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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: FRONT LINKAGE ASSEMBLY

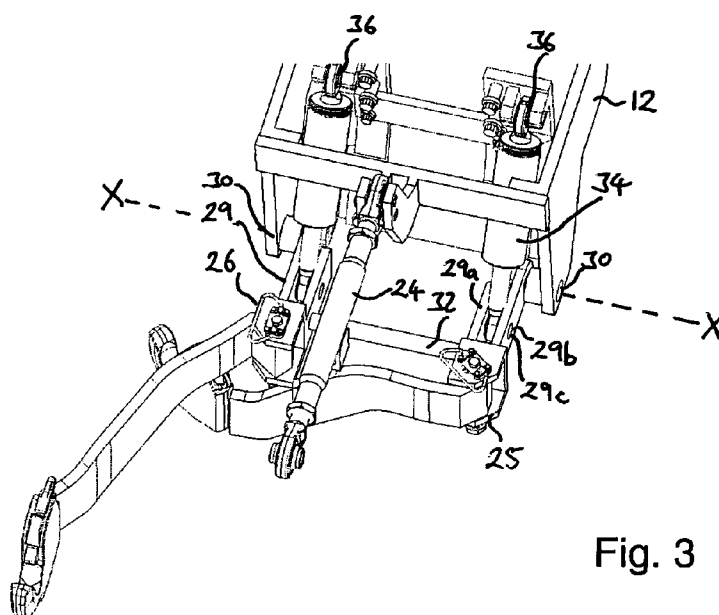


Fig. 3

(57) Abstract: A front linkage assembly (10) for a tractor is provided. The assembly comprises a pair of lift arms each comprising an intermediate joint (25, 26) which provides a pivotal connection between an inner section (29) and an outer section (21, 22). Each inner section (29) is pivotally attached to a tractor frame. Each outer section can fold relative to the inner section around a substantially vertical axis between a forwardly extending operating position and a transversely extending transport position.

DESCRIPTION

FRONT LINKAGE ASSEMBLY

5 The invention relates to tractor front linkage assemblies which facilitate the attachment of implements to the front of a tractor. In particular, the invention relates to linkage assemblies commonly known as three-point linkage assemblies which include a pair of lift arms and a top link attachment point.

10 Implements were traditionally hauled by tractors and attached thereto using either a drawbar or three-point linkage. Today, many large range tractors are fitted with three-point linkage on both the rear and front to allow two implements to be attached thereby increasing productivity and reducing the number of passes required to work a given area.

15 Front linkage assemblies inherently protrude forwardly of the main tractor frame in order to provide sufficient clearance between implement and tractor. When not in use, the lift arms of front linkage assemblies present a hazardous extension of the tractor's profile.

Attempts have been made to reduce the hazard by providing a transport position for the lift
20 arms in which they are stowed closer to the tractor frame. However, these can be cumbersome for the operator to change between the transport and operating positions often requiring the detachment and/or lifting of heavy components. Furthermore, the stowed arms often obstruct the tractor lights thus presenting an additional hazard especially when on the road.

25 It is therefore an object of the invention to provide a front linkage assembly which can be switched between a transport position and an operating position with greater ease and without the need to lift heavy parts whilst maintaining sufficient strength in the structure.

It is another object of the invention to provide a front linkage assembly which does not
30 obstruct the tractor lights when in the transport position.

In accordance with the invention there is provided a front linkage assembly for a tractor comprising a pair of lift arms each comprising an intermediate joint which provides a pivotal connection between an inner section, which is pivotally attached to a tractor frame, and an
35 outer section which can fold relative to the inner section around a substantially vertical axis between a forwardly extending operating position and a transversely extending transport position, each intermediate joint comprising a releasable locking mechanism to hold the arms

in the operating position. By folding the outer sections of the lift arms sideways across the front of the tractor the need for the operator to lift any significant portion of the lift arm weight is avoided. This provides a more user-friendly assembly which can be moved into the transport position with greater ease.

5

Furthermore, the lift arms in the transport position can be easily arranged to not obstruct the tractor lights thereby not interfering with their function.

10

The assembly may further comprise actuating means connected between the tractor frame and the inner section of each lift arm, the actuating means serving to lift and lower the lift arms. Advantageously, this leaves the outer part of each lift arm free to pivot sideways without any interference from the actuating means.

15

The actuating means preferably comprise a pair of hydraulic cylinders each connected to an inner section of a respective lift arm.

20

The inner sections of the respective lift arms may be provided by a common lift arm support structure which is pivotally mounted to the tractor frame. Advantageously, by providing a common support structure for the lift arms, the number of components required is reduced thus saving cost and assembly time.

25

In a preferred embodiment each joint comprises a jaw having upper and lower horizontal jaw members, and a vertical sleeve which is held in pivotal connection within the jaw by a vertical pin which is supported by the jaw members. Such an arrangement delivers freedom of movement for the outer sections to pivot sideways whilst maintaining sufficient strength for the lift arms to perform their function.

30

Preferably, the jaw is attached to the associated inner section and the vertical sleeve is attached to the inner end of the associated outer section.

35

In one example of a releasable locking mechanism each pin comprises a keyed section which is slidably engaged within a vertical slot formed in the associated sleeve. This forces the pin to rotate with the folding movement of the outer section. Furthermore the keyed section releasably engages with slots in the jaw members to lock the outer section in one of the transport and operating position. Therefore, the pin itself can be locked in position by engaging with a slot in the jaw members. Such engagement prevents movement of the associated outer section due to the mutual engagement with the pin.

The pin preferably further includes retaining means to prevent removal thereof from the jaw members. Furthermore, the pin may be provided with biasing means to bias the pin downwards into an engaged position. For example, the biasing means may comprise a coil spring which is held between the retaining means and the lower jaw member.

Further advantages of the invention will become apparent from the following description of a specific embodiment with reference to the appended drawings in which:-

- 10 Figure 1 is a perspective view of a front linkage assembly in accordance with the invention, the assembly mounted to a tractor chassis and shown together with the front axle with the wheels removed;
- 15 Figure 2 is a perspective view of the front linkage assembly of Figure 1 shown in isolation with both lift arms in the operating position;
- Figure 3 is a perspective view of the front linkage assembly of Figure 2 shown with the left hand lift arm in the transport position;
- 20 Figure 4 is a perspective view of the front linkage assembly of Figure 2 shown with both lift arms in the transport position, and
- Figure 5 is an enlarged view of the linkage assembly of Figure 2 showing the left hand lift arm in a partly exploded form so as to show the detail of the associated pivot pin.
- 25

Construction

With reference to Figure 1 a front linkage assembly, referenced generally at 10, is mounted to the chassis 12 of a tractor. It should be appreciated that Figure 1 shows only part of the front end of the tractor with only the chassis 12, front axle arrangement 14 and engine arrangement 16 for ease of understanding.

Referring now to Figures 2 to 4 the linkage assembly 10 comprises a left hand lift arm 21, a right hand lift arm 22 and a top link attachment point 23 for attachment of a top link 24 thereto. Each lift arm 21,22 is secured at an intermediate joint 25,26 to a lift arm support structure 28 which is pivotally attached to the chassis 12. The lift arm support structure 28

comprises a pair of longitudinally extending arms 29 which each provide an inner section for each respective lift arm 21,22 (Figure 3). Each inner lift arm section 29 is pivotally connected at its innermost end to the chassis 12 at pivoting connections 30 so as to allow lifting and lowering of the lift arms around a transverse axis X as shown in Figure 3. The inner sections 29 are connected together by a transverse tie bar 32 which increases the rigidity of the lift arm support structure 28.

A pair of hydraulic cylinders 34 are each connected between a fixing point 36, which is bolted to the tractor frame 12, and a respective inner section 29. As shown in Figure 3 each inner section 29 comprises an inner bar 29a and an outer bar 29b which are spaced apart so as to receive the lower end of the associated cylinder 34. For each lift arm a fixing bolt (not shown) is inserted through holes 29c in the inner section 29 and lower most end of the hydraulic cylinder 34 so as to provide a pivoting attachment. Appropriate control of pressurised fluids to the hydraulic cylinders controls lifting and lowering of the lift arms 21,22 in a similar manner to known front linkage systems.

The intermediate joints 25,26 are located at the forward end of each inner section 29. Each joint 25,26 comprises a jaw integrated with the associated inner lift arm section 29. Each jaw comprises an upper jaw member 38 and a lower jaw member 39, vertically spaced so as to receive the respective outer section of the lift arms 21,22 (see Figure 5). Each jaw is welded to the forward end of the associated inner lift arm section 29.

The innermost end of each outer section 21,22 comprises a vertical sleeve 40 which is held in pivotal connection within the associated jaw by a vertical pin 42 which is supported by the jaw members 38,39. Each vertical pin 42 is inserted through holes in each jaw member 38, 39 thereby securing the outer lift arm section 21,22 to the inner lift arm section 29.

In accordance with the invention each outer section 21,22 can pivot with respect to the associated inner section 29 around the vertical pin 42 provided at the intermediate joint 25,26. This sideways pivoting motion allows the lift arms 21,22 to be folded into a transport position so as to reduce the forward extension of the tractor's profile when on the road for example.

With particular reference to Figure 5 each joint 25,26 includes a releasable locking mechanism to lock the outer section 21,22 in position relative to the associated inner lift arm section 29 in both the transport and operating position. Each pin 42 comprises an integrated keyed section 43 disposed down one side of the pin shaft. The keyed section 43 engages with a corresponding vertical slot 44 formed in the associated sleeve 40 so that the pin 42 rotates

with the folding movement of the outer section 21. It will be understood that the right-hand intermediate joint 26 which is obscured in Figure 5 is of the same construction as that of joint 25.

5 The receiving holes for the pin 42 in the upper and lower horizontal jaw members 38,39 include a pair of slots 46a, 46b into which the keyed section 43 engages so as to lock the arms 21, 22 in the operating position or transport position respectively. The keyed section 43 is of a height which is less than the spacing between the upper and lower jaw members 38,39 so as to allow rotation of the outer section of the lift arm relative to the inner section. The pin 42
10 includes a handle 48 which allows the operator to lift the pin and disengage the keyed section 43 from the slot 46a,46b. A retaining nut 49 prevents the pin 42 from being fully removed from the jaw section whilst a coil spring 50 held between the retaining nut 49 and lower jaw member 39 biases the pin 42 downwards so as to prevent undesirable disengagement of the keyed section 43 from the slots 46a,46b when in use.

15

Operation

Starting from the operating position shown in Figure 2, the operator may lift the pin handle 48
20 so as to disengage the keyed section 43 from the operating position slot 46a in the lower jaw member 39. Whilst lifted the operator simply pushes the outer section of the left hand lift arm 21 in a sideways movement so as to fold the arm in to a transport position as shown in Figure 3. It will be appreciated that once the lift arm 21 is moved from the operating position the operator need not continue lifting the pin 48 as the keyed section 43 retains the pin in a lifted
25 position until the arm is rotated to the transport position wherein the coil spring 50 biases the pin downwards to engage with slot 46b. The same action can be repeated for the right hand arm 22 so as to reach the full transport position as shown in Figure 4.

In order to revert the lift arms 21,22 to the operating position the described process is simply
30 reversed and the operator can release the lift arms by simply lifting the respective pins 42 and unfolding the outer sections 21,22.

The invention allows an operator to move the arms to a transport position without the need to support the weight of the lift arms 21,22. Furthermore, as can be seen from Figure 4 for
35 example, the stowed lift arms 21,22 are disposed no higher than when in the operating position. This avoids any interference with the forward lighting which is typically disposed on the front end of the tractor.

Alternative Constructions

5 The lift arms 21,22 shown in the drawings taper outwardly to deliver the required spacing between the implement attachment hooks 52 so as to conform with the standardised categories used with agricultural implements. However it will be appreciated that the size and shape of the lift arms may differ from those shown without deviating from the scope of the invention.

10

The hydraulic cylinders 34 described above, and as shown in Figure 3 for example, are connected directly between the frame 12 and the lift arms. However, many alternative arrangements are envisaged in which the actuators may be connected indirectly between the frame and the lift arms, for example via pivoting joints and levers. Also, electric motors may
15 be employed in place of hydraulic rams.

It is envisaged that the intermediate joint which allows sideways folding of the lift arms may be constructed in a number of different ways whilst still allowing the lift arms to fold in accordance with the invention. For example, the aforementioned jaw may be provided on the
20 outer sections of the lift arms whilst the sleeve is provided on the inner sections. Alternatively, a hinge-style joint may include a plurality of vertically stacked jaw and sleeve elements.

From reading the present disclosure, other modification will be apparent to persons skilled in
25 the art. Such modifications may involve other features which are already known in the field of linkage assemblies and component parts thereof and which may be used instead of or in addition to features already described herein.

30

CLAIMS

1. A front linkage assembly for a tractor comprising a pair of lift arms each comprising an intermediate joint which provides a pivotal connection between an inner section, which is
5 pivotally attached to a tractor frame, and an outer section which can fold relative to the inner section around a substantially vertical axis between a forwardly extending operating position and a transversely extending transport position, each intermediate joint comprising a releasable locking mechanism to hold the arms in the operating position.
- 10 2. An assembly according to Claim 1, further comprising actuating means connected between the tractor frame and the inner section of each lift arm, the actuating means serving to lift and lower the lift arms.
3. An assembly according to Claim 2, wherein the actuating means comprises a pair of
15 hydraulic cylinders each connected to an inner section of a respective lift arm.
4. An assembly according to Claim 1, 2 or 3, comprising a lift arm support structure which is pivotally mounted to the tractor frame and forms both inner sections of the lift arms.
- 20 5. An assembly according to any preceding claim, wherein each joint comprises a jaw having upper and lower horizontal jaw members, and a vertical sleeve which is held in pivotal connection within the jaw by a vertical pin which is supported by the jaw members.
6. An assembly according to Claim 5, wherein the jaw is attached to the associated inner
25 section and the vertical sleeve is attached to the inner end of the associated outer section.
7. An assembly according to Claim 5 or 6, wherein each pin comprises a keyed section which is slidably engaged within a vertical slot formed in the associated sleeve, and wherein the keyed section releasably engages with slots in the jaw members to lock the outer section
30 in one of the transport position and operating position.
8. An assembly according to any one of Claims 5 to 7, wherein the pin includes retaining means to prevent removal of the pin from the jaw members.
- 35 9. An assembly according to Claim 8, wherein the pin is provided with biasing means to bias the pin downwards.

10. An assembly according to Claim 9, wherein the biasing means comprises a coil spring held between the retaining means and the lower jaw member.

11. A tractor comprising a front linkage assembly according to any preceding claim.

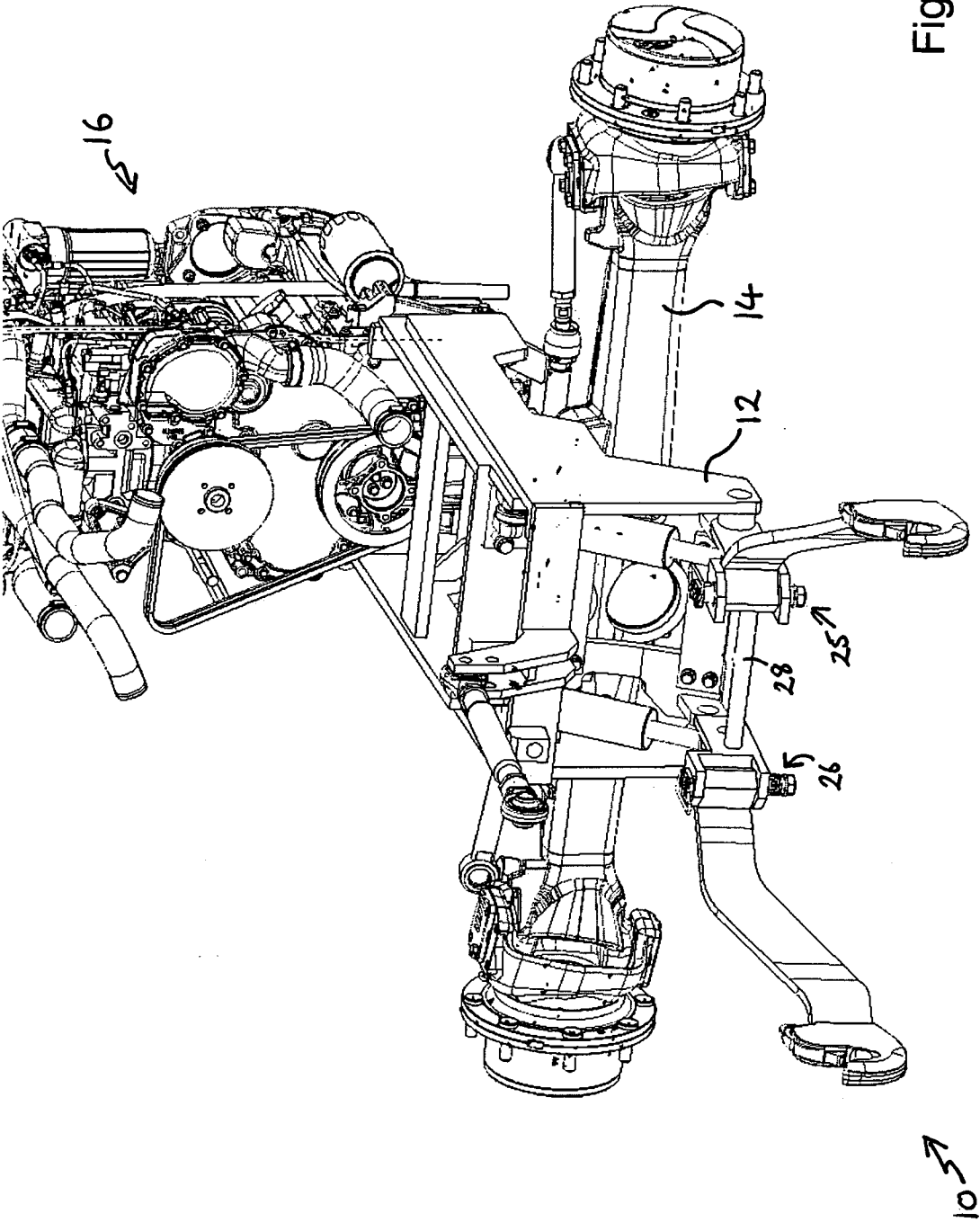
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12. A front linkage assembly for a tractor constructed and arranged substantially as hereinbefore described with reference to, and as shown in the accompanying Figures.

10

1/4

Fig. 1



2/4

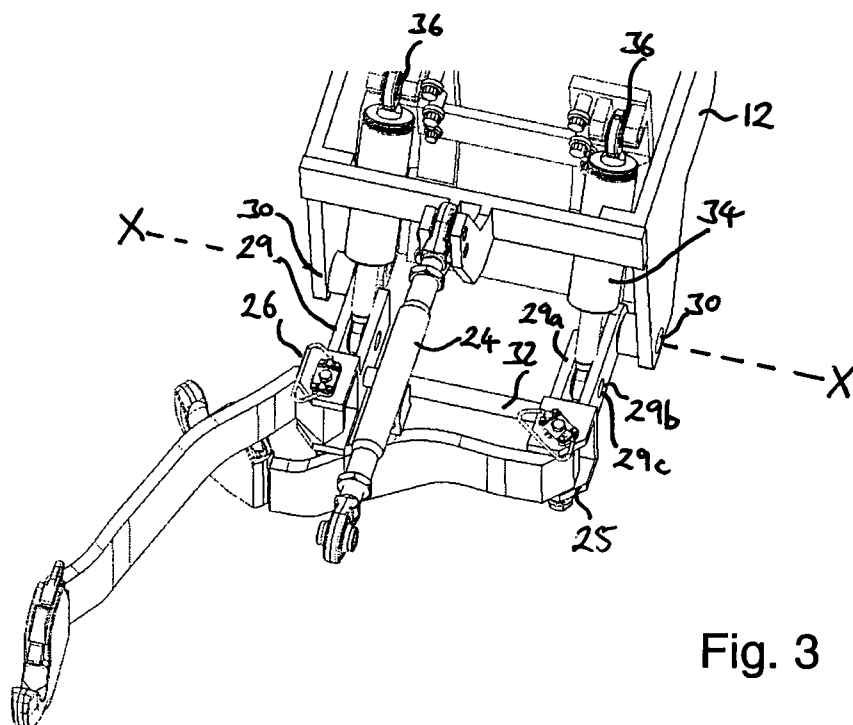
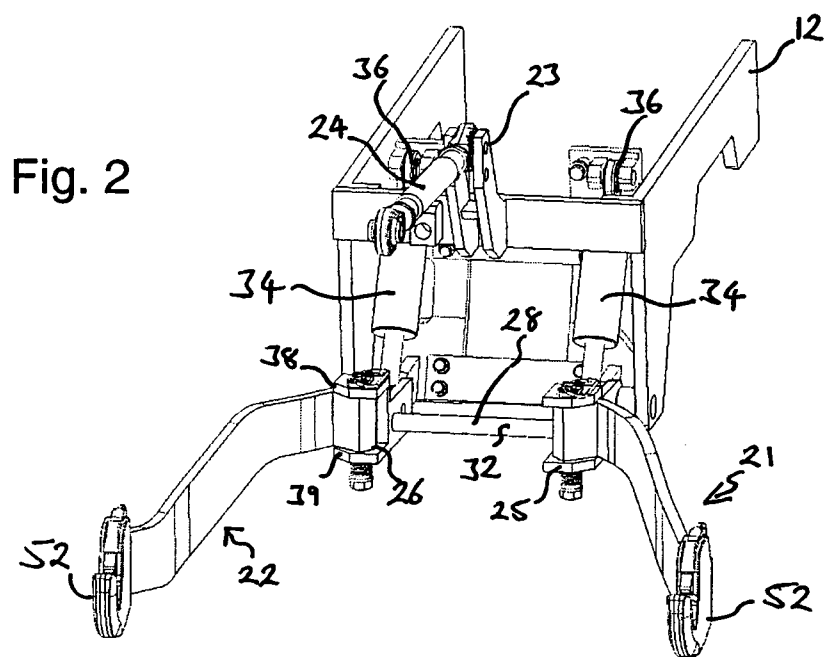


Fig. 3

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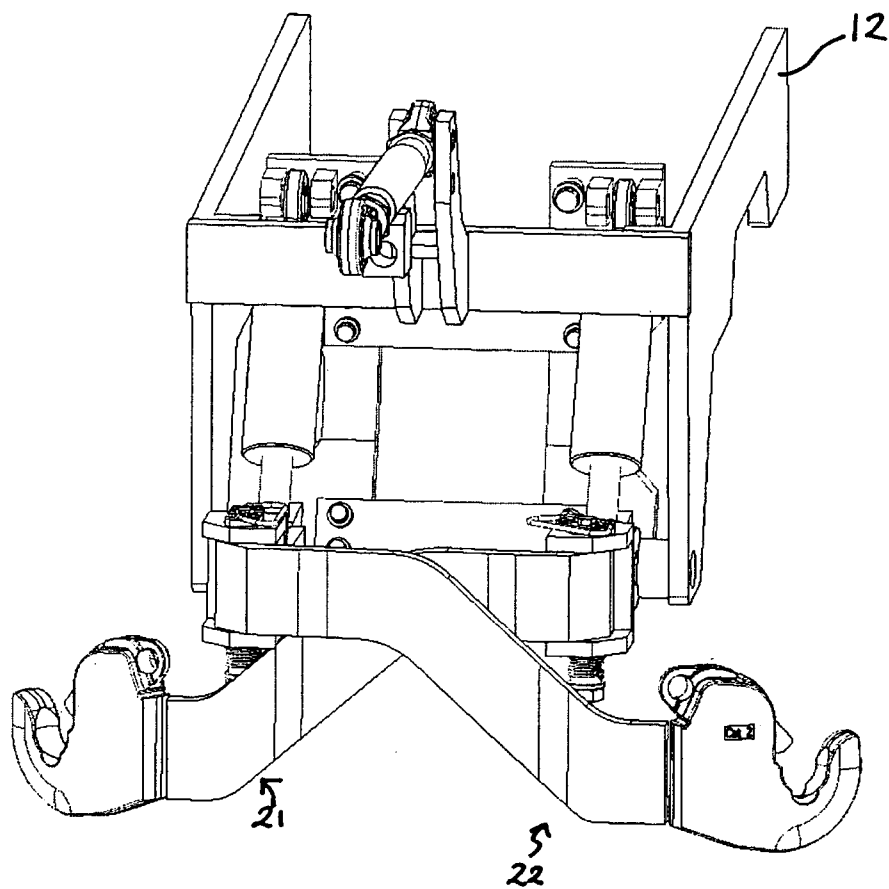


Fig. 4

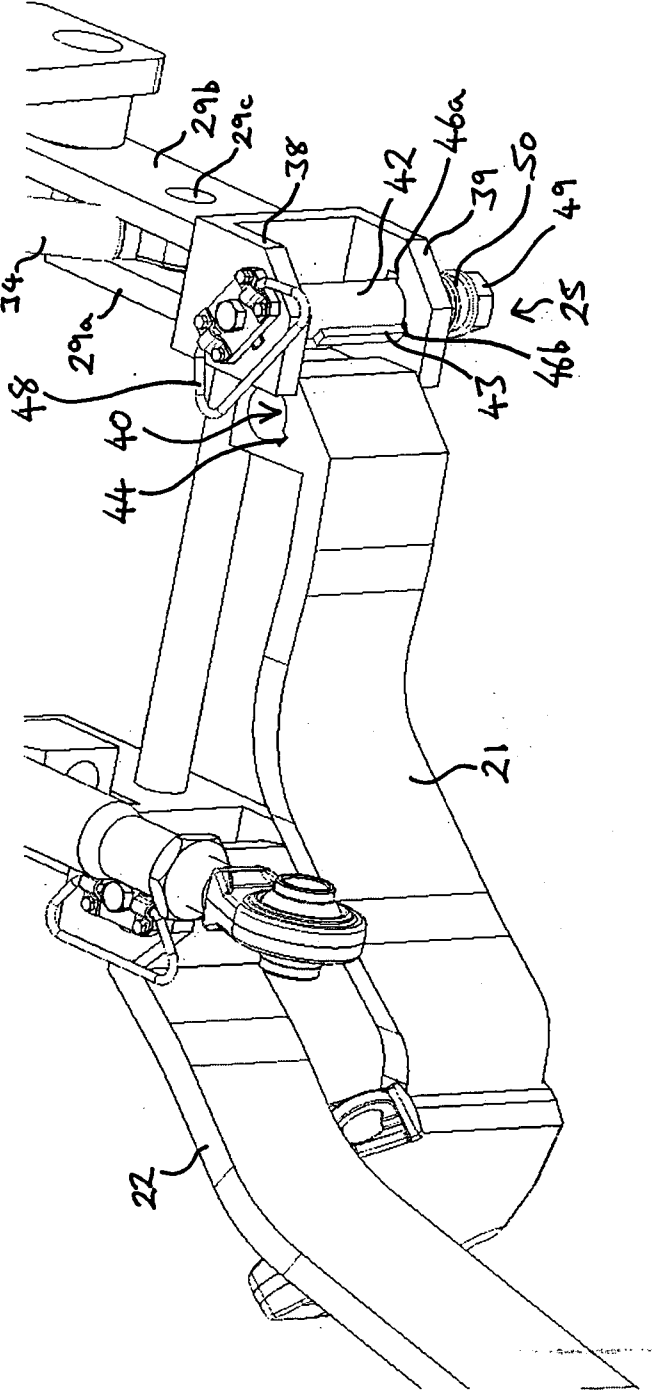


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2010/001130

A. CLASSIFICATION OF SUBJECT MATTER

INV. A01B59/06

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A01B B60D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 940 096 A (JOHNSON JERRY A [US]) 10 July 1990 (1990-07-10)	1-6,8-10
Y	the whole document	7
X	FR 2 789 846 A1 (ALTEC [FR]) 25 August 2000 (2000-08-25)	1-4,11
A	US 3 310 123 A (ABBOTT PAUL D) 21 March 1967 (1967-03-21)	1
Y	GB 2 330 514 A (DEFRANCO HUBERT [FR]) 28 April 1999 (1999-04-28)	7
A	US 4 062 560 A (MUELLER JR OTTO ET AL) 13 December 1977 (1977-12-13)	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

14 September 2010

Date of mailing of the international search report

07/10/2010

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2010/001130

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 12
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 12

The formulation of independent claim 12 does not comply with Rule 6.2 (a) PCT and is thus completely unclear (Article 6 PCT).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2010/001130

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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