

PATENT SPECIFICATION

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(54) VEHICLE FRAME

(71) We, CATERPILLAR TRACTOR CO., a corporation organized and existing under the laws of the State of California, United States of America, of 100 N.E. 5 Adams Street, Peoria, Illinois 61629, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be 10 particularly described in and by the following statement:-

This invention relates generally to a vehicle frame having a pair of arms, and more particularly to a frame for more effectively 15 transmitting forces from an implement through the arms thereof.

In general, crawler track vehicles or the like have a pair of parallel arms, a saddle extending between and connected to the 20 arms, and an equalizer bar pivotally mounted to the saddle. The ends of the equalizer bar are in turn seated on an opposite pair of vehicle undercarriages or track roller frames pivotally secured to the body 25 of the vehicle.

In the past, however, implements such as a C-frame mounted bulldozer blade have been pivotally mounted to the outside of such oscillating track roller frames because 30 of several problems that develop when any attempt is made to mount them on the inside thereof. For example, only a minimum of lateral clearance exists between the main frame arms and the track roller 35 frames so that for the most part previous inside mounted C-frames have been limited to those tractors having non-oscillating track roller frames. Unfortunately, there are many disadvantages to such fixed undercarriages including poorer vehicle maneuverability over irregular terrain and loss of traction under adverse surface conditions. 40

Another problem with inside mounted C-frames, is that they have been heretofore 45 connected to the main frame arms on outstanding pins in such a manner that they have imposed undesirable twisting loads and fatigue stresses on the main frame arms. Accordingly, these arms have been made 50 more rigid and costly in construction in

order to withstand the high forces of the bulldozer blade. Another disadvantage is that these heavier arms are often deeper in cross-section, which imposes servicing problems because certain components of the 55 tractor are then not conveniently accessible. Furthermore, these C-frames have been coupled to the main frames at elevationally low pivot axes so that there has been less ground clearance under the frames. 60

Therefore, it can be appreciated that it would be advantageous to provide a vehicle with a pivotal equalizer bar to allow the track roller frames to oscillate for better maneuverability and overall operation of 65 the tractor, and also an inside mounted implement that can more effectively distribute working forces into the main frame arms and can thereby overcome the problems associated with the prior art. Also, 70 inside mounting of the implement reduces the vehicle width to the width of the usual blade.

According to the present invention, a vehicle frame having a longitudinal axis comprises a pair of arms each having first, second, and third portions, the first portion extending substantially longitudinally of the frame in a first upright plane, the third portion extending substantially longitudinally 80 of the frame forwardly of the first portion in a second upright plane transversely offset from the first upright plane, and the second portion connecting the first and third portions; means defining an opening for a 85 transversely extending equalizer bar at the forward end of each first portion; and mounting joint means on the first portions of each of the arms forwardly of the openings for mounting an implement and transmitting forces from the implement to the 90 first portions substantially in the first upright plane.

Some examples of a vehicle frame constructed according to the invention are illustrated in the accompanying drawings, in which:- 95

Figure 1 is a diagrammatic perspective view of a vehicle frame;

Figure 2 is an enlarged diagrammatic side 100

24

elevation of part of the frame shown in Figure 1;

Figure 3 is a fragmentary and enlarged diagrammatic top plan view of the part shown in Figure 2;

Figure 4 is a fragmentary and diagrammatic side elevation similar to Figure 2, of a second example;

Figure 5 is a top plan view of the frame illustrated in Figure 4;

Figure 6 is a diagrammatic perspective view of a third example of a vehicle frame;

Figure 7 is a fragmentary and enlarged diagrammatic side elevation of part of the frame shown in Figure 6; and,

Figure 8 is a top plan view of the part shown in Figure 7.

Referring initially to Figure 1, there is shown a vehicle main frame 10 having a central longitudinal axis 12 parallel to the normal direction of travel of the vehicle. When viewing these figures the right hand side thereof will hereinafter be identified as the front or forward part thereof, and the left hand side will be referred to as the rear or rearward part.

The main frame 10 generally includes a transversely extending rear case or housing 14 having a pair of elongate and upright sidewalls 16, and a pair of contoured arms identified generally by the reference numeral 18 connected to the case in integrally forwardly extending relation from the sidewalls. Each of the arms has in generally serially connected order a first or rear portion 20, a second or central portion 22 and a third or front portion 24.

In this example, the first or rear portion 20 of each of the arms 18 is of compound construction consisting of an upright box beam 26 at the rear end thereof and a single upright plate 28 at the front end. The rear end of each box beam is interlockingly welded to the respective sidewall 16 along a generally encircling weld joint 30. Further, each box beam decreases in height in the forward direction and is provided with a first step 32 and a second step 34 at the upper edge thereof. As shown in more detail in FIGS. 2 and 3, a contoured upright anchor plate 36 is weldably and interlockingly secured to the top of each of the box beams along the first and second steps to provide a rigid mount for an upstanding mounting bracket 38. Each mounting bracket is bifurcated so that it straddles the anchor plate and is welded to it. The mounting brackets provide a lift pivot joint 40 at the upper front portions thereof including a transversely and horizontally oriented pivot pin 42.

As is best shown in FIG. 3, the rear portions 20 of the arms 18 extend longitudinally in a first upright plane 44 parallel to the central longitudinal axis 12 of the vehi-

cle. The rear box beam 26 and the front plate 28 are aligned on that plane, and the plate extends rearwardly and interlockingly into the box beam and is weldably connected thereto. An implement mounting 70 pivot joint 46 which is adapted to receive a transversely and horizontally oriented pivot pin 48 is disposed on the front end of each of the plates 28, and a relatively large transverse opening 50 is formed through the solid plates between the front and rear ends thereof. As will hereinafter be more completely explained, each opening 50 advantageously defines an upper bridging body portion 52 and a lower bridging body portion 54 as best shown in FIG. 2 to better transmit forces from the pivot joints 46 rearwardly into the rear portions of the arms.

Referring to FIG. 1, a transversely 85 extending hollow saddle 56 is shown which is formed by an inverted, U-shaped channel member. The saddle 56 extends interlockingly into or through the openings 50 in the opposite solid front plates 28, and is weldably secured thereto. A longitudinally oriented pivot joint identified generally by the reference numeral 58 is provided in the saddle substantially on the control plane through the axis 12 for pivotally mounting 95 an equalizer bar 60. Thus the centrally mounted equalizer bar is protected within the saddle and can oscillate in a generally upright transverse plane, with the opposite ends 62 thereof extending laterally outwardly through the openings 50.

The vehicle main frame 10 is supported rearwardly thereof by a laterally outwardly extending cylindrical support shaft 64 suitably connected to each of the arms 18. The main frame is supported forwardly thereof by the equalizer bar 60. A pair of similar, laterally spaced undercarriages such as conventional track roller frames, not shown, are connected to the respective support shafts 64 for pivotal movement in essentially vertical and longitudinally oriented planes. The ends 62 of the equalizer bar are supported on the oscillatable undercarriages in the usual manner. Reference is made to U.K. Patent Specification No. 1,443,897 for an understanding of such general type of support system.

Turning now to the instant construction of the third or front portion 24 of each of the arms 18, it is a single upstanding plate 66 having a substantially horizontal upper edge 68, a rearwardly depending and diverging lower front rolled edge 70 for strength, a rearwardly facing shoulder 72 which abuts the front of the saddle 56, and a horizontal lower rear edge 74 which abuts the top of the saddle. Each of the front plates is welded to the saddle and has a mounting platform 76 connected to the laterally inside

front surface thereof so that a transverse engine support bar 78 may be releasably connected to the opposite platforms. This bar thereby stabilizes the front ends of the arms: As representatively shown in FIG. 3, at least the distal or front end of each of the front plates 66 extends longitudinally in substantially a second upright plane 80 which is transversely offset from the first upright plane 44 of the rear portion 20 of the arms.

The second or central portion 22 of each of the arms 18 includes the laterally outward end of the saddle 56 and also a plurality of appropriately profiled plates 82 which are generally transversely oriented in construction for bridgingly interconnecting the respective rear portions 20 and the front portions 24 of the arms. It may therefore be appreciated that the central portions serve to connect the relatively heavier and deeper rear portions from the relatively lighter and shallower front portions while maintaining the laterally offset condition thereof.

With reference to FIG. 1, a front-mounted implement 84 is pivotally mounted on the pivot joints 46. Specifically, the implement includes a C-frame 86 mounted at its rearward ends on the pivot pins 48, and a pair of fluid operated linear actuators or telescoping lifting jacks 88. Each lifting jack is rearwardly connected to a respective one of the pivot pins 42 of the upstanding mounting brackets 38, and is longitudinally oriented and connected to a pivot pin 90 secured to a relatively larger upstanding mounting bracket 92 on each side of the C-frame. In this way the lifting jacks can maintain the C-frame in a generally forwardly extending horizontal working position, or can elevate or lower the front end of the C-frame about the axis of the pins 48.

Although it is not shown in the drawings for illustrative convenience, it is to be appreciated that a tool such as an earthmoving bulldozer blade is preferably connected to the front of the C-frame 86. Thus, in operation, heavy loads on the tool and the C-frame are generally transferred horizontally rearwardly through the pins 48, the front plate 28, and the rear box beam 26 to the case 14, and including the sidewalls 26. The forces produced by these loads are rearwardly directed to the front end of the rear portions 20 of the arms 18 in substantially load bypassing relation to the central portions 22 and front portions 24. This is extremely advantageous from the standpoint that only the rear portions of the arms need then be of a substantial cross section or of a construction having a maximum of structural integrity. Particularly, the front portions 24 of the arms can be of more lightweight and economical construction since the heavy loads of the implement are

not passing therethrough.

It is important to notice the substantial longitudinal alignment of both arms of the C-frame 86 and the respective lifting jacks 88 with the first upright planes 44 passing centrally through the rear portions 26 of the arms. As best shown in FIG. 3, the loads on the pins 48 are directed symmetrically rearwardly through the respective plates 28 and the box beams 26 substantially along the planes 44. Also, operating loads on the lifting jacks 88 are transmitted symmetrically rearwardly through the pins 42 and the mounting brackets 38 to the box beams substantially along the same planes. This construction minimizes the distortion resulting from prior art structures wherein C-frame and lifting jack loads were directed rearwardly to the arms via laterally offset joints secured to the arms.

Also the arms 18 are able to transmit loads rearwardly from the implement 84 through preselected upper and lower paths immediately adjacent the openings 50 for the pivoting equalizer bar 60. Particularly, as shown in FIG. 2, loads are communicated rearwardly through both the upper and lower bridging body portions 52 and 54 as respectively indicated by the load-indicating arrows A and B. This may be referred to as an "enclosed saddle" construction, as opposed to the prior art "open saddle" form of construction which has a downwardly opening recess in the main frame arms and therefor is constructed to transmit such high forces rearwardly only along the upper path A. As a result of the ability to transmit forces through both the upper and lower paths the cross sectional height of the arms in this area can be reduced. This presents not only certain economical advantages, but also a less restricted access path to components within the vehicle which may require servicing.

Referring to FIGS. 4 and 5, a second example is shown in which generally like parts carry like reference numeral. As in the first example, the rear portion 20 of each of the main frame arms 18 includes a rear box beam 26 and a front plate 28. The front plates 28 are solid in cross-section, as opposed to a hollow box section, since the large opening 50 through each one would weaken or unduly complicate the construction of the arms thereat if a hollow structure were utilized.

In this example the upper part of the box beam 26 is simplified and a lifting jack mounting bracket 94 of somewhat different shape is interlockingly insertably welded to the beam at the upper edge thereof. The front portion 24 has an upright main plate 96 of generally forwardly converging rectangular cross section and a channel 98 weldably secured to the inside surface

26

thereof for additional strength and rigidity. One or more plates 82 and the saddle 56 make up the central portion 22 of the arms and, substantially as herein before stated, the longitudinally extending front portion 24 is laterally inwardly offset a preselected distance D as indicated on FIG. 5 from the longitudinally extending rear portion 20 of the arms in order to allow the C-frame 86 to be alignably connected to the mounting pivot joints 46.

Referring next to FIGS. 6, 7 and 8, a third example is shown, wherein the rear portions 20 of the arms 18 are of forwardly converging solid rectangular cross section substantially throughout their length and are integral with the sidewalls 16 of the case 14. Moreover, each of the central portions 22 of the arms differs from the previously described examples in that a single lightweight and forwardly converging contoured plate 98 makes up a major portion thereof and is integral with the forward portion 24. Note is made that in this example each of the plates 98 has a rear part 100 with a large transverse opening 102 therethrough so that an annular fillet weld joint 104 can be used to secure the plates against the rear portions 20 as shown in FIGS. 6 and 7. A plurality of strengthening gusset or reinforcing plates 106 are welded to the plates 98, to the rear portions 20 of the arms, and to the saddle 56 to increase rigidly and to complete the structural integrity of this offset connection.

The third example differs in a major respect from the first two constructions described above in that the saddle 56 is of composite construction including a foreshortened and inverted U-shaped channel 107 and a pair of opposite casting members 108 symmetrically connected thereto by a pair of encircling weld joints 109. These three members jointly provide an inverted U-shaped channel or recess 110 for receiving the oscillatable equalizer bar 60. The undersides of a rear member parts of the rear portions 20 of the arms are contoured or stepped to interlockingly mate with the topside of the casting members and to permit a weld joint 112 of extended length to individually connect them to improve the structural integrity. The pivot joints 46 include a pair of parallel ears 114 formed in the front lower portion of each of the casting members, which joints support the C-frame 86 through the pivot pins 48 substantially in force transmitting alignment with the first upright plane 44 passing centrally and longitudinally through the rear portion 20. The lifting jacks 88 likewise are substantially alignably mounted for load transmission substantially along the same plane.

In operation, and as best illustrated in FIG. 7, rearward forces from the C-frame 86 are transmitted rearwardly through a

single major path in the connecting casting members 108 to each of the rear member parts of the rear portions 20 of the arms as indicated by the load indicating arrow identified by the letter C. This is achieved, as before, in loading bypassing relation to the front portions 24 of the arms so that they can desirably be made more lightweight in overall construction with the accompanying advantages thereof. While this example does not have the dual path load transmitting capability described previously, it has the advantage that the unified saddle and casting members may be directly lowered on or raised from the equalizer bar to provide a substantial assembly and disassembly advantage.

It should be understood that the rear portions 20 of the arms 18 can be modified to contain the downwardly facing recess 110, without utilizing the separate casting members 108, and the channel 107 laterally extended to pass within the recesses and to be directly weldably connected to the rear portions of the arms.

Thus, it is apparent that the vehicle main frame 10 of the present invention provides a construction better able to transmit forces from an implement rearwardly into the contoured arms thereof. Since the opposite arms of the C-frame of the implement are longitudinally aligned with only the major rear portions of the arms and transmit loads directly thereto, the minor front portions of the arms can be desirably reduced in size to effect economy in construction and greater accessibility to components within the vehicle for servicing purposes. Moreover, since the C-frame is substantially longitudinally aligned with the front end of the rear portions of the arms, rather than being mounted laterally offset therefrom, there is no longer a substantial problem in locating the pivoting undercarriages in juxtaposed relation to the arms.

WHAT WE CLAIM IS:—

1. A vehicle frame having a longitudinal axis, the frame comprising a pair of arms each having first, second, and third portions, the first portion extending substantially longitudinally of the frame in a first upright plane, the third portion extending substantially longitudinally of the frame forwardly of the first portion in a second upright plane transversely offset from the first upright plane, and the second portion connecting the first and third portions; means defining an opening for a transversely extending equaliser bar at the forward end of each first portion; and mounting joint means on the first portions of each of the arms forwardly of the openings for mounting an implement and transmitting forces from the implement to the first portions substantially in the first upright plane.

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thereof for additional strength and rigidity. One or more plates 82 and the saddle 56 make up the central portion 22 of the arms and, substantially as herein before stated, the longitudinally extending front portion 24 is laterally inwardly offset a preselected distance D as indicated on FIG. 5 from the longitudinally extending rear portion 20 of the arms in order to allow the C-frame 86 to be alignably connected to the mounting pivot joints 46.

Referring next to FIGS. 6, 7 and 8, a third example is shown, wherein the rear portions 20 of the arms 18 are of forwardly converging solid rectangular cross section substantially throughout their length and are integral with the sidewalls 16 of the case 14. Moreover, each of the central portions 22 of the arms differs from the previously described examples in that a single lightweight and forwardly converging contoured plate 98 makes up a major portion thereof and is integral with the forward portion 24. Note is made that in this example each of the plates 98 has a rear part 100 with a large transverse opening 102 therethrough so that an annular fillet weld joint 104 can be used to secure the plates against the rear portions 20 as shown in FIGS. 6 and 7. A plurality of strengthening gusset or reinforcing plates 106 are welded to the plates 98, to the rear portions 20 of the arms, and to the saddle 56 to increase rigidly and to complete the structural integrity of this offset connection.

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WHAT WE CLAIM IS:—

1. A vehicle frame having a longitudinal axis, the frame comprising a pair of arms each having first, second, and third portions, the first portion extending substantially longitudinally of the frame in a first upright plane, the third portion extending substantially longitudinally of the frame forwardly of the first portion in a second upright plane transversely offset from the first upright plane, and the second portion connecting the first and third portions; means defining an opening for a transversely extending equaliser bar at the forward end of each first portion; and mounting joint means on the first portions of each of the arms forwardly of the openings for mounting an implement and transmitting forces from the implement to the first portions substantially in the first upright plane.

2. A vehicle frame according to claim 1, wherein the front ends of the first portions of the arms are solid, the mounting joint means being located on the solid ends.
- 5 3. A vehicle frame according to claim 2, further including a transversely extending saddle connected between the solid ends of the first portions; and an equaliser bar pivoted within the saddle.
- 10 4. A frame according to claim 2 or claim 3, wherein the solid front end of each first portion is welded to the rear end of the first portion.
- 15 5. A vehicle frame according to any of claims 2 to 4, wherein the solid ends of the first portion define the transverse openings, and each opening is defined by upper and lower bridging body portions, the bridging body portions being arranged to transmit
- 20 forces from the implement to the rear of the first portions of the arms.
- 25 6. A vehicle frame according to any of claims 2 to 4, wherein each first portion comprises a front and a rear member connected together, each front member defining one of the openings therethrough, and the mounting joint means being provided on the front members forwardly of the openings.
- 30 7. A vehicle frame according to claim 6, wherein the front members each have a pair of ears substantially symmetrically aligned with the first planes of the arms, the implement being connected to the ears.
- 35 8. A vehicle frame according to any one of claims 4 to 7, when dependent on claim 3, wherein the saddle is formed by an inverted, U-shaped channel member extending between and into the openings, and is welded
- 40 to the solid ends of the arms.
9. A vehicle frame according to any one of claims 2 to 8, wherein the ends of the first portions of the arms have a box beam cross-section.
- 45 10. A vehicle frame according to any of the preceding claims, wherein the mounting joint means comprises a first pivot joint on each arm.
11. A vehicle frame according to claim 10, further including a second pivot joint on 50 each of the first portions of the arms, and wherein the implement includes a C-frame and a pair of fluid operated linear actuators connected between the C-frame and the second pivot joints for pivotally raising and 55 lowering the C-frame on the arms.
12. A vehicle frame according to any of the preceding claims, wherein the third portions of the arms have a solid cross-section.
13. A vehicle frame according to any of the preceding claims wherein the first and 60 third portions of the arms decrease in height in the forward direction.
14. A vehicle frame according to any of the preceding claims, wherein the second 65 portions of the arms include a plurality of plates connected to the first and third portions by a plurality of weld joints.
15. A vehicle frame according to any one of claims 1 to 13, wherein the second 70 and third portions of both of the arms are integrally formed from a single plate, each of the plates being welded to the first portion of the respective arms.
16. A vehicle frame according to any of 75 the preceding claims, wherein a case extends transversely to the longitudinal axis and connects the ends of the first portions of the arms remote from the mounting joint means.
- 80 17. A vehicle frame according to claim 1, substantially as described with reference to any one of the examples illustrated in the accompanying drawings.
18. A vehicle fitted with a frame con- 85 structed according to any of the preceding claims.

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