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(54) SUPPORT FRAME FOR ADJUSTABLE BLADE ASSEMBLY

(57) A support frame (20) for supporting a blade (16) on a machine (10) is provided. The support frame (20) includes a lower frame section (22) including a first leg (26), a second leg (28) and a transverse portion (30) that extends between the first leg and the second leg. Each of the first and second legs has a respective end portion (32, 34) and the transverse portion (30) carries a lower connecting element (42) configured to connect to a blade. An upper frame section (24) includes a first leg (27), a second leg (29) and a transverse portion (31) that extends between the first leg and the second leg, each of the first and second legs having a respective end portion (33, 35). The end portions (32, 33) of the respective first legs (26, 27) of the lower frame section (22) and the upper frame section (24) are connected together and the respective transverse portions (30, 31) of the lower frame section (22) and the upper frame section (24) are spaced from each other.

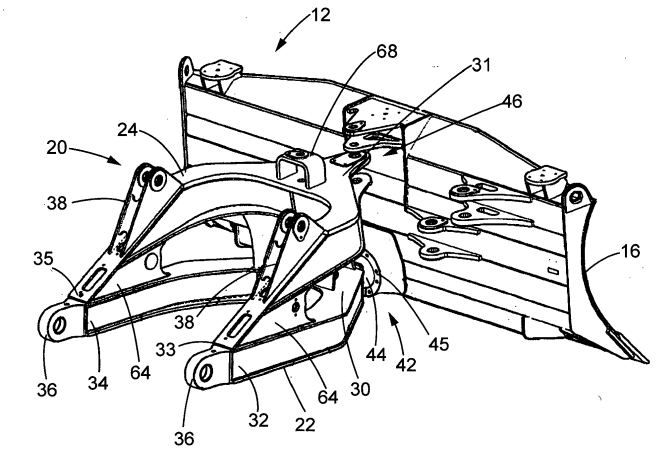

FIG. 2

EP 3 040 481 A1

Description

Technical Field

[0001] This disclosure relates generally to a blade assembly for a machine and, more particularly, to a support frame that is configured to support a blade assembly on a machine.

Background

[0002] Blade assemblies may be attached as a work implement to a variety of different types of machines used in the construction, mining and agricultural industries including, for example, wheeled and track-type tractors. Such blade assemblies may be used to perform a variety of tasks. For example, they may be designed for bulldozing a flat surface wherein the material is pushed in front of the tractor. In such arrangements, the blade may be supported such that the pitch, defined as the fore/aft relationship of the top of the blade with respect to the bottom thereof or as the angle of the cutting edge thereof with the ground, can be adjusted. In other arrangements, the blade may be supported such that the blade can be angled in one direction or the other (i.e., pivoting the end of the blade forwardly or rearwardly about the center portion of the blade) with respect to its travel path, thus, directing the materials to one side or the other of the travel path of the tractor. Furthermore, in many arrangements the blade may be supported such that it can be tilted, i.e. the raising or lowering of one end of the blade relative to the center of the blade. The blade may also be supported such that the entire blade can be raised and lowered.

[0003] An example of a support frame that supports such an adjustable blade assembly on a machine is disclosed in U.S. Patent No. 5,447,204 ("the '204 patent"). The support frame disclosed in the '204 patent can be relatively heavy and bulky in order to support the weight of the blade assembly and withstand the forces that are absorbed by the blade. As a result, the support frame may be relatively expensive. Moreover, the weight of the support frame may adversely affect the balance and performance of the machine.

Summary

[0004] In one aspect, the disclosure describes a support frame for adjustably supporting a blade on a machine. The support frame includes a lower frame section including a first leg, a second leg and a transverse portion that extends between the first leg and the second leg. Each of the first and second legs has a respective end portion and the transverse portion carries a lower connecting element configured to connect to a blade. An upper frame section includes a first leg, a second leg and a transverse portion that extends between the first leg and the second leg, each of the first and second legs having a respective end portion. The end portions of the respective first legs of the lower frame section and the upper frame section are connected together and the respective transverse portions of the lower frame section and the upper frame section are spaced from each other.

[0005] In another aspect, the disclosure describes a blade assembly for a machine. The blade assembly including a blade and a support frame for supporting the blade. The support frame includes a lower frame section including a first leg, a second leg and a transverse portion that extends between the first leg and the second leg. Each of the first and second legs has a respective end portion and the transverse portion carries a lower connecting element configured to connect to the blade. An upper frame section includes a first leg, a second leg and a transverse portion that extends between the first leg and the second leg, each of the first and second legs having a respective end portion. The end portions of the respective first legs of the lower frame section and the upper frame section are connected together and the respective transverse portions of the lower frame section and the upper frame section are spaced from each other.

[0006] In yet another aspect, the disclosure describes a machine including a chassis, a blade and a support frame for supporting the blade on the chassis. The support frame includes a lower frame section including a first leg, a second leg and a transverse portion that extends between the first leg and the second leg. Each of the first and second legs has a respective end portion and the transverse portion carries a lower connecting element configured to connect to the blade. An upper frame section includes a first leg, a second leg and a transverse portion that extends between the first leg and the second leg, each of the first and second legs having a respective end portion. The end portions of the respective first legs of the lower frame section and the upper frame section are connected together and the respective transverse portions of the lower frame section and the upper frame section are spaced from each other.

Brief Description of the Drawings

[0007]

FIG. 1 is an isometric view of a portion of an exemplary machine with an attached blade assembly according to the disclosure.

FIG. 2 is a top isometric view of the blade assembly of FIG. 1 with the cylinders removed.

FIG. 3 is a top isometric view of the support frame of the blade assembly of FIG. 1.

FIG. 4 is a side isometric view of the support frame of the blade assembly of FIG. 1.

FIG. 5 is a rear view of the support frame of the blade assembly of FIG. 1.

FIG. 6 is a top isometric view of the support frame of the blade assembly of FIG. 1 with portions of the support frame in phantom.

Detailed Description

[0008] This disclosure generally relates to a blade assembly for a machine and the support frame for supporting the blade assembly on the machine. Referring to FIG. 1, a portion of an exemplary machine 10 equipped with a blade assembly 12 is shown. In the embodiment illustrated in FIG. 1, the machine 10 is a tractor that includes a chassis 14 which may support various components associated with the machine. The chassis 14 may be supported on traction devices such as tracks or wheels that can propel the machine 10. The exemplary machine of FIG. 1 is configured to be supported on tracks, however, the tracks have been removed from the illustration in order to more clearly show the blade assembly 12.

[0009] The blade assembly 12 includes a blade 16 that may be adjustably supported on the machine 10 by a support frame 20. The blade 16 may have a curved front face with a cutting edge disposed along the bottom thereof. The front face of the blade 16 may be brought into engagement with material (e.g., dirt, rocks, sand, debris, etc.) so that the blade may push the material as the machine 10 is propelled along a surface. The support frame 20 may extend between the chassis 14 of the machine 10 and the blade 16 and be configured to support the blade 16 such that the orientation of the blade 16 relative to the chassis 14 may be adjusted as described in more detail below.

[0010] As shown in FIGS. 2 and 3, the support frame 20 may include a lower frame section 22 and an upper frame section 24 each of which has a U-shaped configuration in which the open side of the U faces towards the chassis 14 of the machine 10 (see FIG. 1). Each of the lower and upper frame sections 22, 24 may include respective first legs 26, 27 and respective second legs 28, 29 and a respective transverse portion 30, 31 that extends between the first and second legs 26, 28 as shown in FIG. 3. End portions 32, 33 of the respective first legs 26, 27 of the lower and upper frame sections 22, 24 may be connected together and end portions 34, 35 of the respective second legs 28, 29 of the lower and upper frame sections 22, 24 may be connected together. Moreover, the lower frame section 22 and the upper frame section 24 may be oriented relative to each other such that the lower frame section 22 and the upper frame section 24 extend away from each other so as to become spaced apart as the lower frame section 22 and the upper frame section 24 extend in a forward direction toward the blade and away from their respective end portions 32, 33, 34, 35. In this way, the lower frame section 22 and upper frame section 24 may define a jaws-like configuration when view from the side, such as in FIG. 4.

[0011] The end portions 32, 34 of the lower frame section 22 and the end portions 33, 35 of the upper frame section 24 may be configured for connection to the chassis 14 of the machine 10. More particularly, as shown in FIGS. 2 and 3, connecting flanges 36 may be provided at the end portions 32, 33, 34, 35 of the lower and upper frame sections 22, 24 that may pivotally connect to the chassis 14 of the machine 10 (see FIG. 1) such that the support frame 20 and the blade assembly 12 may be moved upward and downward between raised and lowered positions relative to the chassis 14. To this end, each of the legs 27, 29 of the upper frame section 24 may include a lift bracket 38 (see FIG. 2) to which a respective lift cylinder 40 may be pivotally connected (one of which can be seen in FIG. 1). Each lift cylinder 40 may extend between the respective lift bracket 38 and the chassis 14 of the machine 10 to which each lift cylinder may also be pivotally attached as shown in FIG. 1 such that extension and retraction of the lift cylinders 40 moves the support frame 20 and the blade 16 between the raised and lowered positions.

[0012] To connect the support frame 20 to the blade 16, the lower frame section 22 may be provided with an lower connecting element 42 and the upper frame section 24 may be provided with an upper connecting element 46. As shown in FIG. 3, the lower connecting element 42 may be provided on the transverse portion 30 of the lower frame section 22 and may be configured as a ball or trunnion 44 that may be received in a complementary receptacle 45 in a rear face of the blade 16 (see, e.g., FIG. 2). The upper connecting element 46 may be provided on the transverse portion 31 of the upper frame section 24 and may be configured with a pair of forwardly extending flanges 48. The connection of the upper connecting element 46 with the blade 16 will be described further below. It will be appreciated by those skilled in the art that the upper and lower connecting elements 42, 46 may have different configurations.

[0013] The upper connecting element 46 and the lower connecting element 42 may define front load points for the support frame 20. To provide support for these load points, each of the lower and upper frame sections 22, 24 may have a generally box-like construction. In particular the lower frame section may have an upper wall 50, lower wall 52, outer wall 54 and inner wall 56 and the upper frame section may have an upper wall 51, lower wall 53, outer wall 55 and inner wall 57 as best shown in FIGS. 3, 5 and 6. More particularly, as shown in FIG. 6, the inner wall 57 of the lower frame section 22 may run from the respective end portions 32, 34 straight to the front load point defined by the lower connecting element 42.

[0014] To provide further support for the blade assembly 12, the support frame 20 may include at least one brace that extends between the lower frame section 22 and the upper frame section 24. For example, the support frame 20 may include at least one front brace 58 that may extend between the upper wall 50 of the transverse portion 30 of the lower frame section 22 and the lower wall 53 of the transverse portion 31 of the upper frame section 24 as shown in FIG. 4. More particularly, the support frame 20 may include two front braces 58 as shown in FIG. 4 with each front brace 58 extending rearwardly and outwardly as it extends between the lower and upper

frame sections 22, 24. These front braces 58 may help transfer vertical loads on the blade 16 to the lift cylinders.

[0015] The support frame 20 may further include a rear brace 60 extending between the lower and upper frame sections 22, 24. As shown in FIG. 5, the rear brace 60 may connect the upper wall 50 of the transverse portion 30 of the lower frame section 22 and the lower wall 53 of the transverse portion 31 of the upper frame section 24. In the illustrated embodiment, the rear brace 60 is configured as a single plate that extends between the lower frame section 22 and the upper frame section 24. The rear brace 60 may help provide torsional rigidity to the support frame 20. As will be appreciated by those skilled in the art, the specific bracing shown in the illustrated embodiment is just one example of what may be used and, for example, additional or differently configured bracing may be provided.

[0016] The support frame 20 may further be configured to accommodate a pair of spaced apart angle cylinders 62 that may be used to adjust the angle of the blade 16. In particular, the support frame 20 may include angle mounting brackets 64 that extend between the lower and upper frame sections 22, 24 near where the end portions 32, 33, 34, 35 of the upper and lower frame sections 22, 24 are connected together as shown in FIG. 2. Each angle cylinder 62 may be pivotally attached to a respective one of the angle mounting brackets 64 and extend to the rear face of the blade 16 (one angle cylinder can be seen in FIG. 1). With this arrangement, the blade 16 may be pivoted about the trunnion 44 and receptacle 45 by extending one angle cylinder 62 of the pair of angle cylinders 62 while retracting the other angle cylinder 62 such that one end of the blade 16 is pivoted in the forward direction while the other end of the blade 16 is pivoted in the rearward direction thus angling the blade 16 relative to the direction of travel of the machine 10.

[0017] The support frame 24 may also be configured to accommodate a pitch link 66 that can be used to adjust the pitch of the blade 16. For example, the upper frame section 24 may include a pitch bracket 68 (shown in FIGS. 1 and 2) to which one end of the pitch link 66 (shown in FIG. 1) may be mounted. In this case, the pitch bracket 68 is arranged on the upper wall 50 of the transverse portion 30 of the upper frame section 24 (see FIG. 2). As shown in FIG. 1, the pitch link 66 may be arranged with one end attached to the pitch bracket 68 and the other end attached to the rear face of the blade 16 at a location above the upper connecting element 46 such that extension of the pitch link 66 causes the blade 16 to pivot about the trunnion 44 and receptacle 45 so as to allow for adjustment of the fore and aft relationship of the upper edge relative to the lower edge of the blade 16. In the illustrated embodiment, the pitch link may be configured as a turnbuckle the length of which may be manually adjusted in order to vary the pitch of the blade 16. Alternatively, a cylinder may be used that would allow for remotely actuated adjustment of the pitch of the blade

[0018] The support frame 20 may also be configured to receive a tilt cylinder 70. For example, as shown in FIG. 1, the upper connecting element 46 on the upper frame section 24 of the support frame 20 may support a pin that is configured to support the tilt cylinder 70 which extends from the upper connecting element 46 to the rear face of the blade 16. The tilt cylinder 70 may be oriented such that extension of the tilt cylinder 70 causes the blade 16 to pivot about the trunnion 44 and receptacle 45 such that one end portion of the blade 16 raises or tilts upward relative to the center of the blade 16.

Industrial Applicability

[0019] The blade assembly and associated support frame of the present disclosure may be applicable to any type of machine that may use a blade, for example, as a work implement. More specifically, the support frame may be used with blade assemblies that allow for multiple adjustments of the orientation of the blade relative to the chassis of the machine on which it is mounted. According to one example, the blade assembly including the support frame may be configured to allow for variable adjustment of the pitch, angle and/or tilt of the blade relative to the machine chassis.

[0020] As compared to single piece support frames, the support frame of the disclosure wherein the frame is split into separate lower and upper frame sections can allow for the use of less material in the construction of the support frame. Moreover, the support frame of the disclosure maintains the strength needed to operatively support the blade. For example, in the configuration illustrated in the drawings the inner walls of the lower and upper frame sections are primary load carrying members. Configuring the inner wall of the lower frame section such that it runs directly to the front load point defined by the lower connecting element may help effectively transfer loads on the blade from that front load point back to where the support frame connects to the machine chassis. As a result, the support frame may be lighter and less costly while maintaining performance. Reducing the weight of the support frame also can make operation of the blade assembly more efficient.

[0021] It will be appreciated that the foregoing description provides examples of the disclosed system and technique. All references to the disclosure or examples thereof are intended to reference the particular example being discussed at that point and are not intended to imply any limitation as to the scope of the disclosure more generally. All language of distinction and disparagement with respect to certain features is intended to indicate a lack of preference for those features, but not to exclude such from the scope of the disclosure entirely unless otherwise indicated.

[0022] Accordingly, this disclosure includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encom-

passed by the disclosure unless otherwise indicated herein or otherwise clearly contradicted by context.

Claims

1. A support frame (20) for supporting a blade (16) on a machine (10), the support frame (20) comprising:

   a lower frame section (22) including a first leg (26), a second leg (28) and a transverse portion (30) that extends between the first leg (26) and the second leg (28), each of the first and second legs having a respective end portion (32, 34) and the transverse portion (30) carrying a lower connecting element (42) configured to connect to a blade (16); and
   an upper frame section (24) including a first leg (27), a second leg (29) and a transverse portion (31) that extends between the first leg and the second leg, each of the first and second legs having a respective end portion (33, 35);
   wherein the end portions (32, 34) of the respective first legs (26, 27) of the lower frame section (22) and the upper frame section (24) are connected together and the respective transverse portions (30, 31) of the lower frame section (22) and the upper frame section (24) are spaced from each other.

2. The support frame (20) of claim 1 further including at least one brace (58, 60) extending between the transverse portion (30) of the lower frame section (22) and the transverse portion (31) of the upper frame section (24).

3. The support frame (20) of claim 1 wherein each of the lower frame section (22) and the upper frame section (24) have an upper wall (50, 51), a lower wall (52, 53), an outer wall (54, 55) and an inner wall (56, 57) and wherein the inner wall (56) of the lower frame section (22) runs from the end portions (32, 34) to the lower connecting element (42).

4. The support frame (20) of claim 3 further including a front brace (58) that extends between the upper wall (50) of the transverse portion (30) of the lower frame section (22) and the lower wall (53) of the transverse portion (31) of the upper frame section (24).

5. The support frame (20) of claim 4 further including a rear brace (60) that extends between the upper wall (50) of the transverse portion (30) of the lower frame section (22) and the lower wall (53) of the transverse portion (31) of the upper frame section (24).

6. The support frame (20) of claim 1 wherein the end portions (32, 33, 34, 35) of the upper and lower frame sections (22, 24) are configured for pivotal connection to a machine.

7. The support frame (20) of claim 1 wherein first and second legs (27, 29) of the upper frame section (24) each include a respective bracket (38) configured for connection to a lift cylinder (40).

8. The support frame (20) of claim 1 further including a first support bracket (64) extending between the lower frame section (22) and the upper frame section (24) near where the respective first legs (26, 27) of the lower and upper frame sections connect together and a second support bracket (64) extending between the lower frame section (22) and the upper frame section (24) near where the respective second legs (28, 29) of the lower and upper frame sections connect together, the first and second brackets (64) being configured for connection to a respective angle cylinder (62).

9. A blade assembly including a blade (16) and a support frame (20) for the blade according to any of the preceding claims.

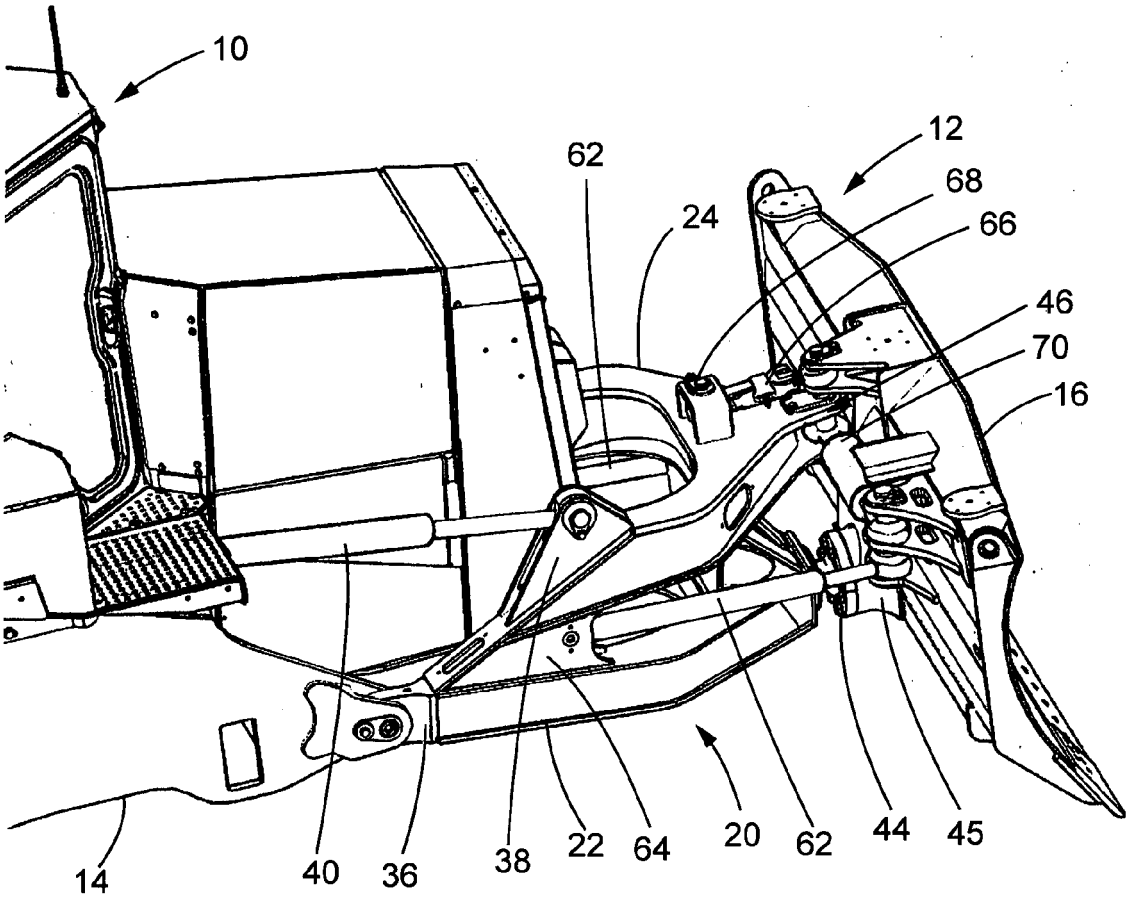

FIG. 1

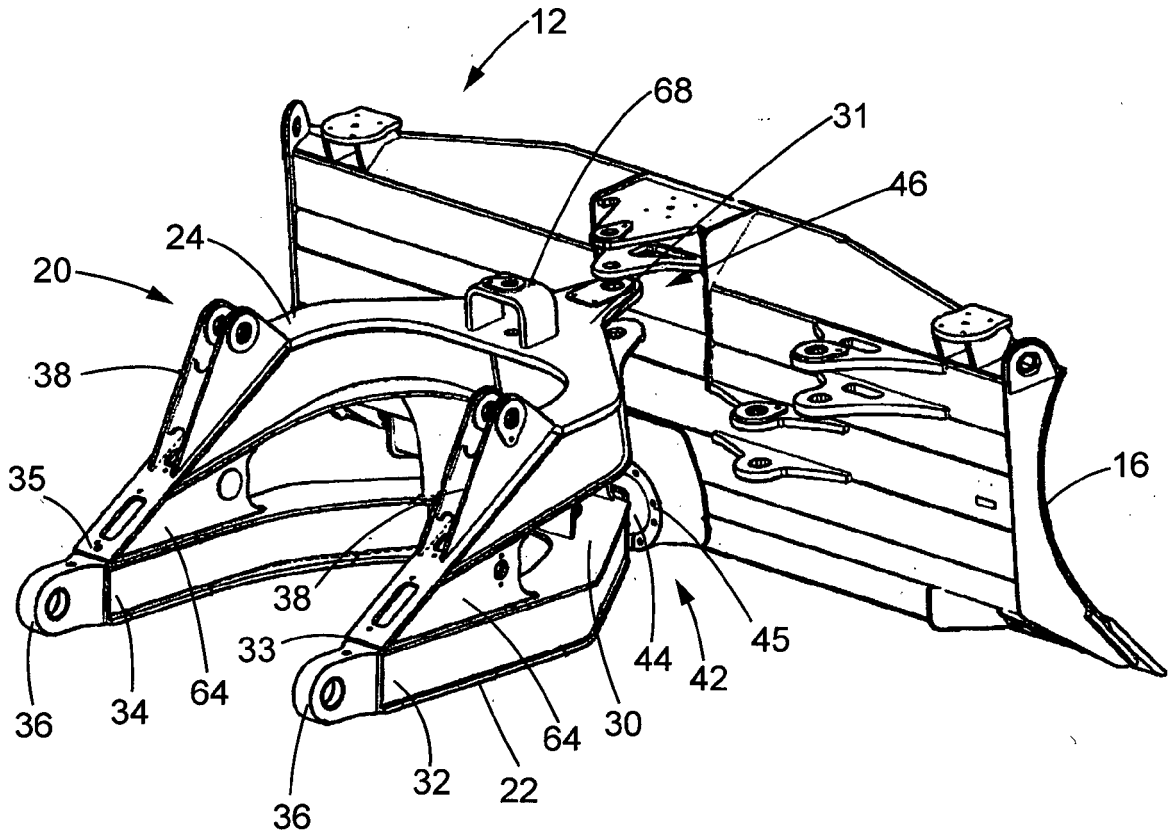

FIG. 2

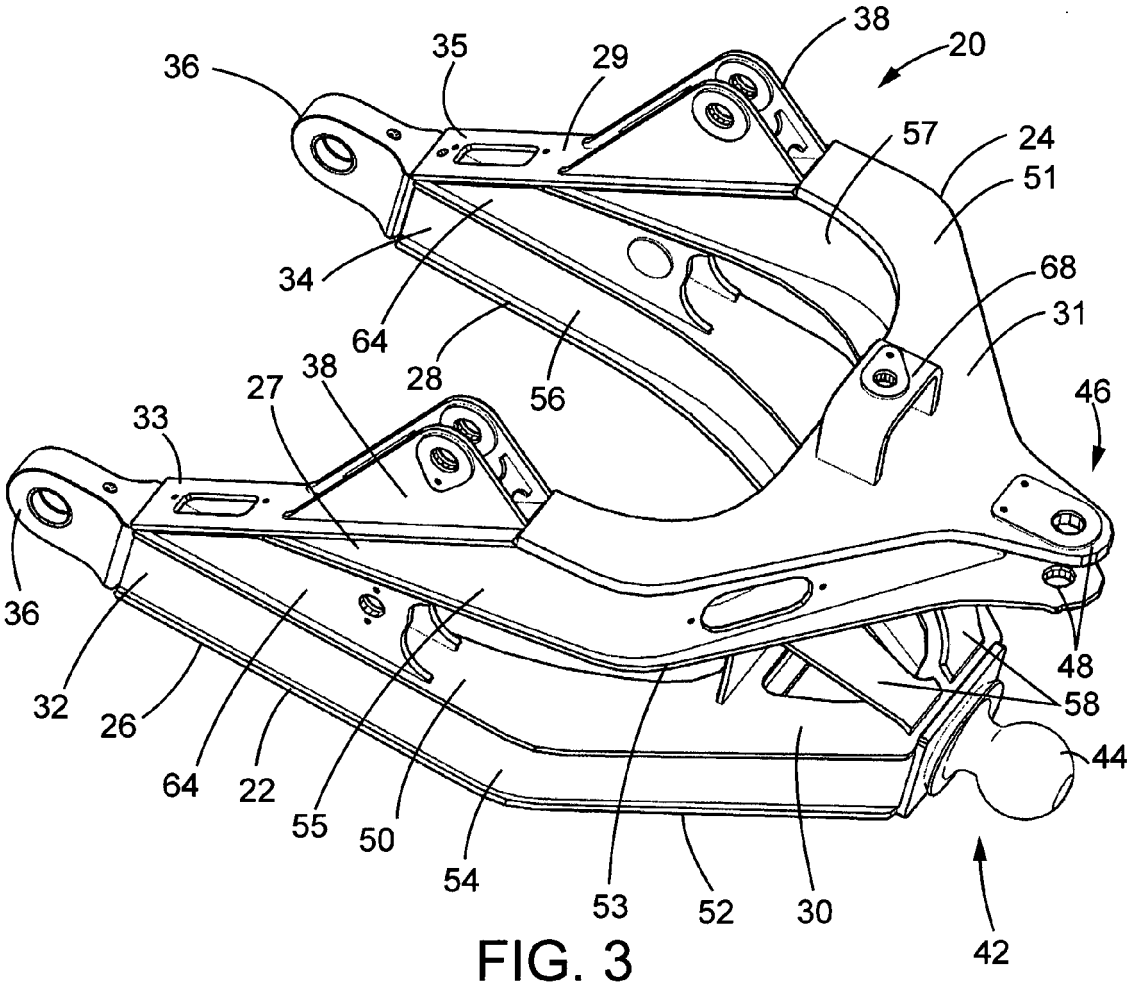
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FIG. 3

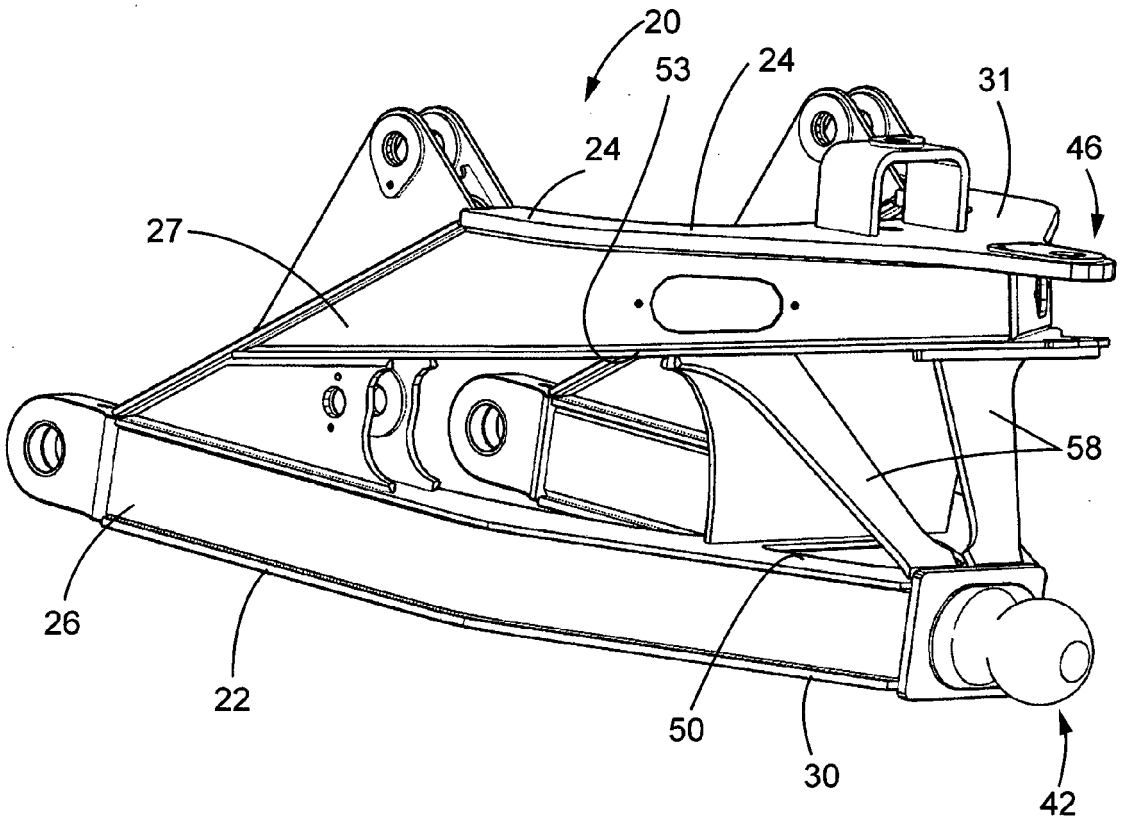

FIG. 4

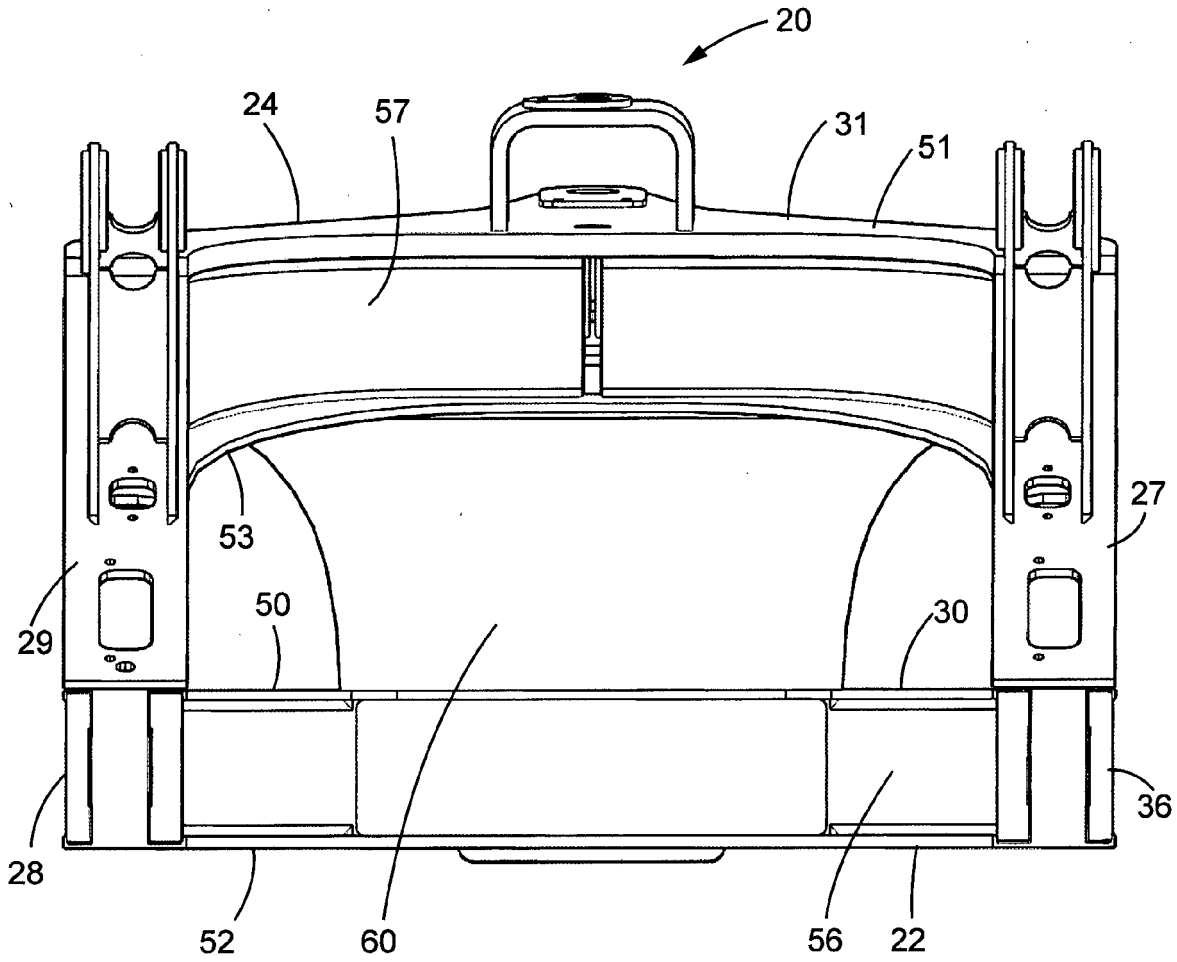

FIG. 5

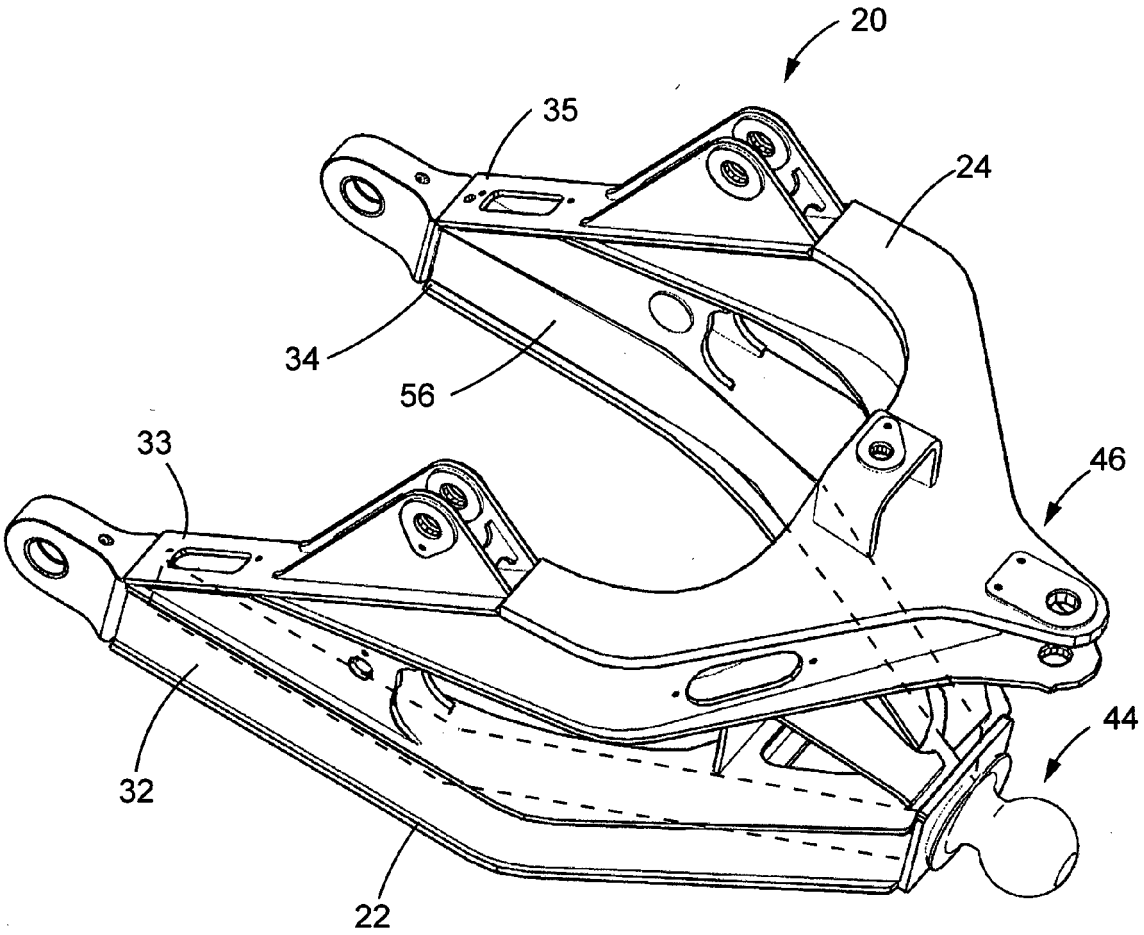

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 15 00 3484

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 111 882 A2 (SCHMIDT ALFRED ING GMBH [DE]) 27 June 1984 (1984-06-27) * abstract; figures 1-3 * * page 6 - page 10 *	1-5,7-9	INV. E02F3/76
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TECHNICAL FIELDS SEARCHED (IPC)

E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 April 2016	Ferrien, Yann

CATEGORY OF CITED DOCUMENTS

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22-04-2016

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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