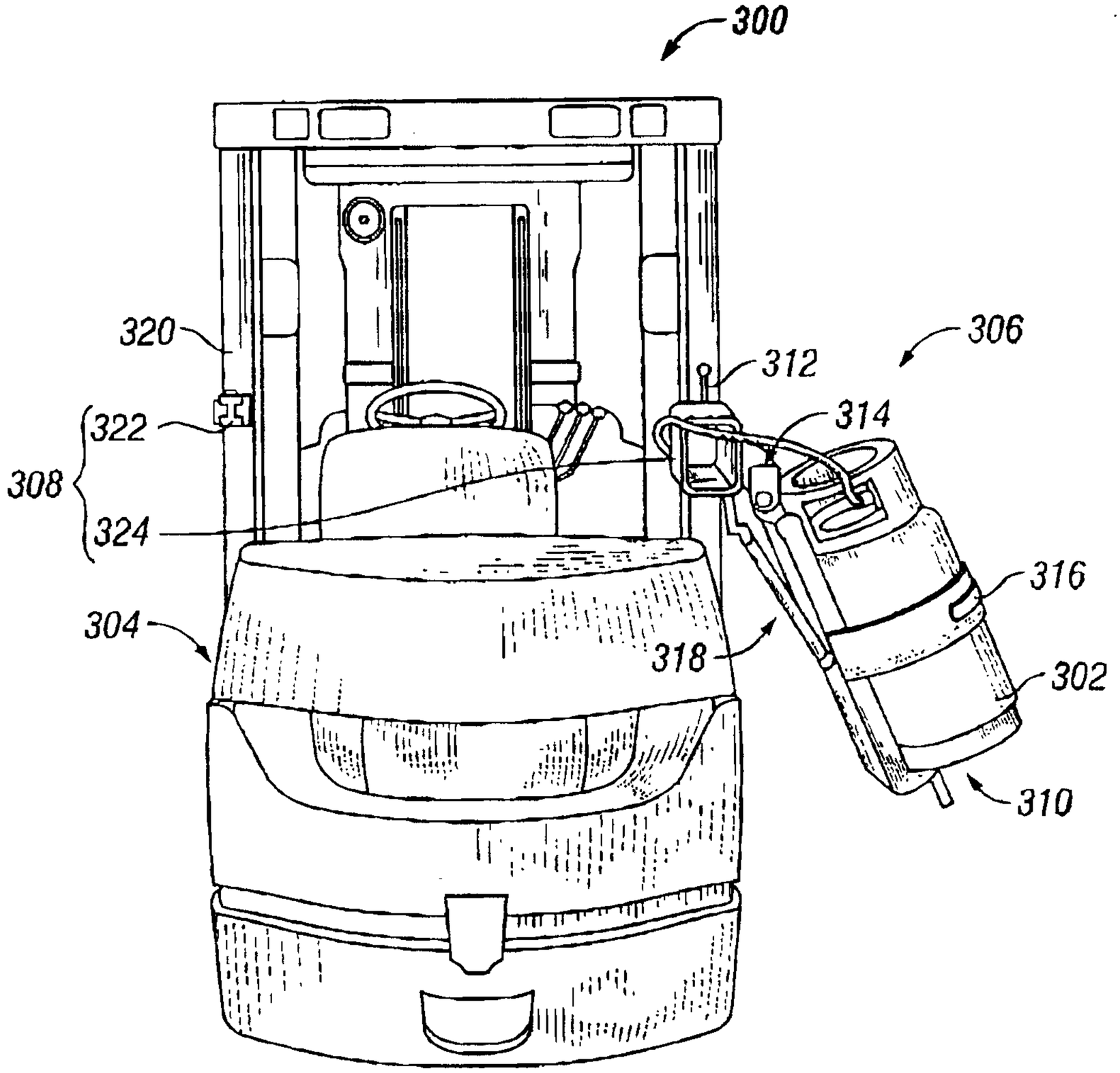

FIG. 3
(Prior Art)

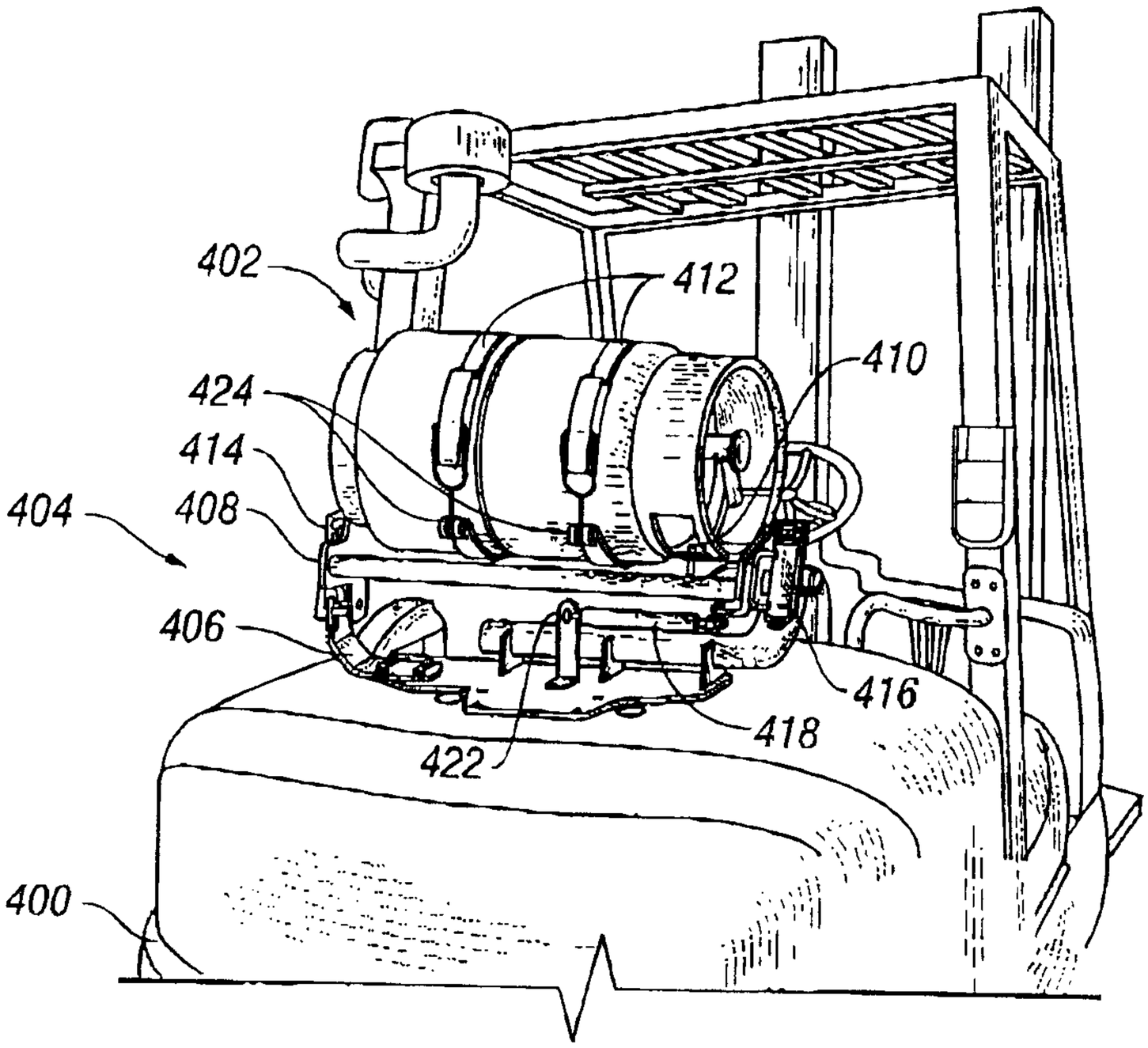
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FIG. 4

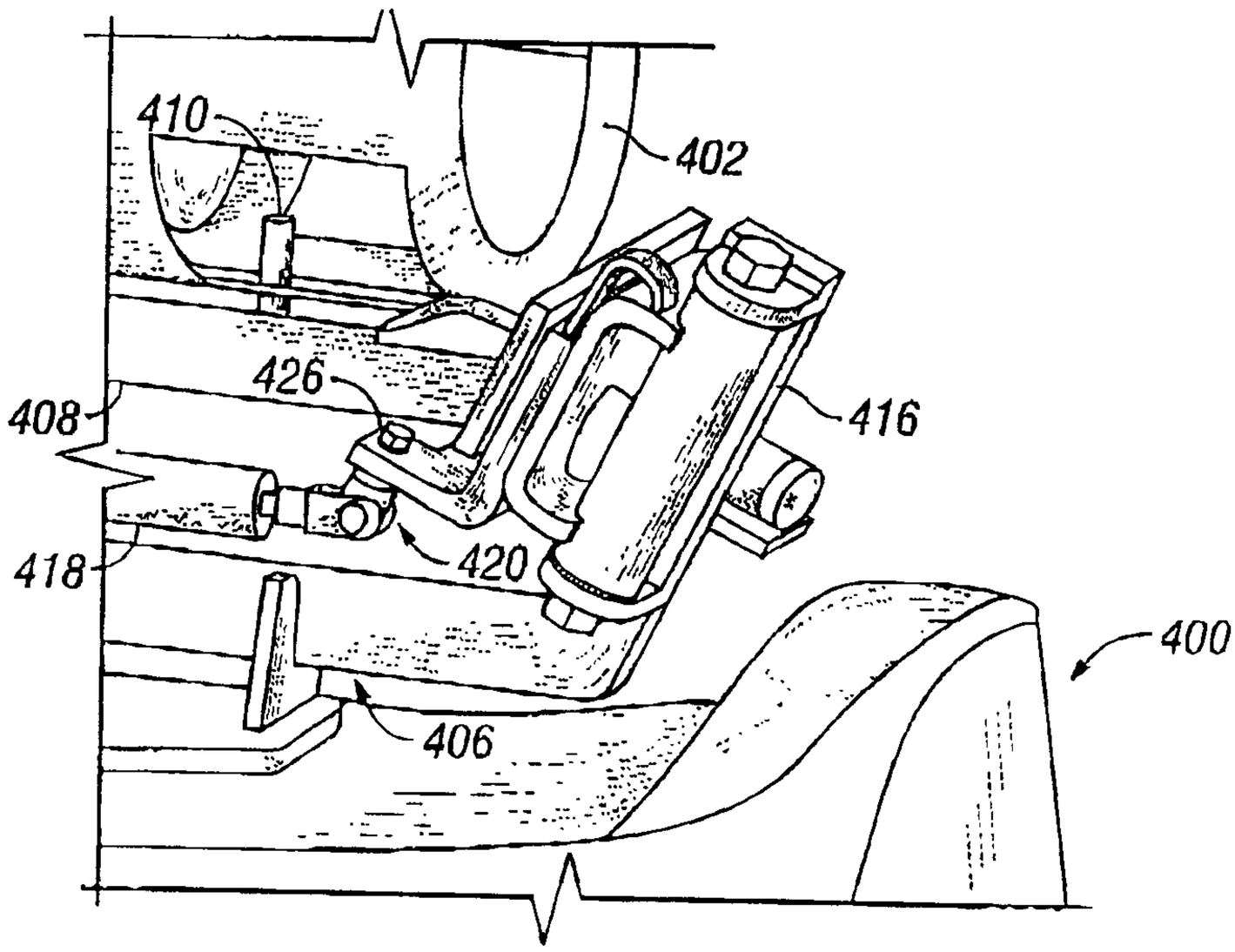
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FIG. 5

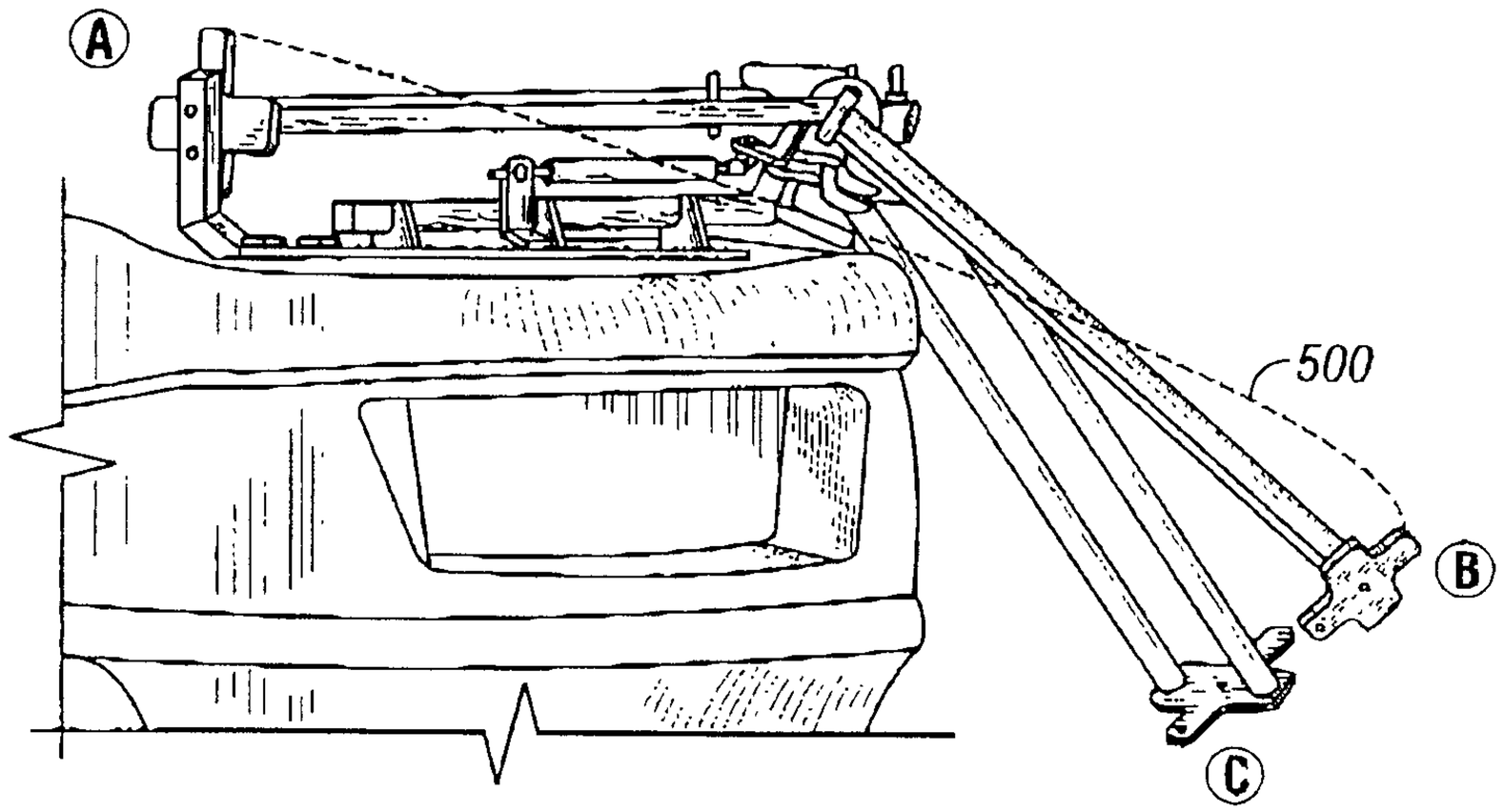


FIG. 6

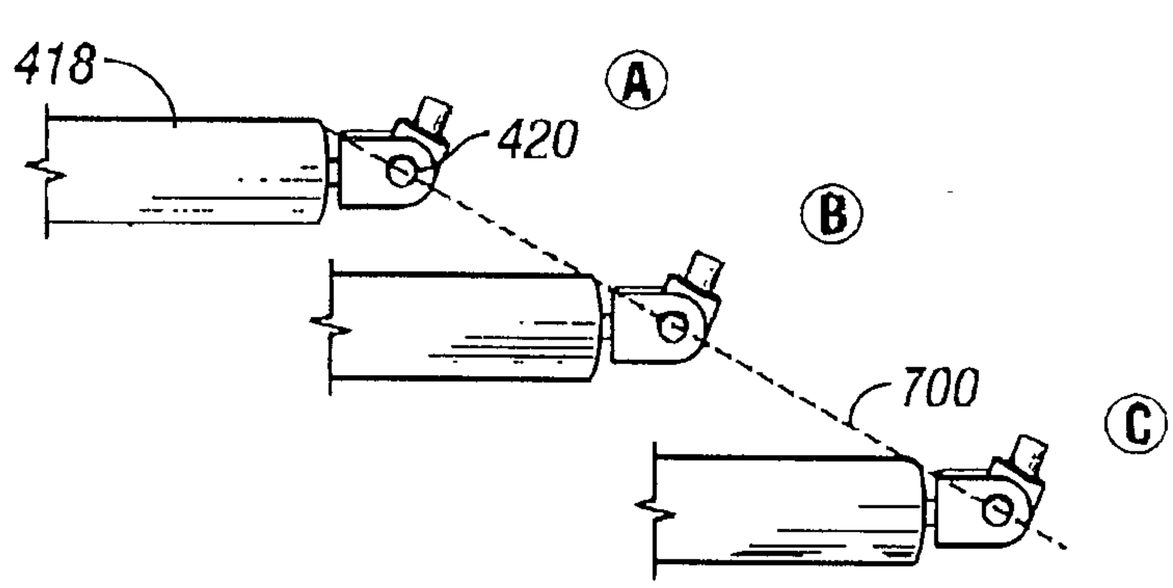


FIG. 7A

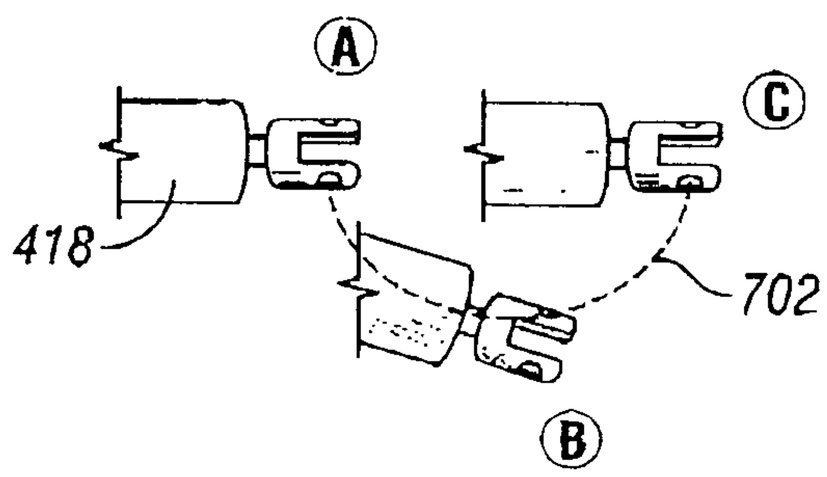
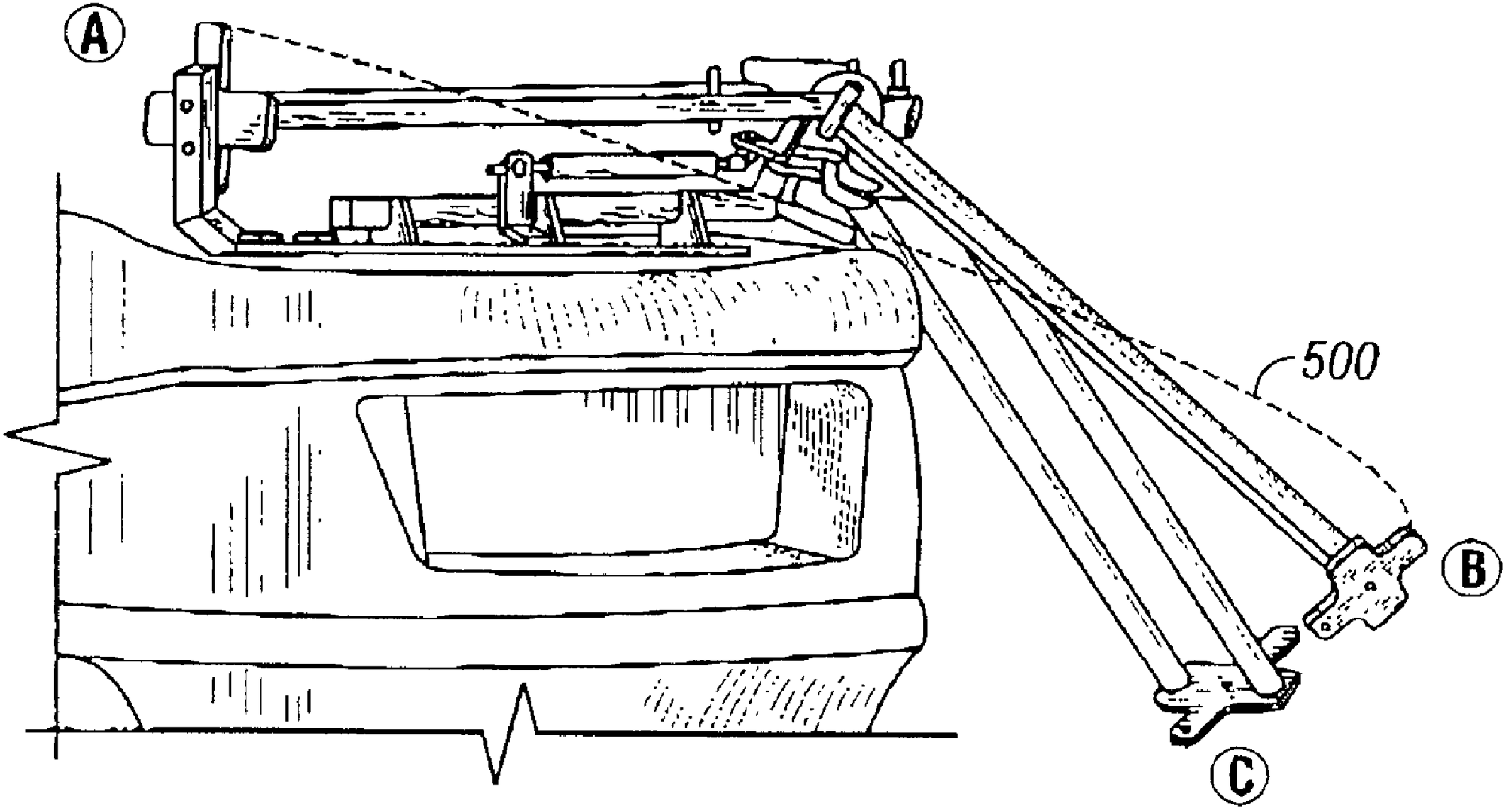


FIG. 7B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