

VEHICLE BODY FOR REACH TYPE FORKLIFT TRUCKS

FIELD OF THE INVENTION

The present invention relates generally to a reach type forklift truck whose mast assembly is movable back and forth relative to a vehicle body and, more specifically, to an improved vehicle body for forklift trucks to which a mast assembly, an overhead guard and wheels are mounted.

DESCRIPTION OF THE PRIOR ART

Forklift trucks have been used either to lift objects of relatively heavy weight up to an elevated location or to move the objects from one place to another within a limited working site. Depending on the power sources employed, the forklift trucks are classified into an engine-driven forklift truck which may usually operate in the outdoor area and an electromotive forklift truck which are suitable for indoor operation, thanks to its reduced or little emission of exhaust gas and noise. Another method of classifying the forklift trucks depends on the mobility of mast assembly with respect to a vehicle body: a standard forklift truck whose mast assembly remains fixedly attached to the front end of the vehicle body; and a reach type forklift truck whose mast assembly is movable back and forth along reach legs with respect to the vehicle body. The standard truck is typically equipped with an internal combustion engine, while the reach type truck is provided with an electric motor and a battery feeding electricity to the motor, in which sense the latter is frequently referred to as an electromotive reach type forklift truck.

The prior art electromotive reach type truck includes a vehicle body and an overhead guard mounted on the top of the vehicle body to protect the operator from any falling objects. Extending forwards from the frontal lower edge of vehicle body are a pair of spaced-apart, parallel reach legs, each of which has a load wheel at its distal end. A drive wheel and a caster wheel are mounted to the vehicle body by way of a suspension so as to support the weight of the forklift truck on the ground in cooperation with the respective load wheel. The vehicle body is further provided with a drive unit compartment and an operator's room both arranged side to side at the rear section thereof, and with a fluid pressure control compartment and a battery storage room disposed one above the other at the front section thereof.

Welded to the respective inboard surface of the reach legs are a pair of mutually confronting rails each having a guide groove extending along the full length of the corresponding reach leg. A mast assembly, which serves to lift objects, is mounted between the rails for back and forth sliding movement, viz, reach operation, relative to the vehicle body. The reach operation of the mast assembly may be effected through the use of a reach cylinder, one end of which is secured to the vehicle body and the other end of which is affixed to the mast assembly.

Examples of the conventional mast assembly include a two stage mast assembly and a three stage mast assembly that can lift objects up to a higher elevation than the two stage mast assembly would do. The two stage mast assembly consists of an outer mast, an inner mast telescopically fitted

to the outer mast for elevational movement therealong and a carriage assembly slidable along the inner mast together with the objects loaded thereon. The elevational movement of the inner mast may be brought about by means of a lift cylinder. The inner mast carries a couple of sheaves rotatably attached to the top portion thereof. Trained over or wound around the respective sheave is a chain anchored at one end to the inner mast and secured at the other end to the carriage assembly such that the elevational movement of the inner mast may cause the carriage assembly to slide along the inner mast.

On the contrary, the three stage mast assembly includes an outer mast, an intermediate mast telescopically fitted to the outer mast for elevational movement therealong, an inner mast similarly fitted to the intermediate mast for elevational movement therealong and a carriage assembly slidable along the inner mast together with the objects to be lifted. A lift cylinder is used to cause elevational movement of the intermediate mast relative to the outer mast. The intermediate mast carries at its top portion a couple of sheaves around which chains are wound with their rear ends anchored to the outer mast and their front end secured to the bottom of the inner mast. This will make sure that the elevational movement of the intermediate mast results in the like movement of the inner mast along the intermediate mast. The sliding movement of the carriage assembly along the inner mast may be provoked by a carriage cylinder fixedly mounted to the inner mast.

According to the prior art forklift trucks as referred to above, need

exists to mount a drive wheel and a caster wheel between the center plate and the rear frame of the vehicle body by use of a suspension. Since the typical suspension is a combination of links and springs, a specially designed suspension mount should be employed to mount the suspension onto the vehicle body. The prior art suspension mount hitherto in use, however, consists of several independent components of different configuration each welded to the vehicle body one by one. This would require time-consuming and laborious welding works and make it difficult to attach the respective component to a precise and exact position.

Furthermore, with the prior art forklift trucks noted hereinabove, the rails are blocked off at their rear ends by virtue of a center plate. Thus the mast base cannot be retracted past the center plate when the mast assembly is subject to back and forth movement, i.e., reach operation, which would shorten the overall stroke of the mast assembly. In addition to the above, the conventional forklift trucks has further drawbacks in that the rails are susceptible of flexural deformation in case of heavy load being applied thereto and in that the strength of supporting the overhead guard is relatively weak.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the invention to provide a vehicle body for reach type forklift trucks that can substantially eliminate the deficiencies pointed out above and further that enjoys not only an increased strength and a prolonged stroke of a mast assembly but also an enhanced convenience in mounting a suspension to the vehicle body.

With this object in view, the invention provides a vehicle body for reach type forklift trucks adapted to slidably support a mast assembly at its front side and to detachably carry a drive wheel side suspension link and a caster wheel side suspension link at its rear side. The vehicle body comprises a center plate, side frames, a rear frame, a pair of parallel reach legs extending forwards from the lower frontal edge of the center plate and a pair of guide rails secured to the reach legs for guiding the sliding movement of the mast assembly. A unitary suspension mount is provided between the center plate and the rear frame to support the respective suspension links. The suspension mount includes first and second brackets respectively attached to the center plate and the rear frame, spacer means for interconnecting the first and second brackets, and a link ledge disposed between the first and second brackets for supporting the drive wheel side suspension link.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features, advantages of the invention will become apparent from a review of the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing the vehicle body of a reach type forklift truck in accordance with the invention;

Fig. 2 is a partially cut-away side elevational view of the reach type forklift truck incorporating the vehicle body according to the invention;

Fig. 3 is a top sectional view of the vehicle body shown in Fig. 1, with

portions thereof removed for simplification;

Fig. 4 shows a suspension mount welded to and disposed between the center plate and the rear frame; and

Fig. 5 is an exemplary view of a multi-link suspension mounted to the vehicle body by means of the suspension mount illustrated in Fig. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to Fig. 1, it will be appreciated that a vehicle body 10 for reach type forklift trucks of the invention includes a center plate 12 extending across the vehicle body 10 and side frames 14 welded to the opposite lateral edges of the center plate 12. Each of the side frames 14 has an inclined front end to which elongate cross bars 16 are secured one above the other. Attached to the rear ends of the side frames 14 is a rear frame 18 which has a cutout 18a providing access to an operator's compartment.

An upwardly open, box-shaped beam bracket 20 is mounted to the inner surface of the respective side frame 18 to support the beam 22a of an overhead guard 22. The beam bracket 20 of such geometry can bear the overhead guard 22 with an increased strength and maintains structural integrity even when an object of heavy weight falls down on the overhead guard 22. Such is not the case in the prior art vehicle body in which an overhead guard would be simply affixed to the respective side frame by bolts and nuts.

In addition, the vehicle body 10 is provided with a pair of reach legs 24 extending forwards from the lower frontal edge of the center plate 12, a

pair of guide rails 26 welded to the inboard surfaces of the reach legs 24 in a confronting relationship with each other and a reinforcing bottom plate 27 interconnecting the guide rails 26.

As clearly shown in Fig. 2, a mast assembly 28 is mounted to the guide rails 26 for back and forth sliding movement by virtue of a reach cylinder 30. The mast assembly 28 has a mast base 28a extending in parallel with the guide rails 26 and an object carrying fork 28b elevationally movable in response to the actuation of a lift cylinder 29.

The mast base 28a serves to stably support the mast assembly 28 on the guide rails 26 and should have as great a length as possible. The increased length of the mast base in the prior art vehicle body may however restrain rearward sliding movement of the mast assembly because the mast base would come into collision with the center plate at the last part of the rearward sliding movement of the mast assembly. Taking this into account, the center plate 12 of the instant vehicle body 10 has a pair of apertures 12a corresponding the guide rails 26 and permitting the mast base 28a to move rearwards past the center plate 12, as illustrated in Fig. 1.

In the meantime, a load wheel 32 is mounted to the front end of the respective guide rail 26 by a wheel shaft 34 so as to bear the weight of the mast assembly 28 and the object to be lifted. As will be apparent in Fig. 1, since the wheel shaft 34 is directly welded to the guide rail 26 and not to the reach leg 24, the guide rail 26 may be subject to flexural deformation in case of a greatly increased load being applied to the load wheel 32. For avoidance of such rail deformation, a wheel cover 32 is fitted to the front

end of the reach leg 24 and then welded both to the reach leg 24 and the guide rail 26 to thereby enhance the strength of the guide rail 26.

Referring to Fig. 3, it will be noted that a suspension mount 38 is disposed between the center plate 12 and the rear frame 18 to demountably support a drive wheel side suspension link and a caster wheel side suspension link of a multi-link suspension which will be described below. The suspension mount 38 will be fabricated as a unit and welded to a given position of the vehicle body 10. As shown in Fig. 4, the suspension mount 38 is provided with first and second generally "L"-shaped brackets 40, 42 attached respectively to the center plate 12 and the rear frame 18.

The first bracket 40 consists of a vertical extension 44 having a pivot hole 44a at its top end and a horizontal extension 46 having a downwardly open pivot recess 46a at its lower edge. The pivot recess 46a is closed off by a journal member 48 which in turn can be detachably secured to the lower edge of the horizontal extension 46 as by bolts 50. Similarly, the second bracket 42 consists of a vertical extension 52 having a pivot hole 52a at its top end and a horizontal extension 54 having a downwardly open pivot recess 54a at its lower edge. The pivot recess 54a is closed off by a journal member 56 which in turn can be detachably secured to the lower edge of the horizontal extension 54 as by bolts 58.

The first and second brackets 40, 42 are interconnected by means of spacer means for the sake of unity and reinforcement. In the illustrated embodiment, the spacer means includes a first spacer plate 60 disposed between the vertical extensions 44, 52 of the first and second brackets 40,

42 and a second spacer plate 62 coupling the horizontal extensions 46, 54 together. The first spacer plate 60 lies on a vertical plane, while the second spacer plate 62 is disposed on a horizontal plane at the upper edges of the horizontal extensions 46, 54.

Positioned just above the first spacer plate 60 is a link ledge 64 which is affixed at one end to the vertical extension 44 of the first bracket 40 and at the other end to the vertical extension 52 of the second bracket 42. The link ledge 64 has first and second vertical lugs 66, 68 projecting upwards adjacent respectively to the vertical extensions 44, 52 of the first and second brackets 40, 42 and a horizontal lug 70 protruding toward the drive wheel side suspension link set forth later. Each of the first and second vertical lugs 66, 68 has a pivot hole 66a or 68a in alignment with the pivot holes 44a, 52a of the vertical extensions 44, 52 whereas the horizontal lug 70 has a couple of through-holes 70a whose axes extend in a vertical direction. Additionally, a pedal bracket 72 is mounted to the first bracket 40 at a position below the link ledge 64 in order to rotatably support a brake pedal in the manner as described below.

As can be seen in Fig. 5, a drive wheel side suspension link 74 is pivotally mounted at one end to the vertical extensions 44, 52 of the first and second brackets 40, 42 through the use of a pivot pin 76 inserted through the pivot holes 44a, 52a, 66a, 68a. The other end of the drive wheel side suspension link 74 is connected to a link frame 84 that holds a drive wheel 78, a drive motor 80 and a transfer device 82 operatively coupling the drive wheel 78 with the drive motor 80. The link frame 84 is

provided with a downwardly extending rod 88 slidably fitted into the through-hole 70a of the link ledge 64 with a spring 86 loaded thereto and an upwardly extending rod 92 slidably mounted to the center plate 12 with a spring 90 loaded thereto. Furthermore, an auxiliary suspension link 87 is connected at one end to the lower end of the link frame 84 by a pivot pin 89 and at the other end to the horizontal extensions 46, 54 of the suspension mount 38.

On the other hand, a caster wheel side suspension link 94 is mounted to the horizontal extensions 46, 54 of the first and second brackets 40, 42 by a pivot pin 96. It should be noted that the pivot pin 96 may be readily placed into the pivot recess 54a by way of detaching the journal member 56 from the lower edge of the horizontal extension 54. This makes it possible to combine the caster wheel side suspension link 94 and the pivot pin 96 prior to their mounting to the suspension mount 38. The suspension link 94 carries at one end a caster wheel 98 and is elevationally movably supported at the other end on the stationary plate 100 with a spring 102 loaded thereto. In addition, a brake pedal 104 is rotatably mounted to the pedal bracket 72.

While the invention has been shown and described with reference to a preferred embodiment, it should be apparent to one of ordinary skill in the art that many changes and modifications may be made without departing from the spirit and scope of the invention as defined in the claims.

WHAT IS CLAIMED IS:

1. A vehicle body for reach type forklift trucks adapted to slidably support a mast assembly at its front side and to detachably carry a drive wheel side suspension link and a caster wheel side suspension link at its rear side, comprising:

a center plate extending across the vehicle body;

side frames attached to the opposite lateral edges of the center plate and extending in a longitudinal direction of the vehicle body;

a rear frame affixed to rear edges of the side frames;

a pair of parallel reach legs extending forwards from the lower frontal edge of the center plate;

a pair of guide rails secured to the reach legs for guiding the sliding movement of the mast assembly; and

a suspension mount provided between the center plate and the rear frame to support the drive wheel side and caster wheel side suspension links, wherein the suspension mount includes first and second brackets respectively attached to the center plate and the rear frame, spacer means for interconnecting the first and second brackets, and a link ledge disposed between the first and second brackets for supporting the drive wheel side suspension link.

2. The vehicle body for reach type forklift trucks as recited in claim 1, wherein each of the first and second brackets of the suspension mount is provided with a vertical extension and an horizontal extension, the spacer means including a first spacer plate adapted to couple vertical extensions of



the first and second brackets together and a second spacer plate adapted to interconnect the horizontal extensions of the first and second brackets.

3. The vehicle body for reach type forklift trucks as recited in claim 2, wherein each of the horizontal extensions of the first and second brackets has a downwardly open pivot recess allowing pivotal attachment of the caster wheel side suspension link and a journal member detachably attached to the underside of the respective horizontal extension to close off the pivot recess.

4. The vehicle body for reach type forklift trucks as recited in claim 2, wherein the link ledge of the suspension mount is provided with first and second vertical lugs projecting upwards adjacent respectively to the first and second brackets and a horizontal lug protruding toward the drive wheel side suspension link at the center of the link ledge.

5. The vehicle body for reach type forklift truck as recited in claim 1, wherein the suspension mount further includes a pedal bracket attached to the first bracket to hold a brake pedal in a rotatable manner.

6. The vehicle body for reach type forklift truck as recited in claim 1, wherein the center plate has a pair of apertures corresponding to the guide rails and permitting at least a part of the mast assembly to pass therethrough.

7. The vehicle body for reach type forklift truck as recited in claim 1, further comprising a wheel cover welded to the front ends of the reach legs and the guide rails.

8. The vehicle body for reach type forklift truck as recited in claim 1,



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further comprising an upwardly open, box-shaped beam bracket attached to the inner surface of the respective side frame.

