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(54) IMPROVEMENTS RELATING TO EARTHWORKING VEHICLES

(71) We, CATERPILLAR TRACTOR CO., a corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61602, 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 particularly described in and by the following statement:—

This invention relates to earthworking vehicles and in particular, to a method and means for mounting a ripper attachment on an earthworking vehicle.

The massive size and weight of modern earthworking vehicles require considerable design effort to be made to assure to optimum location of various vehicle component parts and assemblies. If such efforts are not fruitful, excessive forces and its associated implement create high stresses in tractor components which tend to cause premature failure of these components and of the associated mounting structure for such implement.

The usual approach to this problem is to increase the size of such components. However, this adds significantly to the total weight of the vehicle and renders more difficult the interchanging of vehicle attachments and their associated mounting structures.

Further, to facilitate manufacture and servicing of earthworking vehicles, component parts such as the rear-mounted transmission for crawler tractors described in our U.S. Patent No. 2,971,398 are now employed. Such components, however, present additional problems in that means must be provided to permit access to such components for servicing. Preferably, means are also provided for protecting such components from inadvertent damage during operation of the vehicle.

The usual practice in the industry is to bolt relatively large mounting brackets to the rear of earthworking vehicles upon which the required attachment is mounted. In large machines, attachments such as ripper assemblies are necessarily heavy and bulky and typically require crane or hoist facilities for removal of the ripper assemblies so that access to rear-mounted vehicle components may be had. Additionally, the removal of such large mounting brackets usually entails tedious and time-consuming removal of the associated securing bolts. As a result, the substitution of attachments which require different mounting brackets or the necessity of even minor servicing of the rear-mounted vehicle components can result in excessive down time due to the operations required to remove and reinstall the attachments.

It is, therefore, desirable to provide mounting means for mounting a ripper attachment on an earthworking vehicle which facilitate interchangeability of the ripper with other attachments such as a drawbar or push-block and which further facilitate access to rear-mounted vehicle components. It is also desirable that such mounting means function to alleviate customary stresses between the vehicle and the mounted attachment, provide protection for rear-mounted vehicle components, and afford a secure and convenient mounting structure which does not appreciably increase the total weight of the vehicle.

Viewed from one aspect, the invention provides an earthmoving vehicle having a frame and mounting means mounting a ripper attachment to the frame, said mounting means including a pair of laterally spaced-apart brackets each connected by a plurality of removable pins directly to said frame, said ripper attachment being pivotally connected to said brackets, whereby said ripper attachment and brackets may be pivoted away from a portion of the vehicle on

removal of all but one pair of said removable pins to give access to said vehicle portion.

Viewed from another aspect, the invention provides a method of mounting a hydraulically actuated ripper attachment to an earthmoving vehicle having a frame and having a pair of laterally spaced apart attachment mounting brackets each to be connected by means of a plurality of removable pins to said frame, said method including the sequential steps of:—

a) pivotally connecting said ripper attachment to said brackets;

b) pivotally connecting first portions of said brackets to said frame by means of first pivot pins;

c) hydraulically actuating said ripper attachment to cause rotation of said brackets about said first pivot pins; and

d) connecting second portions of said brackets to said frame by means of second pivot pins.

In the preferred embodiment, the mounting means includes a pair of laterally spaced parallel mounting brackets in combination with a cross-beam member disposed between the brackets to maintain lateral spacing between the brackets and provide a rigid mounting structure for the ripper attachment which absorbs side-loading. The mounting brackets each comprise a pair of parallel laterally spaced bracket plates which are straddle-mounted upon the vehicle frame to evenly and directly transfer attachment loads thereto and which include a plutality of apertures for receiving pins which removably secure the mounting brackets to the vehicle and which permit the pivotal displacement of the mounting brackets from their operating position to a position permitting access to the rear-mounted vehicle components. Pivotal displacement of the mounting brackets may be controlled by powered operation of the hydraulic mechanism associated with the ripper attachment. The mounting means further include means for protecting rear-mounted vehicle components such as a rear-mounted transmission.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is an elevation of an earthworking vehicle according to the invention showing the ripper attachment in its carry position;

Fig. 2 is a partial cutaway view of the vehicle of Fig. 1 illustrating in detail the mounting means and ripper attachment in its lowered position;

Fig. 3 is a rear sectional view of the vehicle and mounting means of Fig. 2 taken along the line III—III of Fig. 2;

Fig. 4 is a view similar to Fig. 2 illustrating the ripper attachment braced against the ground and the mounting means pivotally displaced from the operating position shown in Fig. 2; and

Fig. 5 is a perspective view of the mounting means.

With particular reference to Figs. 1—4, mounting means are shown generally at 10 in association with ripper attachment generally indicated at 11, and a crawler tractor 12. The tractor 12 may be of the type described in our Patent No. 1,422,558 and may include a pair of laterally spaced track assemblies, one of which is shown at 13, individually disposed on opposite sides of the tractor 12.

The tractor 12 includes an elongate main frame 14 of the type described in our Patent No. 1,443,897. The frame 14 includes a transversely extending final drive housing 17 disposed adjacent the rear end of the frame and housing cross-drive means (not shown) for driving the assemblies 13. The frame 14 further includes a pair of laterally spaced rearwardly extending upper mounting lugs 18 and a pair of laterally spaced, rearwardly extending lower mounting lugs 19.

A transmission 21 is mounted in rearwardly disposed relation to the final drive housing 17 and projects rearwardly therefrom beyond the upper mounting lugs 18 so that the transmission is accessible for servicing or removal.

The ripper attachment 11 generally includes a transversely extending ripper beam 22 having a plurality of sockets 23 therein for receiving a corresponding number of ripper shanks 24 which are adapted for ground-engagement to break up material for removal. The shanks 24 desirably each include a replaceable wear point 26. The ripper beam 22 further includes a forwardly extending ripper bracket 27 and an upwardly extending ripper bracket 28 which respectively pivotally receive the rearward end of a lower link 29 and an upper motor link 31. The lower link 29 includes a jack bracket 32 which pivotally supports the rearward end of a ripper lift jack 33 disposed in generally forwardly extending relation therefrom. The upper link 31 is advantageously of the extensible-retractable type such as described in our U.S. Patent No. 3,503,456, comprising a hydraulic motor jack which permits rotation of the ripper beam 22 about its pivotal connection to the lower link 29 for adjusting the angle of the shank 24 with respect to the ground.

As best shown in Figs. 3 and 5, the mounting means 10 comprises a pair of

laterally spaced mounting brackets 34, each of which includes a pair of laterally spaced bracket plates 36 and 37, secured together by a reinforcing member 38. The brackets 34 include first and second pin-receiving means comprising lower aligned mounting apertures 39 and upper aligned mounting apertures 41 for receiving pins which removably secure the brackets 34 to the lower mounting lugs 19 and the upper mounting lugs 18 on the frame 14. Third, fourth and fifth pin-receiving means are provided comprising upper aligned connecting apertures 42, lower aligned connecting apertures 43, and central aligned connecting apertures 44 for receiving pins which removably secure the ripper attachment 11 to the mounting means 10.

The spaced brackets 34 are interconnected by a lower cross-beam member and guard 46. The cross-beam 46 includes a front wall 47 and a pair of extending sidewalls 48 integrally connected to the front wall 47 by a pair of angled connecting portions 49. The front and side walls are integrally formed and connected respectively to the front and side edges of a lower bottom portion 51. The sidewalls 48 include a plurality of mounting holes adapted to receive a plurality of bolts 52 which are disposed in removable securing relation to the innter plates 37 of the brackets 34. This interconnection of the brackets 34 provides a rigid mounting structure for absorbing side loads as well as establishing and maintaining the lateral spacing between the brackets 34.

The mounting means 10 is secured to the tractor main frame 14 with the brackets 34 individually disposed in straddling relation to a respective set of the upper and lower mounting lugs 18 and 19. A pair of upper mounting pins 53 are disposed in retaining relation through the upper mounting apertures 41 and the mounting lugs 18 to removably secure the upper portion of the mounting means 10 to the main frame 14. A pair of retaining pins 54 are disposed in retaining relation through the lower mounting apertures 39 and the lower mounting lugs 19.

The mounting means 10 may be removably secured to the main frame 14 in relatively rigid load-transferring relation thereto for supporting the ripper attachment 11 relative to the tractor 12. This is accomplished by pivotally connecting the forward end of the lower link 29 to the mounting bracket 34 by inserting a pair of pins 56 through the lower connecting apertures 43 in each of the brackets and through a suitably aligned opening in the forward end of the lower link 29. The upper links 31 are pivotally connected to the mounting brackets 34 by inserting a pair of pins 57 through the upper connecting apertures 42 and a suitably aligned opening in the forward end of the upper link. The lift jack 33 is similarly connected to the brackets 34 by inserting a pin 58 through the central aligned connecting apertures 44 and a suitably aligned opening in the forward end of the lift jack 33.

In operation, the ripper 11 may be manipulated between a raised-carry position as illustrated in Fig. 1 and a lower operative position wherein the tip 26 engages the ground for breaking up the material to be worked. This is accomplished by actuating the jack 33 which is disposed between the generally parallel linkage formed by the lower and upper links 29 and 31, the mounting brackets 34 and the ripper beam 22 so that the extension of the jack 33 lowers the ripper 11 and retraction thereof raises the ripper to the carry position shown in Fig. 1.

Access to the transmission 21 or other rear mounted components may be readily provided with the improved mounting means 10 as follows. The operator of the tractor 12 first removes the shanks 24 in order to permit the ripper beam 22 to be lowered adjacent to the ground as illustrated in Fig. 2. A block such as that illustrated at 59 in Fig. 4 is then placed under the beam 22 to support the ripper attachment 11 during the servicing operation. Manipulation of the jack 33 relieves the load on the upper mounting pins 53 and allows removal of those pins from the associated mounting apertures 41 of the brackets 34 and the aligned holes in the upper mounting ears 18 of the main frame 14. The lift jack 33 is then again manipulated in a contracting direction as would normally be done for raising the ripper mechanism 11. Since the pins 53 have been removed, the contracting action of the jack 33 will rotate the mounting brackets 34 about their lower pivotal connections 54 to the lower mounting lugs 19. This action results in the ripper mounting means 10 being rotated downwardly to the position illustrated in Fig. 4 wherein the cross-beam member and guard 46 engage the work surface.

As shown in Fig. 4, this disposes the mounting means 10 in a position which permits convenient access to the transmission 21 or other rear-mounted components. Once servicing of the transmission 21 or other rear-mounted component is completed, the lift jack 33 is actuated to an extended position to lift the mounting brackets 34 back into the installed position illustrated in Figs. 1 and 2 to permit the reinstallation of the pins 53.

Once this is accomplished the ripper 11 is again secured to the main frame, and the shanks 24 may be reinstalled to place the ripper again in operative condition. If desired, somewhat limited access to the transmission is possible by unbolting and unpinning member 46 from brackets 34.

As shown in Figs. 1—3, with the mounting brackets 34 secured in supporting relation to the main frame 14, the cross beam 46 is disposed in underlying protective relation to the transmission 21 which substantially prevents rocks or other large objects unearthed by the forward movement of the ripper shank 24 during the ripping operation from contacting and damaging the transmission 21. The lower wall 51 of the cross-beam member 46 also provides a convenient mounting surface for ripper control valves 61, Fig. 5. The cross-beam 46 also affords protection by the front wall 47 and the sidewalls 48. This permits the ripper control valves 61 to be mounted adjacent to the lift jacks 33 and the extensible-retractable upper links 31 so as to minimize the length of the inter-communicating hydraulic lines. In this way, only a main supply line 62 and a return line 63 are required to extend between the control valves 61 and the body of the tractor 12. This convenient location of the control valves minimizes fluid communication problems and reduces the risk of damage to the hydraulic lines as well as reducing hydraulic flow losses between the control valves 61 and the ripper-actuating cylinders.

The mounting brackets may readily be replaced by those described in our copending application No. 26593/75 (Serial No. 1507499) (filed herewith) if it is desired to replace the ripper attachment with a drawbar or pushblock attachment.

It is apparent that the present invention provides ripper-mounting means which permit ready interchangeability of the ripper attachment with other rear-mounted attachments, and which further facilitate access to rear-mounted vehicle components. The described mounting means further provides a strong mounting structure without adding appreciably to total vehicle weight and further alleviates stresses customarily developed in the vehicle and its mounted attachment.

WHAT WE CLAIM IS:—

1. An earthmoving vehicle having a frame and mounting means mounting a ripper attachment to the frame, said mounting means including a pair of laterally spaced-apart brackets each connected by a plurality of removable pins directly to said frame, said ripper attachment being pivotally connected to said brackets, whereby said ripper attachment and brackets may be pivoted away from a portion of the vehicle on removal of all but one pair of said removable pins to give access to said vehicle portion.

2. A vehicle as claimed in claim 1 wherein each of said brackets comprises a pair of upstanding plates spaced apart from one another by a reinforcing member.

3. A vehicle as claimed in claim 2 wherein each pair of upstanding plates has aligned first apertures and aligned second apertures spaced apart from said first apertures, the frame including first lug portions having third apertures aligned with the first apertures and removable pins being disposed in said first and third apertures.

4. A vehicle as claimed in claim 3 wherein said frame includes second lug portions having fourth apertures aligned with said second apertures, removable pins being disposed in said second and fourth apertures.

5. A vehicle as claimed in claim 3 or 4 wherein said upstanding plates are substantially triangularly shaped with said first and second apertures being disposed at respective first and second apices thereof.

6. A vehicle as claimed in any of claims 2 to 5 wherein said upstanding plates include apertures for coacting with further apertures in said ripper attachment to selectively pin-connect said ripper attachment to said spaced-apart brackets.

7. A vehicle as claimed in any preceding claim wherein said mounting means further includes a cross beam laterally disposed between said pair of laterally spaced-apart brackets and secured to both of said pair of brackets for structural support thereof.

8. A vehicle as claimed in claim 7 wherein said cross beam includes a bottom plate extending laterally across from one said brackets to the other said brackets for protecting the underportion of said vehicle from impact damage.

9. A vehicle as claimed in claim 7 or 8 wherein said cross beam is removably bolted to said brackets.

10. A vehicle as claimed in any preceding claim wherein said ripper attachment includes ripper shank-holding means for removably supporting a ripper shank, said ripper shank being adapted to carry a ripper tip member.

11. A vehicle as claimed in claim 10 wherein said ripper attachment further includes a plurality of hydraulic jack means connected between said shank-holding means and said pair of brackets for selectively changing the orientation of said shank-holding means with respect to said brackets and with respect to said vehicle.

Once this is accomplished the ripper 11 is again secured to the main frame, and the shanks 24 may be reinstalled to place the ripper again in operative condition. If desired, somewhat limited access to the transmission is possible by unbolting and unpinning member 46 from brackets 34.

As shown in Figs. 1—3, with the mounting brackets 34 secured in supporting relation to the main frame 14, the cross beam 46 is disposed in underlying protective relation to the transmission 21 which substantially prevents rocks or other large objects unearthed by the forward movement of the ripper shank 24 during the ripping operation from contacting and damaging the transmission 21. The lower wall 51 of the cross-beam member 46 also provides a convenient mounting surface for ripper control valves 61, Fig. 5. The cross-beam 46 also affords protection by the front wall 47 and the sidewalls 48. This permits the ripper control valves 61 to be mounted adjacent to the lift jacks 33 and the extensible-retractable upper links 31 so as to minimize the length of the inter-communicating hydraulic lines. In this way, only a main supply line 62 and a return line 63 are required to extend between the control valves 61 and the body of the tractor 12. This convenient location of the control valves minimizes fluid communication problems and reduces the risk of damage to the hydraulic lines as well as reducing hydraulic flow losses between the control valves 61 and the ripper-actuating cylinders.

The mounting brackets may readily be replaced by those described in our copending application No. 26593/75 (Serial No. 1507499) (filed herewith) if it is desired to replace the ripper attachment with a drawbar or pushblock attachment.

It is apparent that the present invention provides ripper-mounting means which permit ready interchangeability of the ripper attachment with other rear-mounted attachments, and which further facilitate access to rear-mounted vehicle components. The described mounting means further provides a strong mounting structure without adding appreciably to total vehicle weight and further alleviates stresses customarily developed in the vehicle and its mounted attachment.

WHAT WE CLAIM IS:—

1. An earthmoving vehicle having a frame and mounting means mounting a ripper attachment to the frame, said mounting means including a pair of laterally spaced-apart brackets each connected by a plurality of removable pins directly to said frame, said ripper attachment being pivotally connected to said brackets, whereby said ripper attachment and brackets may be pivoted away from a portion of the vehicle on removal of all but one pair of said removable pins to give access to said vehicle portion.

2. A vehicle as claimed in claim 1 wherein each of said brackets comprises a pair of upstanding plates spaced apart from one another by a reinforcing member.

3. A vehicle as claimed in claim 2 wherein each pair of upstanding plates has aligned first apertures and aligned second apertures spaced apart from said first apertures, the frame including first lug portions having third apertures aligned with the first apertures and removable pins being disposed in said first and third apertures.

4. A vehicle as claimed in claim 3 wherein said frame includes second lug portions having fourth apertures aligned with said second apertures, removable pins being disposed in said second and fourth apertures.

5. A vehicle as claimed in claim 3 or 4 wherein said upstanding plates are substantially triangularly shaped with said first and second apertures being disposed at respective first and second apices thereof.

6. A vehicle as claimed in any of claims 2 to 5 wherein said upstanding plates include apertures for coacting with further apertures in said ripper attachment to selectively pin-connect said ripper attachment to said spaced-apart brackets.

7. A vehicle as claimed in any preceding claim wherein said mounting means further includes a cross beam laterally disposed between said pair of laterally spaced-apart brackets and secured to both of said pair of brackets for structural support thereof.

8. A vehicle as claimed in claim 7 wherein said cross beam includes a bottom plate extending laterally across from one said brackets to the other said brackets for protecting the underportion of said vehicle from impact damage.

9. A vehicle as claimed in claim 7 or 8 wherein said cross beam is removably bolted to said brackets.

10. A vehicle as claimed in any preceding claim wherein said ripper attachment includes ripper shank-holding means for removably supporting a ripper shank, said ripper shank being adapted to carry a ripper tip member.

11. A vehicle as claimed in claim 10 wherein said ripper attachment further includes a plurality of hydraulic jack means connected between said shank-holding means and said pair of brackets for selectively changing the orientation of said shank-holding means with respect to said brackets and with respect to said vehicle.

12. A vehicle as claimed in claims 2 and 11 wherein said ripper attachment further includes a pair of longitudinally extending support beams pivotally connected to said shank-holding means and straddlingly connected between said upstanding plates of said brackets.

13. A vehicle substantially as hereinbefore described with reference to the accompanying drawings.

14. A method of mounting a hydraulically actuated ripper attachment to an earthmoving vehicle having a frame and having a pair of laterally spaced-apart attachment mounting brackets each to be connected by means of a plurality of removable pins to said frame, said method including the sequential steps of:

a) pivotally connecting said ripper attachment to said brackets;

b) pivotally connecting first portions of said brackets to said frame by means of first pivot pins;

c) hydraulically actuating said ripper attachment to cause rotation of said brackets about said first pivot pins; and

d) connecting second portion of said brackets to said frame by means of second pivot pins.

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