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(54) **REAR-MOUNTED IMPLEMENT MOUNTING SYSTEM**

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E02F 3/96 (2006.01)

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USPC **37/468**; 37/403; 414/723; 414/686; 172/481

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USPC 172/272, 274, 275, 481; 37/468, 403, 37/408, 409; 414/723, 724, 686, 687, 694
See application file for complete search history.

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Primary Examiner — Jamie L McGowan

(57) **ABSTRACT**

A rear-mounted implement mounting system includes semi-cylindrical seats open upwardly and mounted on a lower back portion of a utility vehicle chassis that receive bar members located on a facing lower part of the rear-mounted implement. The utility vehicle chassis further includes semicylindrical receivers open in a rearward direction and adjacent cylinder portions open laterally. The receivers guide cylindrical bosses, located on an upper portion of the rear-mounted implement, into alignment with the cylinder portions, when the rear-mounted implement is pivoted upwardly by extending the boom cylinder of the rear-mounted implement. Connecting pins can be slipped through the cylindrical bosses and cylinder portions to lock the rear-mounted implement to the utility vehicle chassis. An operator remaining in the vehicle cab or operator station can easily operate the mounting system.

12 Claims, 6 Drawing Sheets

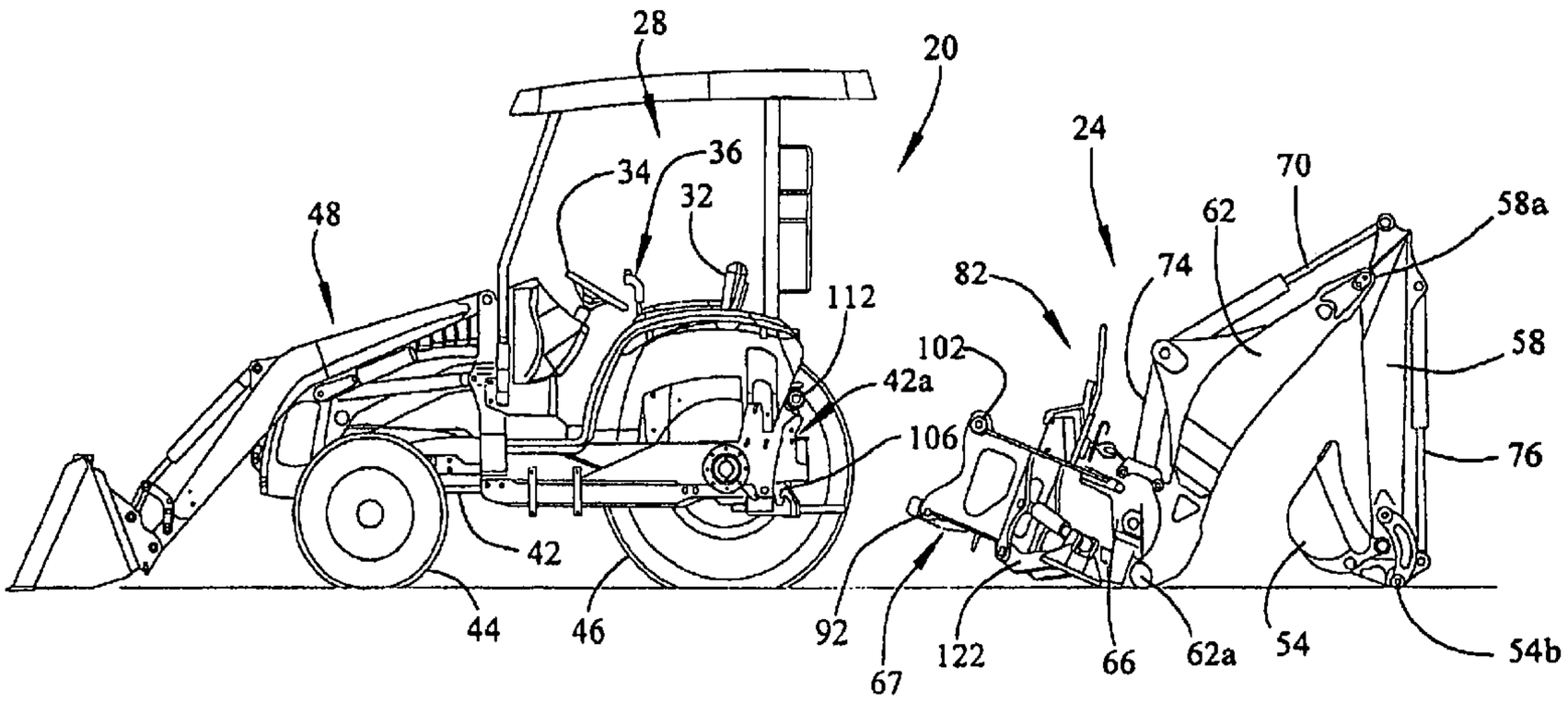

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FIG. 1

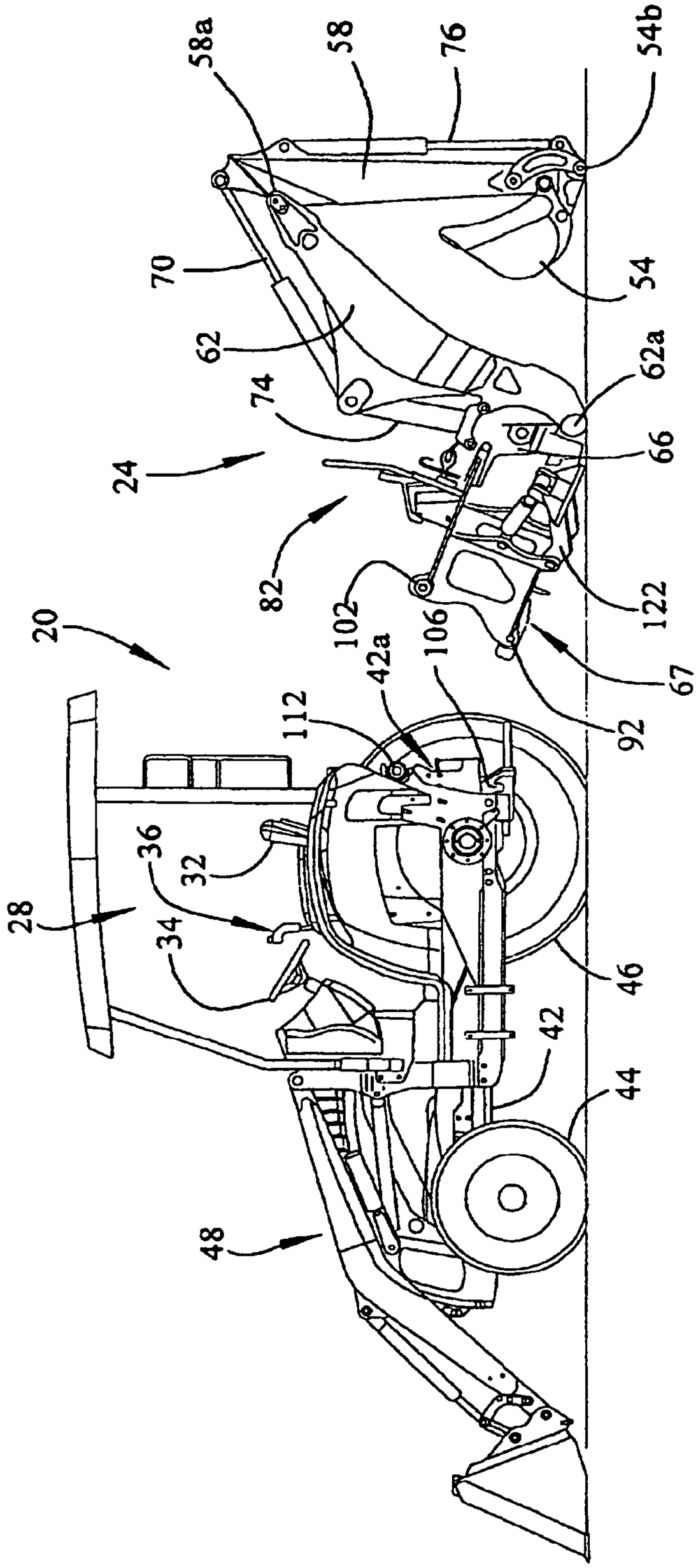

58a
58
76
54b
70
54
62
62a
74
66
24
82
102
122
20
42a
106
67
112
92
36
32
28
34
46
42
44
48

FIG. 2

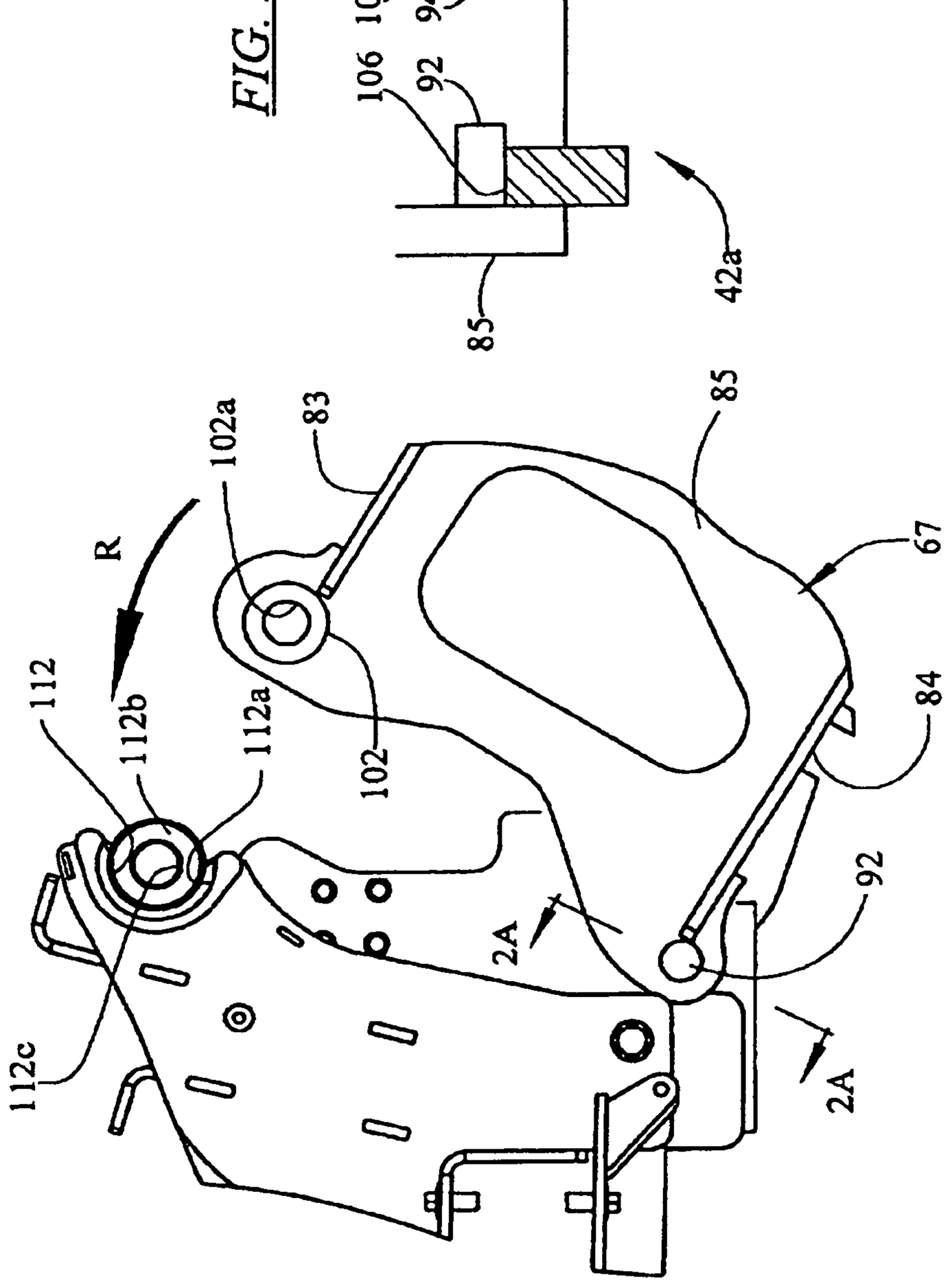

112
112b
112a
112c
R
102a
102
83
85
67
84
92
2A
2A
2A

FIG. 2A

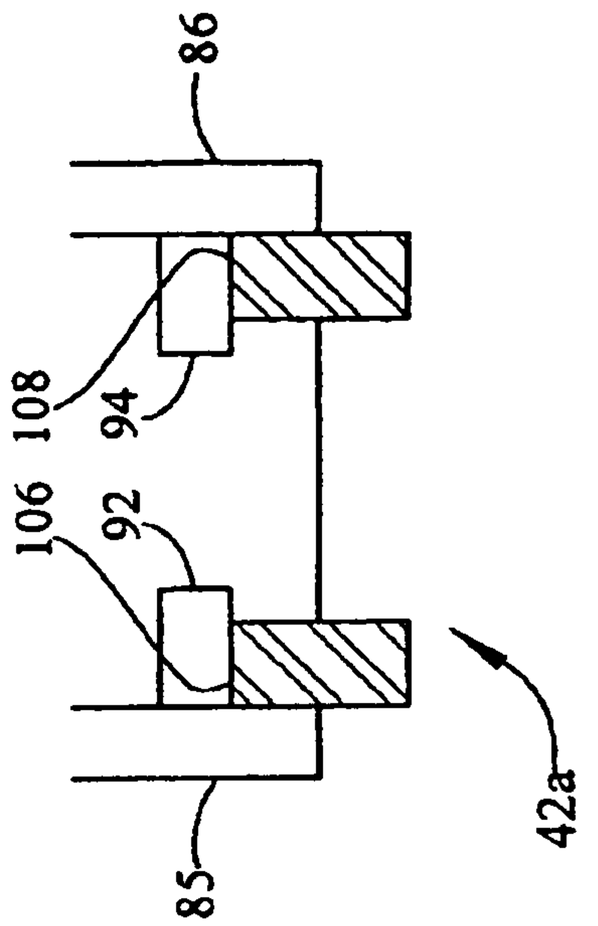

86
108
94
106
92
85
42a

FIG. 3

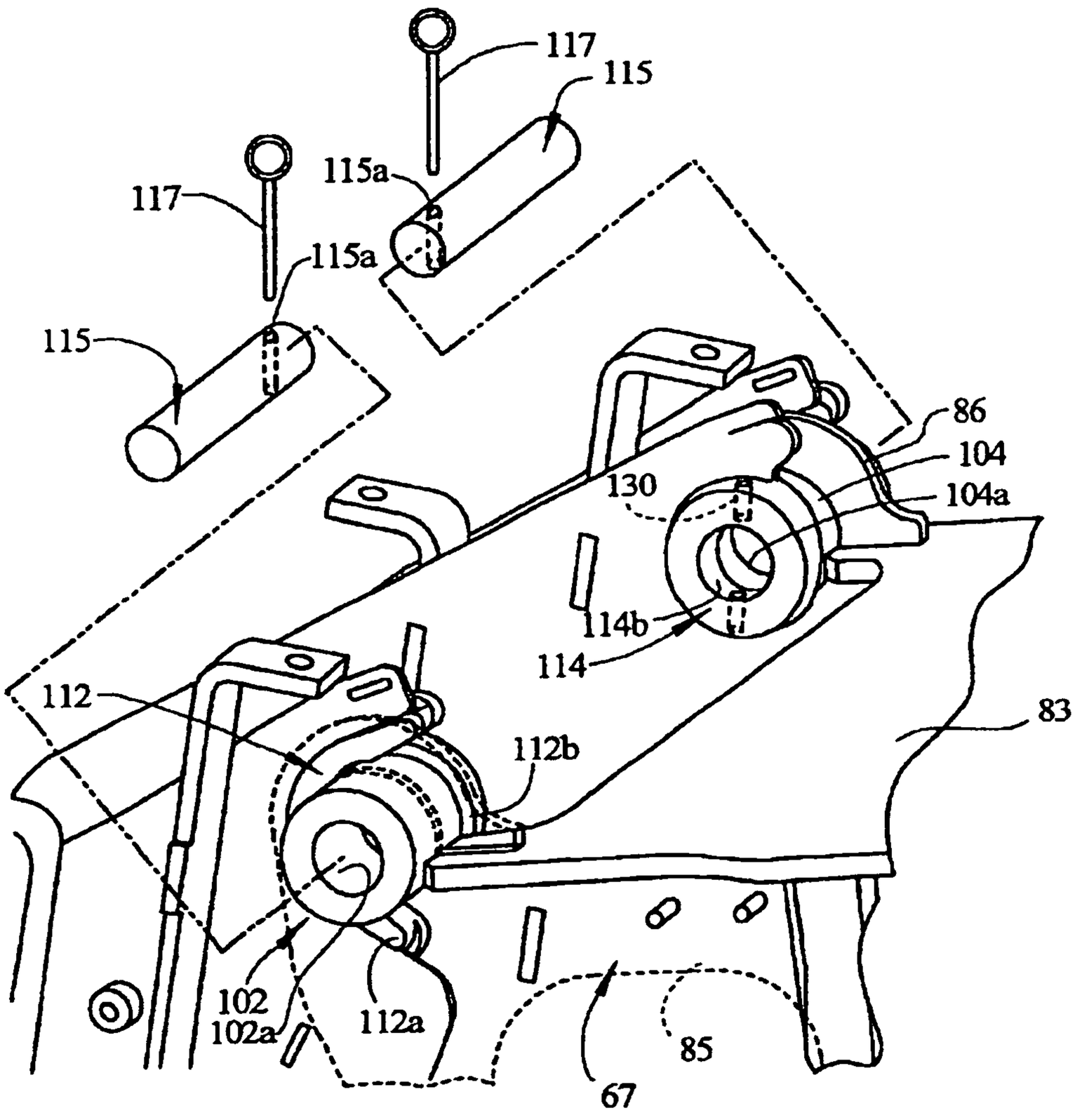

117
115
115a
117
115a
115
86
104
104a
130
114b
114
112
83
112b
102
102a
112a
85
67

FIG. 4B

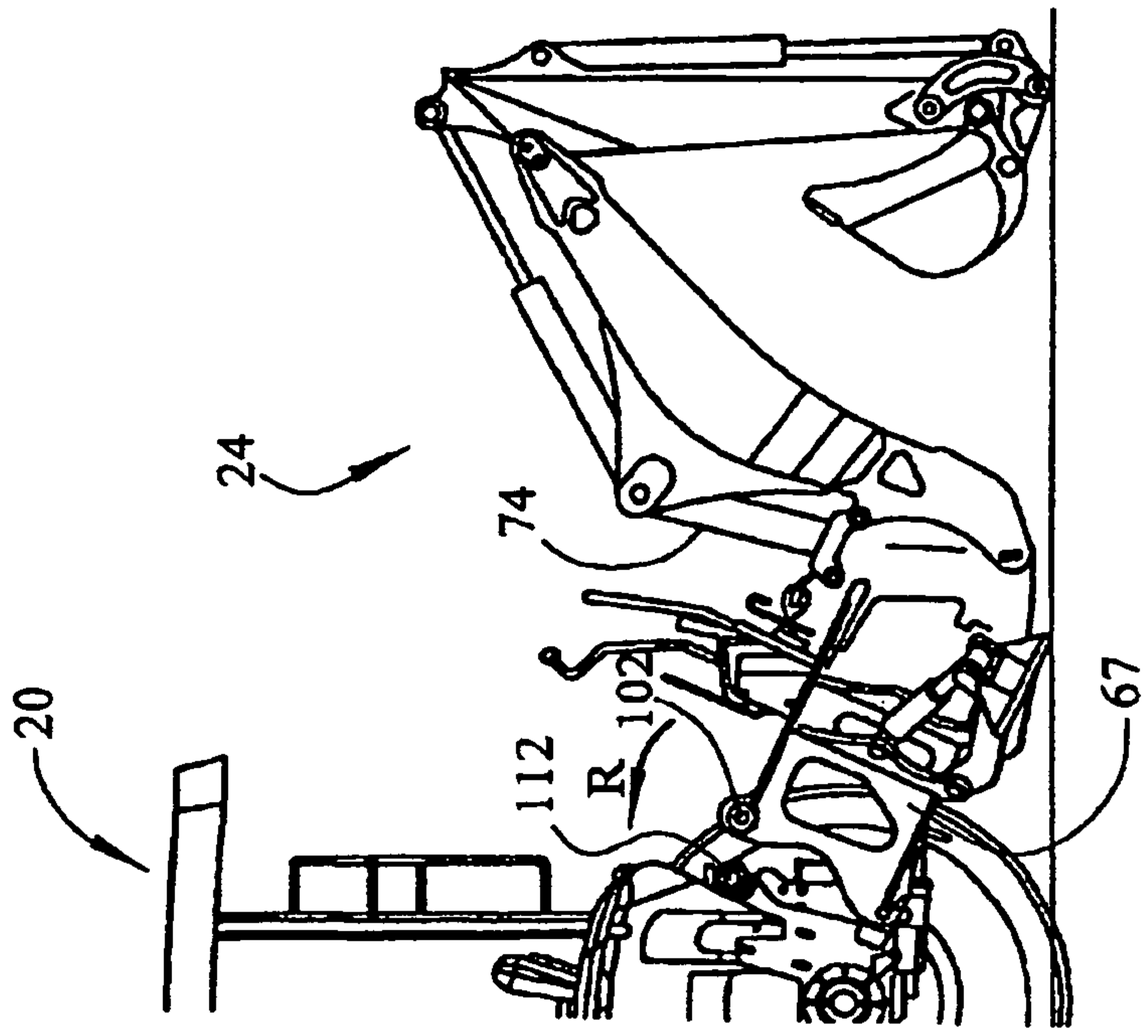
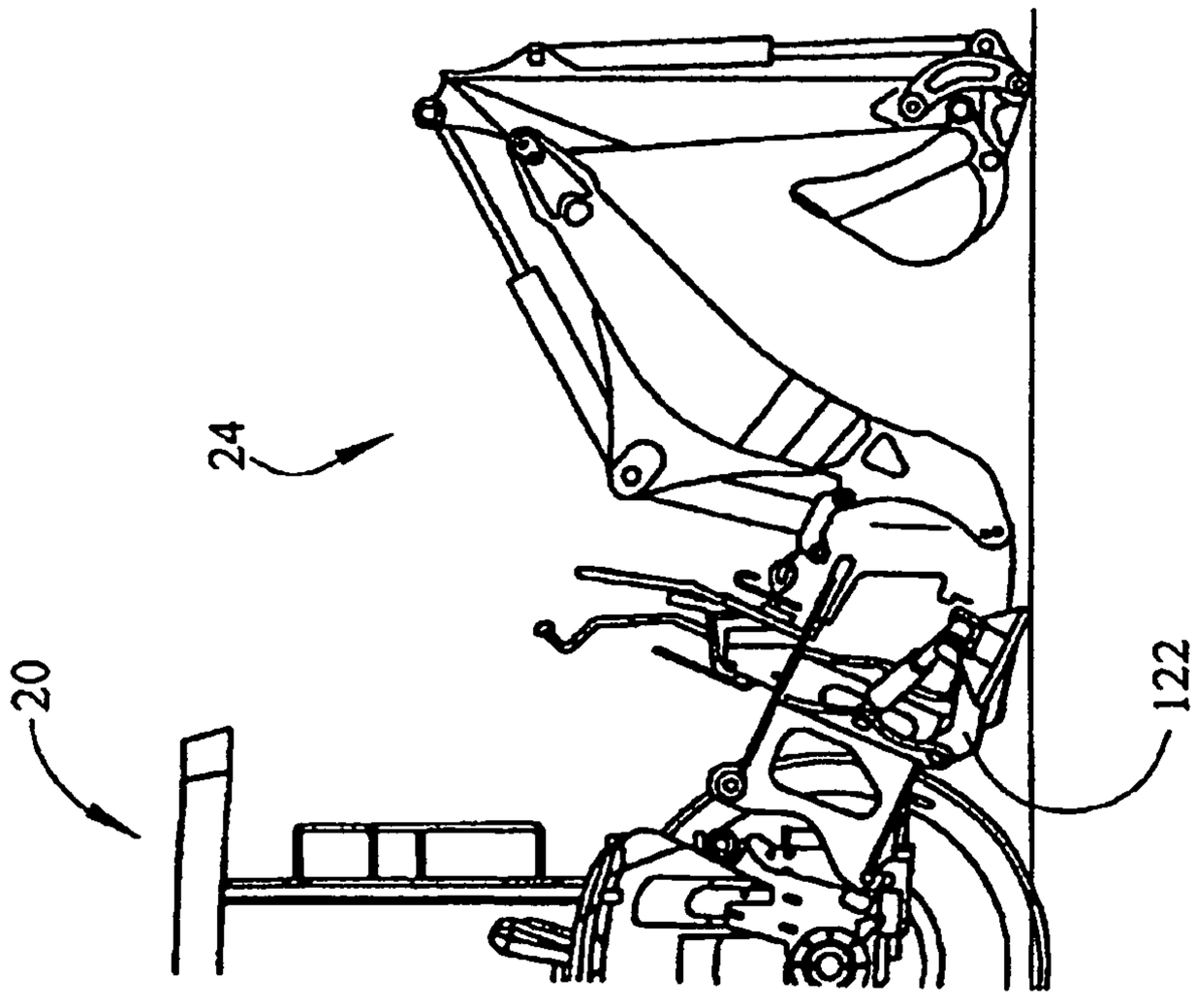


FIG. 4A



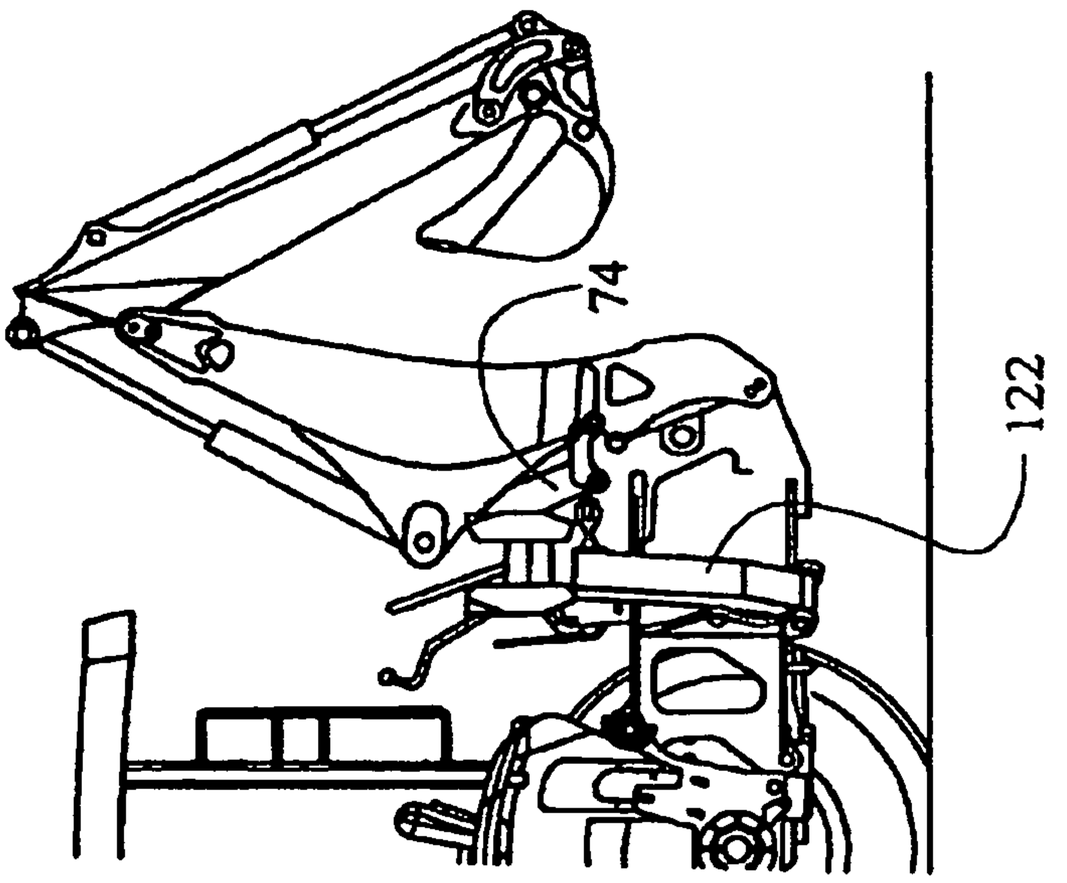


FIG. 4D

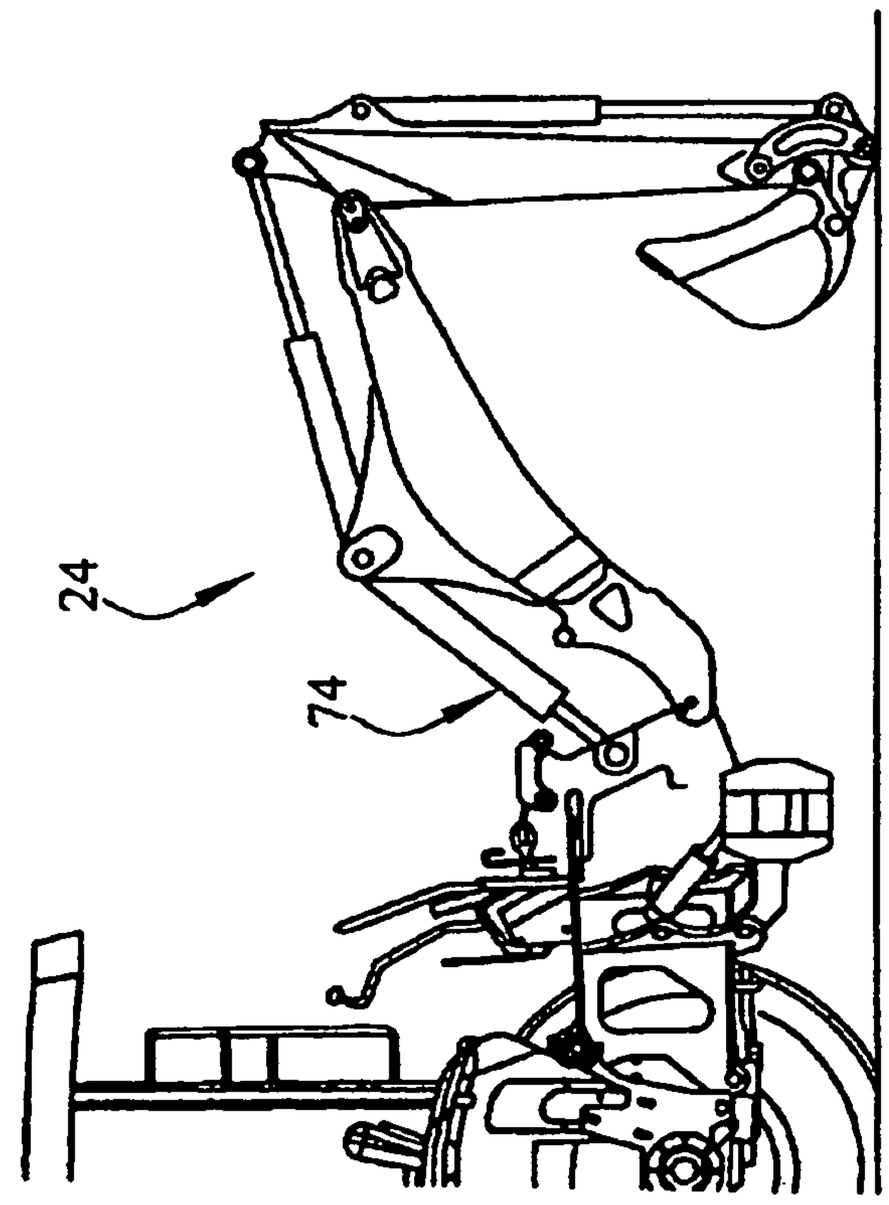
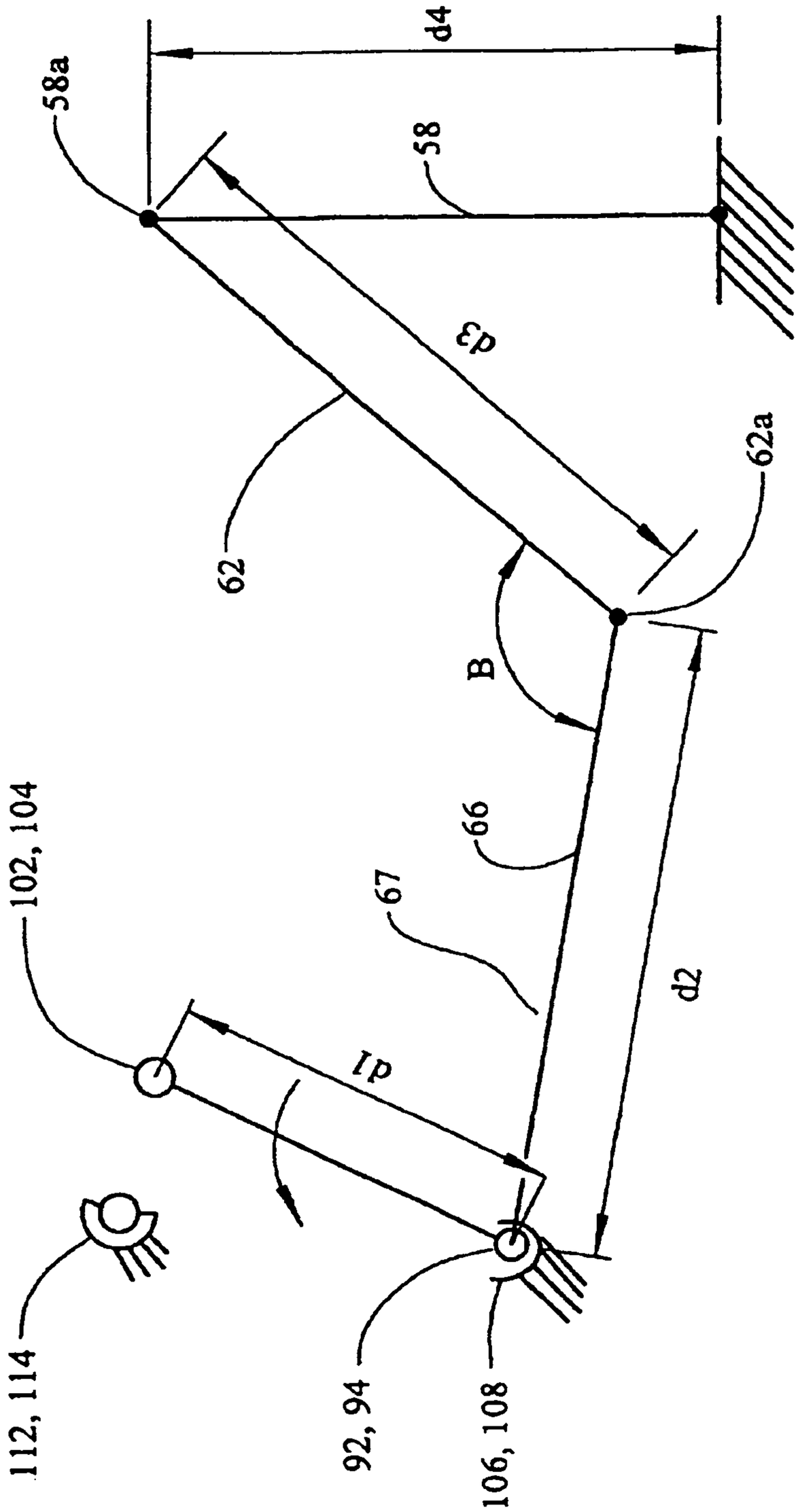


FIG. 4C

FIG. 5



REAR-MOUNTED IMPLEMENT MOUNTING SYSTEM

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

TECHNICAL FIELD OF THE INVENTION

The present invention relates to utility vehicles such as tractors. Particularly, the invention relates to a tractor that is provided with a detachable rear-mounted implement, such as a backhoe.

BACKGROUND OF THE INVENTION

Utility vehicles, such as compact tractors, are configured to accept a plurality of rear-mounted implements. Such implements include mower decks, tillers, cultivators, trenchers and backhoes. For attaching a rear-mounted implement, a mounting system is required. A mounting system must allow for attachment and detachment of the rear-mounted implement to the utility vehicle such that other rear-mounted implements can be used alternatively. A rigid and secure rear-mounted implement mounting system is required.

Most backhoe mounting systems in use today require the operator to be on the ground, out of the vehicle cab or operator station, to attach the backhoe attachment, thus exposing the operator to certain inconveniences and hazards inherent in manipulating such a large and heavy attachment. These mounting systems are cumbersome and complex.

The present inventors have recognized the desirability of providing a rear-mounted implement mounting system that is rigid and secure but which also is easily attached and detached. The present inventors have recognized the desirability of providing a rear-mounted implement mounting system that can be engaged to a utility vehicle by the operator without leaving the vehicle cab or operator station.

SUMMARY OF THE INVENTION

The invention provides a rear-mounted implement mounting system for a utility vehicle, including a rear-mounted implement, that comprises a first connection arranged between the utility vehicle and the rear-mounted implement, the first connection being engageable in a first direction and restrained along a second direction, the second direction substantially perpendicular to the first direction, and a second connection between the utility vehicle and the rear-mounted implement, the second connection being engaged in a tangential direction rotationally about the first connection, and thereafter restrained along the tangential direction.

Advantageously, the first direction is a substantially vertical direction and the second direction is a substantially horizontal direction, although the invention encompasses other directions angled to the vertical and horizontal directions. The invention allows for a setting of the first connection and a pivoting of the rear-mounted implement to set the second connection, engaged in the tangential direction, and once set, restrained in the tangential direction.

The present invention provides a rear-mounted implement mounting system for a utility vehicle that includes a set of lower hooks or seats and a set of upper receivers, located on a chassis of the utility vehicle. The rear-mounted implement includes round bar features that are configured to be inserted into the lower hooks, and boss features that are configured to be engaged to the upper receivers. Locking devices can be engaged to the bosses and receivers to lock the rear-mounted implement to the utility vehicle.

According to one aspect of the invention, in order to mount the rear-mounted implement, the utility vehicle is backed up to a detached rear-mounted implement, and the operator connects the hydraulic supply lines of the rear-mounted implement to the utility vehicle. Using hydraulic power, the round bar features on the rear-mounted implement are set above the lower hooks on the utility vehicle. The rear-mounted implement is then lowered to position the bar features into the books using lateral stabilizers of the rear-mounted implement. The boom cylinder of the rear-mounted implement is then extended which rotates the entire rear-mounted implement base into a mounting position. The boss features on the rear-mounted implement contact specially machined receivers, which force the rear-mounted implement into its final attached position. The operator can then easily insert and lock-in mounting pins by hand. All of these tasks can be accomplished from the operator's seat.

The present invention allows the operator to attach and detach a rear-mounted implement without the need to exit the utility vehicle cab. This enhances productivity and safety of the operator. Secondly, the mounting system is robust, and securely mounts the rear-mounted implement to the utility vehicle. Thirdly, the number of parts required to assemble the mounting system is low. This further reduces complexity of the mounting system, and increases the robustness of the mounting system. The mounting system allows mounting of the rear-mounted implement to the utility vehicle even if the rear-mounted implement is stored on unlevel ground or dirt.

Numerous other advantages and features of the present invention will become readily apparent from the following detailed description of the invention and the embodiments thereof, from the claims and from the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary elevational view of a tractor and a backhoe attachment with a foreground rear wheel removed for viewing portions behind the wheel;

FIG. **2** is an enlarged fragmentary elevational view of an interface between the tractor and the backhoe attachment;

FIG. **2**A is a fragmentary sectional view taken generally along line **2**A-**2**A of FIG. **2**;

FIG. **3** is an enlarged fragmentary perspective view of the mounting arrangement of the backhoe attachment to the tractor;

FIGS. **4**A through **4**D are fragmentary elevational views of the tractor and the backhoe attachment in progressive stages of attachment; and

FIG. **5** is a schematic diagram of the backhoe attachment and mounting system of the tractor of FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While this invention is susceptible of embodiment in many different forms, there are shown in the drawings, and will be described herein in detail, specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

FIG. **1** illustrates a utility vehicle **20** and a rear-mounted implement, such as a backhoe attachment **24**. The utility vehicle **20** includes a cab or operator's station **28** including a seat **32**, a steering wheel **34**, and controls **36**. The cab is supported on a chassis **42** that is supported on front wheels **44** and larger rear wheels **46**. The foreground rear wheel is removed in FIG. **1** to view portions behind the wheel. The utility vehicle **20** can be equipped with a front mounted loader assembly **48**.

The backhoe attachment **24** includes a bucket **54**, a distal arm or dipperstick **58**, an intermediate arm or boom arm **62**, a swivel arm or swivel tower **66** and a base assembly or mainframe **67**. The distal arm **58** can be pivoted about a pivot point **58**a with respect to the intermediate arm **62** by a hydraulic cylinder **70**. The intermediate arm **62** can be pivoted with respect to the swivel arm **66** by a hydraulic cylinder or boom cylinder **74**. The swivel arm **66** can be rotated about a vertical axis with respect to the base assembly **67**. The bucket **54** can be curled with respect to the distal arm **58** by a hydraulic cylinder **76**. The operation of the hydraulic cylinders is by rear-mounted controls **82**.

The chassis **42** includes a rear-mounted implement mounting structure **42**a located on a rear end of the chassis **42**, facing the backhoe attachment **24**. The backhoe attachment base assembly **67** includes features that engage the rear-mounted implement mounting structure **42**a. The rear-mounted implement mounting structure **42**a and the base assembly **67** are both substantially mirror-image symmetrical about a vertical, longitudinal plane.

As illustrated in FIGS. **2**, **2**A and **3**, the backhoe attachment base assembly **67** includes horizontal upper and lower plates **83**, **84** and side plates **85**, **86**. The side plate **85** is shown in phantom in FIG. **3** to allow viewing of the receiver **112**. Laterally directed, round bars **92**, **94** extend on opposite sides of the base assembly **67** on a bottom thereof (FIG. **2**A). As illustrated in FIG. **3**, the base assembly **67** includes cylindrical bosses **102**, **104** located substantially above the round bars **92**, **94** and extending laterally on opposite sides of the base.

The mounting structure **42**a includes hooks or seats **106**, **108**, open upwardly and located on opposite lateral sides of the rear portion of the chassis **42** of the utility vehicle. The seats **106**, **108** are sized to receive the round bars **92**, **94** therein. The mounting structure **42**a further includes semicylindrical receivers **112**, **114** that are sized and shaped to receive the bosses **102**, **104** therein and guide the bosses into a mounting position. The receivers **112**, **114** are open horizontally toward the backhoe attachment.

FIG. **2** illustrates in an enlarged view, the partial engagement of the base assembly **67** of the backhoe attachment **24** to the mounting structure **42**a. The round rods **92**, **94** are already fit into the seats **106**, **108**. The bosses **102**, **104** are being rotated upwardly about the rods **92**, **94** to engage the receivers **112**, **114** in a tangential direction. The receivers **112**, **114** include semi-circular rim portions **112**a, **114**a and pin receiving cylinder portions **112**b, **114**b. The bosses **102**, **104** include central bores **102**a, **104**a. When a boss **102**, **104** is fit into the receiver rim portions **112**a, **114**a the bores **102**a, **104**a aligns with the bores **112**c, **114**c as the bosses **102**, **104** fit coaxially against the cylinder portions **112**b, **114**b.

As shown in FIG. **3**, cylindrical connection pins **115** fit through the central bores **102**a, **104**a of the bosses **102**, **104**, respectively, and through the adjacent bores **112**c, **114**c of the cylinder portions **112**b, **114**b of the receivers **112**, **114**.

The cylindrical portions **112**b, **114**b include a radial through-hole **130** penetrating completely through the cylinder portions **112**b, **114**b in order to receive a retainer pin **117**. Once the respective connector pin **115** is pushed through both

the bosses **102**, **104** and the respective cylinder portions **112**b, **114**b, a retainer pin **117** is inserted through both the cylinder portions **112**b, **114**b and through a through-hole **115**a of the respective connector pin **115** to retain the connector pins **115** in place. This locks the backhoe attachment to the utility vehicle.

FIG. **4**A illustrates the first step of attachment of the backhoe attachment **24** to the utility vehicle **20**. The round bars **92**, **94** are positioned above the hooks **106**, **108**. In order to elevate and position the round bars **92**, **94** above the seats **106**, **108**, the stabilizers **122** (one shown in FIG. **4**A) that are located on opposite lateral sides of the backhoe attachment **24**, are lowered as necessary. The stabilizers can then be raised such that the round bars are lowered to fit snuggly within the seats.

FIG. **4**B illustrates the next step in the attachment of the backhoe attachment **24** to the utility vehicle **20** wherein the hydraulic cylinder **74** is extended to pivot the base assembly **67** with respect to the utility vehicle **20** to mate the bosses **102**, **104** to the receivers **112**, **114**. The base assembly **67** is rotated in the direction R. The rotation also drives the round bars **92**, **94** into the seats **106**, **108**.

FIG. **4**C shows the complete attachment of the backhoe attachment **24**. The round bars **92**, **94** are completely set into the seats **106**, **108**. The bosses **102**, **104** are set into the receivers **112**, **114**. Connection pins (shown in FIG. **3**) have been inserted through the bosses **102**, **104** and the receivers **112**, **114** are locked in place.

FIG. **4**D shows the stabilizers **122** raised and the hydraulic cylinder **74** retracted to make the utility vehicle ready for ground travel.

FIG. **5** illustrates the geometric proportions that allow for the easy attachment of the backhoe attachment to the utility vehicle chassis **42**. The bars **92**, **94** are located at a distance d**1** from the cylindrical bosses **102**, **104**. The seats **106**, **108** are located at substantially the same distance to the receivers **112**, **114**.

The pivot point **62**a of the intermediate arm **62** to the swivel arm **66** is located at a distance d**2** to the bars **92**, **94**. The pivot point **58**a between the intermediate arm **62** and the distal arm **58** of the backhoe attachment is located at a distance d**3** to the pivot point **62**a. The pivot point **58**a is located at a distance d**4** to a bottom **54**b of the distal arm **58** with the bucket in a fully curled orientation as shown in FIG. **1**A.

During the rotary movement of the backhoe attachment, the distal arm **58** remains substantially vertical. The intermediate arm **62** pivots clockwise about the pivot point **58**a. The swivel arm **66** and the base assembly **67** pivot counterclockwise about the bars **92**, **94** and the bosses rotate counterclockwise in the direction R about the bars **92**, **94** to engage into the receivers **112**, **114**. An angle B between the swivel arm **66** and the intermediate arm **62** opens up.

According to one exemplary embodiment, the distances set forth in FIG. **5** are: d**1**=500 mm; d**2**=1125 mm; d**3**=2171 mm; and d**4**=1825 mm.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

The invention claimed is:

1. A rear-mounted implement mounting system for a utility vehicle and a rear-mounted implement, comprising:

at least one elongated connection member;

a first connection arranged between the utility vehicle and the rear-mounted implement, the first connection being engageable in a substantially vertical first direction and restraining separation of the utility vehicle and the rear-mounted implement along a second substantially horizontal direction that is substantially perpendicular to the first direction;

a second connection between the utility vehicle and the rear-mounted implement, said second connection at a distance above said first connection, said second connection being engageable in a tangential direction as said rear-mounted implement is rotated about said first connection and restraining separation of said utility vehicle and the rear-mounted implement along the tangential direction, said second connection comprising two laterally spaced-apart cylindrical bosses mounted together rigidly on a frame of said rear mounted implement, each boss having a first substantially horizontal bore therethrough along a common lateral axis, and two laterally spaced-apart receivers mounted on said utility vehicle, each receiver having a cylinder portion with a second substantially horizontal bore therethrough along a common lateral axis and an adjacent rim portion positioned to guide said cylinder portion into alignment with said boss, wherein after said rear mounted implement is rotated about said first connection, said first and second substantially horizontal bores of said bosses and cylinder portions are aligned to receive therein said at least one elongated connection member.

2. The mounting system according to claim **1**, wherein said elongated connection member is a separate member from said utility vehicle and said rear-mounted implement.

3. The mounting system according to claim **2**, wherein said first connection comprises seats arranged on said utility vehicle, and bars arranged on said rear-mounted implement which can be placed into said seats.

4. A rear-mounted implement mounting system for a utility vehicle and a rear-mounted implement, comprising:

a first connection arranged between the utility vehicle and the rear-mounted implement, the first connection being engageable in a first direction and restraining separation of the utility vehicle and the rear-mounted implement along a second direction that is substantially perpendicular to the first direction;

a second connection between the utility vehicle and the rear-mounted implement, said second connection at a distance from said first connection, said second connection being engageable in a tangential direction as said rear-mounted implement is rotated about said first connection and restraining separation of said utility vehicle and the rear-mounted implement along the tangential direction;

wherein said second connection comprises two cylindrical bosses **[**connected to said rear-mounted implement**]**, said bosses having first open bores with axes thereof oriented laterally, and **[**said utility vehicle includes**]** two receivers each having a guide portion and an adjacent cylinder portion with a second open bore, and wherein said receivers are arranged to receive said cylindrical bosses and said guide portion are arranged to align said cylindrical bosses with said cylinder portions, said guide portions arranged outside of said cylinder portions *arranged outside of said cylinder portions* in a lateral direction; and

two connector pins fit through respective pairs of first and second open bores of said cylindrical bosses and said cylinder portions to lock said rear-mounted implement attachment to said utility vehicle.

5. A rear-mounted implement mounting system for a utility vehicle and a rear-mounted implement, comprising:

a first connection arranged between the utility vehicle and the rear-mounted implement, the first connection being engageable in a first direction and restraining separation of the utility vehicle and the rear-mounted implement along a second direction that is substantially perpendicular to the first direction**[**:**]** ;

a second connection between the utility vehicle and the rear-mounted implement, said second connection at a distance from said first connection, said second connection being engageable in a tangential direction as said rear-mounted implement is rotated about said first connection and restraining separation of said utility vehicle and the rear-mounted implement along the tangential direction;

wherein said second connection comprises two cylindrical bosses **[**connected to said rear-mounted implement**]**, said bosses having first open bores with axes thereof oriented laterally, and **[**said utility vehicle includes**]** two receivers each having a semicircular rim portion and an adjacent cylinder portion with a second open bore, and wherein said receivers are arranged to receive said cylindrical bosses to align said cylindrical bosses with said cylinder portions; and two connector pins fit through respective pairs of first and second open bores of said cylindrical bosses and said cylinder portions to lock said rear-mounted implement attachment to said utility vehicle;

wherein said semicircular rim portions are arranged outside of said cylinder portions in a lateral direction.

6. The mounting system according to claim **4**, wherein said cylinder portions include pin receiving holes arranged in a radial direction and said connector pins each include a pin receiving hole arranged in a radial direction, and said second connection comprises retainer pins inserted through said pin retaining holes and said pin holes to lock said connector pins to said cylinder portions.

7. A utility vehicle comprising:

a rear-mounted implement including a base assembly, a swivel arm, an intermediate arm, a distal arm, and a bucket, said base assembly rotationally connected to said swivel arm, rotationally about a vertical axis, said swivel arm rotationally connected to said intermediate arm, rotationally about a lateral axis, said intermediate arm rotationally connected to said distal arm, rotationally about a lateral axis, and said distal arm rotationally connected to said bucket, rotationally about a lateral axis;

a hydraulic cylinder connected between said swivel arm and said intermediate arm and elongated or contracted to change the angle between said swivel arm and said intermediate arm;

a utility vehicle chassis supported on front and rear wheels, said chassis including rear-mounted implement-supporting seats extending rearward of the chassis and open upwardly, and receivers mounted above said seats and open in a rearward direction, said receivers being laterally spaced apart and each having a cylinder portion having a first lateral through bore;

said rear-mounted implement including bar members arranged to be fit substantially vertically into said seats, and boss members arranged to be fit into said receivers, each of said boss members having a second lateral bore therethrough; and

two locking portions for locking said boss members into said receivers;

wherein said receivers each include a guide portion located adjacent to a respective cylinder portion, said guide portions arranged outside of said cylinder portions in a lateral direction, each said guide portion arranged to guide one boss member into a respective receiver with said second lateral through bore of said one boss member aligning with said first lateral through bore of said respective cylinder portion such that a respective locking portion can penetrate both said first lateral through bore of said respective cylinder portion and said second lateral through bore of said one boss member.

8. The utility vehicle according to claim **7**, wherein said guide portions comprise semi-circular rim portions open in a rearward direction, and said locking portions comprise pins for fitting through said cylindrical bosses and said cylinder portions.

9. The utility vehicle according to claim **8**, wherein said bosses are set at a distance from said bar members such that extension of the hydraulic cylinder causes rotation of said swivel arm about said bar members, and rotation of said swivel arm with respect to said intermediate arm, to precisely locate said bosses into said receivers.

10. A mounting system for a rear-mounted implement to a utility vehicle, comprising:

a utility vehicle chassis supported on front and rear wheels, said chassis including rear-mounted implement-supporting scats extending rearward of the chassis and open upwardly and receivers mounted above said seats and open in a rearward direction, said receivers being laterally spaced apart and each having a cylinder portion having a first lateral through bore;

said rear-mounted implement including bar members arranged to be fit substantially vertically into said seats, and boss members arranged to be fit into said receivers when said implement is rotated about said bar members, each of said boss members having a second lateral bore therethrough; and

two locking portions for locking said boss members into said receivers;

wherein said receivers each include a guide portion located adjacent to a respective cylinder portion, said guide portions arranged outside of said cylinder portions in a lateral direction, each said guide portion arranged to guide one boss member into a respective receiver with said second lateral through bore of said one boss member aligning with said first lateral through bore of said respective cylinder portion such that a respective locking portion can penetrate both said first lateral through bore of said respective cylinder portion and said second lateral through bore of said one boss member.

11. The mounting system according to claim **10**, wherein each said guide portion includes a curved rim portion open in a rearward direction, and said locking portions comprise connector pins for fitting through said cylindrical bosses and said cylinder portions.

12. The mounting system according to claim **11**, wherein said cylinder portions include pin receiving holes arranged in a radial direction and said connector pins each include a pin receiving hole arranged in a radial direction, and said second connection comprises retainer pins inserted through said pin retaining holes and said pin holes to lock said connector pins to said cylinder portions.

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