A clamp attachment especially for lift trucks in which the elements of each of a pair of pivotal clamp pad and supporting clamp arm assembly provide a substantially coplanar and continuous clamping surface.

9 Claims, 8 Drawing Figures
CLAMP ATTACHMENT FOR LIFT TRUCK AND THE LIKE

BACKGROUND OF THE INVENTION

The field of the invention relates to articulated clamping apparatus and includes a pair of oppositely disposed load-clamp assemblies which are actuated toward each other and against the opposite sides of a load to enable the load to be lifted and transported.

A primary consideration in the design of such clamping devices concerns the combined thickness of each support arm and clamp pad assembly which desirably is minimized while providing required structural rigidity in order to be capable of storing cartonized loads side by side with minimum spacing between the cartons. To the extent the space required between cartons can be minimized while enabling pickup and deposit operations by such clamps, to that extent is the effective storage space maximized.

Heretofore various constructions for such clamps have been used, some of which are disclosed and/or discussed in U.S. Pat. Nos. 3,433,376, and others of which are disclosed in assignee’s sales brochures identified as SS-1668 and TL-59, as well as in, for example, sales publication Form No. 4006 of Cascade Corporation of Portland, Oregon.

In none of these prior articulated clamp devices does the right support arm of the clamp function in cooperation with the articulated clamp pad or plate which is mounted on the support arm to provide a single essentially coplanar and continuous clamping surface at each clamp arm and clamp pad assembly. In each known instance of the prior art the clamp pad is located laterally inwardly of the clamp support arm so that the total thickness of the assembly includes the sum of the thicknesses of the major elements, viz., the support arm and the clamp pad.

Yet another prior construction of the assignee hereof involves a hollow pivotal clamp pad assembly having spaced sides into which is inserted at the time of manufacture the clamp support arm, but again the support arm does not provide any clamping surface which cooperates with the clamp pad, merely functions to support the pad or plate. In the latter structure the thickness of the end assembly is again substantially greater than that of the present invention because the clamp pad or plate is constructed to enclose the support arm in an interior space formed between the spaced sides thereof, and so includes the sum of the thicknesses of the major elements thereof.

SUMMARY OF THE INVENTION

The present invention is an improvement over such prior clamp constructions. In a typical actual construction of one embodiment of my invention the total thickness of the clamp pad and support arm assembly is about 1½ inches, which is significantly thinner than any known prior articulating clamp construction. It is therefore a principal object of my invention to provide an articulating clamp arm and pad assembly of such a construction as to provide a combined thickness substantially less than that hereof.

Another object of the invention is to provide a clamp arm and articulated pad assembly in which these elements cooperate to provide a substantially coplanar clamping surface formed by the elements.

Other more particular objects and features of the invention will be apparent to those skilled in the art from the following description and drawing forming a part hereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front perspective view of a lift truck having associated therewith one form of a clamp attachment which embodies my invention;

FIG. 2 is a rear right quarter perspective view of the clamp attachment shown removed from the truck and in a partially opened condition;

FIG. 3 is an enlarged and detailed right side elevational view of FIG. 2;

FIG. 4 is a partial sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a view in side elevation similar to FIG. 3 of another embodiment of my invention;

FIG. 6 is a partial front elevational view of the assembly shown in FIG. 5;

FIG. 7 is a sectional view taken along line 7—7 of FIG. 5; and

FIG. 8 is a sectional view taken along line 8—8 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in detail to FIGS. 1–4, the front masted portion of an industrial lift truck is shown generally at numeral 10. Front drive wheels 12 are connected by a drive axle, not shown, to the housing of which is mounted the front end of the truck chassis and a mast or uprise assembly shown generally at numeral 14. Upright 14 includes a hydraulic lift cylinder 16 adapted to elevate in known manner nested telescopic rail sections and a lift carriage, not shown, of known construction, supported thereby for vertical actuation in the mast rail sections by chains 20.

Supported from the carriage is a clamp support and actuator assembly 22 (FIG. 2) of known construction which comprises generally a pair of laterally spaced vertical support plates 24 having bracket or hook means 26 secured adjacent the top ends thereof for supporting the entire clamp and actuator assembly of FIG. 2 from the lift truck carriage for elevation in the upright. A generally box-shaped housing assembly for supporting clamp actuator and support elements which are connected to the clamp arms extends transversely of the truck and is secured at its opposite ends to the front of support members 24, said box-shaped assembly being shown generally at numeral 28. It comprises a pair of forward and vertically extending plate members 30 secured at the rear edges thereof to the outer ends of the respective ones of support members 24. A plurality of vertically spaced transversely extending openings 32, which are preferably square shaped, are formed in plates 30 and support pairs of square section support members 34 and 36 mounted for oppositely directed extensible movement on bearing surfaces in square tubes 32. Oppositely extending double-acting, vertically spaced hydraulic cylinder-piston assemblies 40 and 42 are supported at the base ends of the cylinders at opposite ones of support plates 30; the piston rods connected to vertically and transversely spaced rearwardly extending brackets 44 which are secured to the rear surfaces of a pair of vertically extending clamp arm and pad assembly support members 46 and 48. The pair of extensible support members 36 are secured to member 48 and the opposite pair of such members 34 to member 46 by means of projections 50 which secure together respective ones of said members as shown, said projections 50 extending forwardly through corresponding slots 51 formed suitably in the front sides of square tubes 32. The piston rod of cylinder assembly 40 is secured at 52 to bracket 44 on support plate 46, whereas the piston rod of cylinder assembly 42 is secured to the opposite bracket 44 on support plate 48. The base end of cylinder assembly 42 is supported from the one housing plate member 30 at 54.

When hydraulic actuator assembly 22 is mounted from the fork carriage of a lift truck the cylinders are connectable to conduits of a known hydraulic system, not shown, which is operable to actuate cylinders 40 and 42 simultaneously in extension or retraction by means of a valving arrangement controllable by the truck operator and at any elevation of the carriage in upright 14. Extension of said cylinder assemblies actuates support plates 46 and 48 laterally outwardly in opposite directions, whereas retraction actuates said members laterally inwardly, said support projections 50 being actuated in one direction or the other in and out of slots 51 as the pairs of support members 34 and 36 extend and retract in support tubes 32.

Extending inwardly from opposite ones of support plates 46 are a plurality of vertically spaced, hollow half-tubular rods
Referring now to FIGS. 5-8, a somewhat different construction is shown wherein fixed arm support 70' is of a somewhat different configuration than shown in FIG. 3, it being still basically rectangular however with a cutout lower front corner portion 110 which receives a portion of a semi-circular reinforcing plate 80 of a somewhat differently configured reinforcing plate 78. The reinforcing plate 80 has basically the same relationship to plate 78 as does plate 80 to plate 78. The means mounting plate 78 for articulation is different in that a pivot pin 116 is mounted at the lower end of the assembly in mating semicircular and coaxial openings (formed as in FIG. 3) in the respective portions of arm 70', plate 80' and plate 78'. Plate and plate 78' and 80' are pivoted from the top end by a bearing block 84' secured to plate 80' by studs and having a pivot pin 116 mounted in similar mating openings 118 of the corresponding parts 70', 84' and 78'. A flat side of bar 116 is engaged by a setscrew 120 permitting the bar to pivot with plate 78' and plate 80' (FIG. 8).

Plates 78' and plate 80' are urged towards a toe-out position by a leaf spring 124 which is secured at 126 to plate 70' and which bears at its free end against the rear portion of plate 78' (FIG. 7). As will be seen, the plate is urged by leaf spring 124 to a toe-out position, the extent of such movement being again limited by a T-shaped member 104' secured to plate 78' and having the projection thereof operating in a clearance opening of vertical support member 46'.

FIG. 6 shows a camber adjustment means by which the plate and clamp assembly can be adjusted to camber or converge toward the truck support surface as shown in broken lines. In this construction each vertical support plate 46' is separated from its connection to respective pairs of support members 34 and 36 by a plate member 142 which is secured to the respective pair of said support members by projections 50'. Mounted centrally of the upper edge of each plate 142 is a block member 144 located between a pair of setscrews 146 which are adjustably located in a pair of block members 148 secured to the back surface of the respective plate member 46' in predetermined spaced relationship to block 144. An interrupted or oblong opening 150 is located near the upper end of each plate 142 and a circular opening 152 is located near the lower end thereof. A pair of stud members 154 having enlarged heads are located in openings 150 and 152 and are threaded at the inner ends to threadedly engage the adjacent plate member 142 and to frictionally engage each plate member 46' in the openings 150 and 152. Lower stud member 154 functions as a pivot for each support arm and clamp pad assembly, which includes plate 46'. Coordinated adjustment of setscrews 146 in and out of blocks 148 effects a slight pivot movement in one direction or the other of the support arm and clamp pad assembly as the setscrews thrust against fixed block member 144; the limit of such movement is determined by the length of the major axis of oblong opening 150 in cooperation with upper stud 154 which is fixed in position relative to plate member 142. By means of such adjustment the operator is able to vary as desired the downward camber of each support arm and clamp pad assembly.

The general description which follows will refer to identifying numerals of the embodiment of FIGS. 1-4, although it will be understood that the description also applies to the second embodiment except as may be specifically indicated otherwise. It is to be emphasized that the thickness of support arm 70 is substantially the same as the combined thickness of reinforcing plate 80 and plate 78, and that the outer and inner side surfaces of each said support arm 70 and plate assembly 78, 80 are substantially coplanar, the plated and plate assembly being capable of articulating a predetermined amount against the effect of torsion bar 96 (leaf spring 124 in FIGS. 5-8). In both embodiments articulation away from a toe-out position is accomplished as the platens engage the sides of a load which forces the inner surfaces into substantially coplanar relationship with the inner surfaces of the support arms. Likewise, with respect to the downwardly converging camber of the support arm and plate assemblies of FIGS. 5 and 6, the pair of said assemblies are thrust into substantially parallel relation by a load having substantially parallel sides.
It will be understood that the inner clamping surfaces of the support arm and platens 70 and 78 are substantially coplanar when the platen is in a centered position, and that said surfaces are preferably faced, for example, with a vulcanized rubber facing 140 secured to the arm and platen by suitable means for increasing the frictional engagement between the clamp arms and the sides of the load. The combination of such support arm and articulated platen assemblies having substantially coplanar inside clamping surfaces on each said element enables me to provide an assembly of minimum thickness and adequate rigidity and strength to handle loads of the type contemplated.

The blunt knife edge 83 of platen 78 and the forwardly tapered edge 81 of reinforcing plate 80 enable the support arm and platens assembly to knife between very closely spaced cartons, for example, while effecting a gentle and adequate spatial separation of cartons as tapered edges 83 and 81 make room for the support arm and platen assembly by separating adjacent cartons from the one to be engaged. It is understood that the various parts comprising the outer sides of support arm 70, reinforcing plate 80 and bearing blocks 84 are preferably flush and smooth to provide for such pushing away action without damage to the adjacent carton or other article.

It will be apparent to those skilled in the art that various changes in the structure and relative arrangement of parts may be made without departing from the scope of my invention. For example, it may be found desirable in some applications to provide for predetermined articulation of herein disclosed fixed support arms 70 and 72. These arms may, for example, be pivotally mounted from plate support members 46 and 48 allowing for some articulation therebetween with clamp arms 78 mounted from such support arms as disclosed herein. In addition, it may be found desirable to mount on one side of the support and actuator assembly 22 a fixed support or nonarticulated clamp unit, while from the other side of assembly 22 is mounted an articulated support and clamp arm construction of this invention. In other words it is not necessarily required in the use of my invention to utilize the support and clamp arm structure disclosed on both sides of the clamp attachment device. In addition, it may be found desirable to utilize a support and clamp arm construction basically as provided herein at the upper end of a horizontal stabilizer device wherein the load is supported, for example, from a standard fixed platen or fork support at the bottom, and an upper horizontal stabilizer plate assembly in accordance with this invention stabilizes the load from the top. Horizontal stabilizer type devices are shown, for example, in U.S. Pat. Nos. 2,772,800 and 3,039,635, both assigned to the present assignee. In other words, use of my invention may also be made in a horizontal stabilizer device wherein a support and articulated clamp arm assembly of the type herein disclosed is utilized in an upper horizontal plane in conjunction with a lower fixed load support. These additional uses and constructions of my invention are merely exemplary of some of the available variations within the scope of the invention.

I claim:

1. A clamp attachment for lift trucks and the like having a pair of clamping assemblies adapted to be mounted from the truck, at least one of said assemblies comprising a support arm extending forwardly from the truck and a clamp arm pivotally supported from the support arm for pivotal movement relative thereto, said support and clamp arms being so constructed and arranged that the inside surfaces thereof are at least sometimes substantially coplanar and cooperate to provide an effective single clamping surface, said clamp arm having a generally inverted L-shaped configuration and said support arm having a generally rectangular configuration which is located in the open space of the clamp arm and is contiguous to the inner horizontal and vertical edges thereof, said clamp arm being supported for pivotal movement about a vertical axis from the forward end portion of the support arm.

2. A clamp assembly as claimed in claim 1 wherein reinforcing plate means is secured to the outer side of said clamp arm adjacent the support arm, the combined thickness of the clamp arm and plate means being substantially equal to the thickness of the support arm.

3. A clamp attachment as claimed in claim 1 wherein spring means is operatively connected between said support arm and clamp arm for urging the latter towards a toe-out position, and means connected to the clamp arm for limiting the articulation thereof relative to the support arm.

4. A clamp attachment as claimed in claim 1 wherein adjustment means is operatively connected between said support arm and clamp arm assembly and a mounting means therefor for adjusting said assembly to have a camber which converges toward the other clamping assembly.

5. A clamp device comprising laterally extending mounting and clamp-actuating means having portions extensible from opposite sides thereof, a support and clamp arm assembly mounted from each of the extensible portions extending forwardly therefrom and forming on the respective inner sides substantially coplanar clamping surfaces actuable on said mounting means into and out of clamping relation to a load located therebetween, each of said assemblies comprising a forwardly extending support arm and a forwardly extending clamp arm contiguous to the support arm and mounted thereon for articulation relative thereto, each of said inside coplanar surfaces providing a single substantially coplanar clamping surface comprised of the separate inner surfaces of the support arm and the clamp arm and movable out of coplanar relationship when the clamp arm is pivoted relative to the support arm, said clamp arm being of a basically inverted L-shaped configuration and said support arm having a basically rectangular configuration and located in the open space of the clamp arm contiguous to the inner edges thereof.

6. A clamp device as claimed in claim 5 wherein reinforcing plate means is secured to the outer side of each clamp arm and comprises a side surface area substantially less than that of the clamp arm, said reinforcing means being located adjacent the support arm and providing a substantially coplanar outside side surface with the support arm.

7. A clamp device as claimed in claim 5 wherein means for supporting the clamp arm for articulation on the support arm is mounted at least in part between the reinforcing plate means and the support arm.

8. A clamp attachment for lift trucks having a load-lifting mast disposed at the one end thereof and clamp-actuating means mounted on the mast including portions extensible laterally in opposite directions, said clamp-actuating means being mounted rigidly from each said portion and extending forwardly thereof, and a forwardly extending clamp arm contiguous to the support arm and mounted thereon for articulation laterally relative thereto, said support and clamp arms together comprising a pair of clamp arm assemblies extending forwardly of the lift truck in substantially parallel relation to each other and actuable laterally in opposite directions on said clamp-actuating means to engage and disengage loads, each said clamp assembly being so constructed and arranged that the inner load engaging surfaces of the respective support and clamp arms are substantially coplanar when in engagement with a load to provide an effective single clamping surface, the effective total thickness of each clamp arm assembly when engaging a load being substantially no greater than the thickness of the support arm.

9. A clamp attachment for lift trucks having a load-lifting mast disposed at the one end thereof and clamp-actuating means mounted on the mast including portions extensible laterally in opposite directions, comprising a support arm mounted rigidly from each said portion and extending forwardly thereof, and a forwardly extending clamp arm contiguous to the support arm and mounted thereon for articulation laterally relative thereto, said support and clamp arms together comprising a pair of clamp arm assemblies extending forwardly of the lift truck in substantially parallel relation to each other and actuable laterally in opposite directions on said clamp-actuating means to engage and disengage loads, each said clamp assembly being so constructed and ar-

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ranged that the inner load engaging surfaces of the respective support and clamp arms are substantially coplanar when in engagement with a load to provide an effective single clamping surface, the effective total thickness of each clamping arm assembly when engaging a load being substantially no greater than the thickness of the clamp arm.