This invention relates to overhead guards for protection of operators in industrial lift trucks, and more particularly to a collapsible overhead guard particularly adapted for use in handling materials in areas having a low overhead or ceiling. The collapsible guard includes multiple longitudinally aligned link members which are hingedly connected at adjacent ends and adapted to be supported from the truck on forwardly and rearwardly located fixed standards, the multiple hinged link members being actuatable to a low height collapsed position behind the operator's station and within the longitudinal dimension of the truck.

These trucks have a tiltable mast structure ahead of the operator's station, and forwardly projecting fork frames or other load handling devices are mounted for vertical movement on the mast structure. Industrial lift trucks may be utilized to transport materials held by the load engaging devices, and to stack these materials by elevating the load handling device on the mast structure in order to put one unit of material on top of another.

In the manipulation of the truck during such a stacking operation, if the load shifts because of careless handling or because of a rough floor or for any other reason, material may fall from the load handling device. Such falling material might injure the operator of the industrial lift truck, and various types of overhead guards have been provided heretofore to prevent injury to the operator by falling objects.

Some areas in which industrial trucks operate have such a low overhead or ceiling as to require the use of a mast structure which has a substantially lower collapsed height than the height of any existing overhead guard structure. Railroad box cars, the holds of some ships, and relatively low height piers in docking areas beneath which material is stored by industrial trucks are exemplary of industrial truck applications in which overhead guards have not been utilized. Of course, in some such applications in which the industrial lift truck is used only for low lifting stacking, overhead guards are not required because a load may never be raised above the top of the upright. However, many such trucks are used both for low and high level stacking, and in order to protect the driver, as aforesaid, an overhead guard should be utilized for such high level stacking. Heretofore, in the latter case, either overhead guards have not been used, or, if used, it has been extremely inconvenient in that for low level stacking in low overhead areas, as aforesaid, it has been frequently necessary to remove the guard from the truck, and to replace it for other applications requiring higher level stacking of materials.

The present invention solves the foregoing problem by providing a collapsible overhead guard which is continuously mounted upon the truck for both low and high level stacking operations in low and high ceiling areas, and which is readily adjustable by the operator to either an operative or collapsed position, depending upon the material handling operation involved. When in an operative position it provides the same type of protection for the operator as is provided by known fixed and rigid structure, and when located in an inoperative or collapsed position the entire guard structure is conveniently and compactly located behind the operator's seat at a sufficiently low level so as not to interfere with low level stacking truck operations within the confines of a low overhead.

It is therefore a principle object of the present invention to provide an improved guard structure for a lift truck which enables the guard structure to be located selectively in both operative and inoperative or collapsed positions.

Another object of the invention is to provide an overhead guard structure which is collapsible into a relatively small area rearwardly of the operator's station and which is of sufficiently low height when collapsed as not to interfere with operation of the truck in low overhead areas.

Other objects and advantages of the invention will become readily apparent to those skilled in the art as the description proceeds.

In carrying out our invention, we provide for and adopt rigid support structure to which is connected a generally inverted U-shaped overhead portion which is detachable from the forward guard support, extends over the operator's station, and is pivotally connected to the fixed rear support by a plurality of hinged or relatively pivotable link members which are independently pivotable to collapse the guard into a compact space rearwardly of the operator's station.

For a clearer and more complete understanding of the invention reference should be had to the accompanying drawings wherein:

FIGURE 1 is a perspective view of an industrial lift truck utilizing the present invention;

FIGURE 2 is a partial sectional view taken longitudinally of the overhead guard structure of FIG. 1 inwardly of one outer side thereof and looking toward the opposite side;

FIGURE 3 is a partial side elevational view of the truck and guard structure shown in FIG. 1 showing the guard in a partially collapsed condition;

FIGURE 4 is the same as FIG. 3 but with the guard structure shown in a fully collapsed position;

FIGURE 5 is a partial sectional view taken along line 5—5 of FIG. 2;

FIGURE 6 is a sectional view taken along line 6—6 of FIG. 5; and

FIGURE 7 is a detailed sectional view taken at one of the hinge members which is connected between a pair of the pivotable links.

Referring now to the drawings in detail, reference numeral 10 indicates generally an industrial lift truck. The vehicle includes a body portion indicated generally by the numeral 12 having a pair of front drive wheels 14 operated by prime mover means, not shown, beneath a hood and body portion 16 upon which is mounted an operator's seat 18 which is associated with a floor portion 20 and operator controls mounted upon a front cowl section 22 having a steering wheel 24 for steering rear dirigible wheels 26. At the front end of the body portion of the truck is located a vertically disposed telescopic mast structure indicated generally by the numerals 28. This mast is pivotally mounted at its lower end by a trunnion means to the housing of the drive axle to which wheels 14 are connected, and is arranged to be tilted forwardly and rearwardly by a pair of hydraulic cylinders, the piston rod of one of which is shown at numeral 30. The mast structure 28 includes an outer guideway formed by a pair of channel members 32, and an inner nested I-beam construction 34 which telescopes within the outer guide structure 30.
A load supporting carriage 36 is arranged to move upwardly and downwardly on the inner construction 32. The load supporting carriage, as illustrated herein, is provided with a pair of forwardly projecting fork tines 39 which are adapted to engage and transport loads. Such raising action is produced in a conventional manner by a hydraulic motor generally shown at numeral 39 having an inner piston arranged to raise and lower the load supporting carriage and the fork tines through a chain and sprocket mechanism. One of the chains which forms a portion of this mechanism is indicated by the numeral 40. Details of a suitable mast construction are disclosed and claimed in Patent No. 3,213,967.

The truck 10 also includes at the rear end thereof a counterweight 42 which ordinarily is made of metal to counterbalance loads which are carried on the fork tines at the front of the truck. The particular truck illustrated utilizes liquefied petroleum gas, the tank for which is shown at numeral 44 mounted on brackets 46 at the rear portion of the truck.

The overhead guard of our invention is illustrated generally by the numeral 50. In the form illustrated, the overhead guard comprises a pair of upwardly and rearwardly extending rigid hollow members 52 which are parallel to each other and which may be secured, as by bolts, to opposite sides of the cowl section 22. As shown, members 52, as well as the other structural elements of the guard, are constructed of hollow rectangular cross-sectional beams and links. It will be understood that any suitable hollow structural section can be used, such as hollow cylindrical members. For convenience of description only hereinafter all such members will be referred to as “tubular” in shape, as an equivalent form. The right-hand side of the overhead guard structure is shown in FIGS. 3 and 4 and the left-hand side in the section of FIG. 2; the description which follows pertains to both sides, which are of the same construction.

A pair of transversely spaced upper forward tubular standard members 54 are secured, as by welding, at the upper end thereof to the opposite ends of the one leg of a transversely extending angle iron 56, and are detachably secured to respective ones of tubers 52, as best shown in FIGS. 2, 5 and 6. An inner short hollow member 58 is welded in the lower end of each member 54 and extends downwardly beyond the end of tube 54, as shown. A block member 60 having a lower biased or wedge surface 61 is welded within the lower end of each tube 58. A cantilever spring member 62 is welded at the top end thereof to the outer side of the inner wall of each tube 54 and has attached to the lower or cantilevered end thereof an inwardly extending pin 64 which is adapted to register with an opening 66 formed in the wall of each tube 52.

A pad member 68 extends through a vertical slot in the wall of each tube 54 and is secured to spring member 62 which urges pin 64 laterally inwardly to engage opening 66. A block member 70 having an upper complementary biased or wedge surface 71 is secured in the upper end of each tubular member 52 to limit the downward telescopic movement of short tube 58 in tube 52 and to adjustably position pin 64 for registry in opening 66 when the biased surfaces of each pair of block members 60 and 70 are in abutment. When pad member 68 is actuated inwardly of tube 54 spring 62 is depressed outwardly to disengage pin 64 from opening 66, whereupon tubular legs 54 of the collapsible portion of the overhead guard structure may be hand actuated upwardly and rearwardly, as shown in FIG. 3. If desired, a pin member may be provided for insertion transversely through the axis of each pad member 68 to prevent the accidental disengagement thereof from opening 66 when the guard structure is in operative position.

At the rear of the truck is mounted preferably in longitudinal alignment with each forwardly located member 52 a fixed upright tubular member 72. A medium length, straight hollow tubular member 74 is mounted adjacent the upper end of each member 72 by means of a hinge and block assembly 75, the structure of which is shown in section in FIG. 7. In the position of the tubular members 72 and 74 are located solid block members 76 and 78 which are secured to the inner walls of the tubular members, as by welding. An enlarged circular hinge part 80 extends from each side of each hinge block 78, axially aligned openings 82 therein being registerable with a press fitted pin 84. Each hinge block 80 is hinged to the member 72 by having from the end adjacent hinge part 80 a hollow thick walled tube registerable with openings 82 and insertable between projections 80 for receiving pin 84 in a non-press fit relation so that tubular members 74 are pivotally rearwardly relative to tubular members 72. Each hinge assembly 75 comprises assembled block members 76 and 78 which include facing surfaces in abutting relation when the guard structure is in operative position, as shown in FIGS. 2 and 7. A pair of relatively short curved hollow link members 86 are similarly pivotally connected to tubular members 74 by means of a second hinge assembly 75, and at the opposite ends thereof are pivotally connected to a pair of relatively long upper hollow members 88 by means of a pair of similar hinge block assemblies 90. Hinge block assemblies 90 are turned 180° relative to hinge block assemblies 75 such that each member corresponding to member 78 is secured in the end of the structural side member of the guard, as shown in FIGS. 6 and 7, with the circular projecting side portions extending inwardly of the member 86 and the mating block member corresponding to member 76 is located in the adjacent end of tubular member 88. Likewise, a second hinge assembly 90 pivotally connects the forward end of each tubular member 88 to the rearward end of a short tubular member 92 which is fixedly secured to transverse frame angle member 56.

The rear of the overhead guard structure between the pairs of tubular members 72 and 74 is open providing ready access to the tank 44 when the guard is in an operative position. Likewise, the forward portion of the guard structure between pairs of tubular members 52 and 54 is open providing good operator visibility. The upper guard structure between pairs of tubular members 92 and a portion of members 88, has secured thereto a plurality of transverse grid members 94 which are interlocked with and extend through a plurality of longitudinally extending and transversely spaced grid or plate members 96 secured at the opposite ends thereof to transversely extending angle frame members 56 and 98. As illustrated in FIG. 2, the longitudinal grid members 96 are preferably of rectangular cross-section, and the transverse grid members 94 are preferably cylindrical in cross-section. A heavy metal plate member 100 extends transversely of the rear upper section of the guard and curves rearwardly and downwardly to the midsection of tubular members 86. The forward end of plate 100 is bent downwardly and secured to the rearwardmost grid bar 94. An adjustment pin 102 is located in each of the one block members of the first named pair of hinge assemblies 90. Pins 102 extend through each of said hinge block members and may be screw or bolt actuated for adjusting the clearance between plate 100 and the upper surfaces of tubular members 86 and 88.

From the foregoing, it will now be understood that the multiple hinged link construction of our overhead guard structure enables the structure to be disengaged from fixed standards 52 and pivoted rearwardly of the truck about fixed standards 72 on the hinge assemblies 75 and 90 through the position illustrated in FIG. 3. As shown in FIG. 4, wherein the entire overhead guard structure is located at a relatively low elevation and rearwardly of the operator’s seat 18, all within the maximum longitudinal dimension of the truck. The collapsed guard structure is sufficiently low in height above the floor as to permit operation of the industrial truck in low overhead storage areas, as herein.
above described, in which, because of the low ceiling, no overhead guard protection of the operator is required. Whenever the truck is utilized in areas permitting high level stacking of materials, the operator is enabled to selectively provide overhead guard protection against the possibility of falling objects by erecting the guard structure from the FIG. 4 to the FIG. 2 position.

It will be noted that with the guard in an operative position the hinge block assemblies 75 and 90 are designed to inherently resist downward forces. For example, hinge assemblies 90 pivot from the lower ends thereof with full abutting surface engagement between the pairs of block members so that a downward force on top of the guard structure tends to increase the abutting force between the adjacent surfaces of the block members.

Although we have described and illustrated a preferred embodiment of our invention, it will be understood by those skilled in the art that modifications may be made in the structure, form and relative arrangement of parts without necessarily departing from the spirit and scope of the invention. Accordingly, it should be understood that we intend to cover by the appended claims all such modifications which fall within the scope of our invention.

We claim:

1. An industrial lift truck having a front portion, a rear portion, upright mast structure located forwardly of the front portion and an operator's station located between said portions, a collapsible overhead guard comprising a generally inverted U-shaped guard structure selectively detachably connected to the front portion, extending rearwardly over the operator's station and pivotably secured to the rear portion, and a plurality of longitudinally related pivotably connected link members forming at least a portion of said inverted U-shaped structure enabling said guard structure to be located in a non-operative collapsed position in the rear portion of the truck, said pivotably-connected link members each comprising an elongated hollow member, and hinge means pivotally connecting each end of each link member to an adjacent end of an aligned link member.

2. An overhead guard as claimed in claim 1 wherein fixed upright standards are secured to both the front and rear portions, said guard structure being detachably connected to the standards secured to both the front portion and pivotally connected to the standards secured to the rear portion.

3. An overhead guard structure as claimed in claim 2 wherein the detachable connection comprises a spring actuated locking member adapted to secure the downwardly depending leg portion of said inverted U-shaped structure to the forward upright standards.

4. An overhead guard structure as claimed in claim 1, wherein said link members are of such different lengths and configurations as to enable the inverted U-shaped guard structure to be detached from the front portion and actuated rearwardly of the truck to a collapsed position rearwardly of the operator's station and within the maximum longitudinal dimension of the truck, said guard structure in said collapsed position having a maximum elevation above the truck supporting surface which is substantially less than the maximum elevation of the guard structure when located in an operative position.

5. An overhead guard structure as claimed in claim 1 wherein said inverted U-shaped guard structure is located adjacent each side of the truck, protective means above the truck's station interconnecting said opposite side located U-shaped structures, said guard structure, including the overhead protective means, being actutable from an operative position rearwardly to said non-operative collapsed position in which said guard structure is located rearwardly of the operator's station within the maximum longitudinal dimension of the truck and at a maximum elevation substantially less than the elevation of the guard structure in operative position.

6. An overhead guard structure as claimed in claim 1 wherein said inverted U-shaped structure comprises an upwardly and rearwardly extending rigid leg structure detachably connected at its lower end to said front portion, said plurality of pivotally connected link members extending rearwardly and downwardly from a pivotal connection with the upper rear end of said rigid leg structure for pivotal connection to the rear portion.

7. An overhead guard structure as claimed in claim 1 wherein said end hinge means pivotally connect the aligned ends of each pair of link members such that a downward force on top of the guard structure is resisted by the hinge members.

8. An overhead guard structure as claimed in claim 6 wherein said hinge means each includes a pair of abutment blocks secured to the respective ends of adjacent link members.

9. In an industrial lift truck having a front portion, a rear portion, upright mast structure located forwardly of the front portion and an operator's station located between said portions, a collapsible overhead guard comprising fixed upright standard means secured to both the front and rear portions, a generally inverted U-shaped guard structure selectively and readily detachably connected to the front upright standard means for manipulation to a non-operative position, extending rearwardly over the operator's station and pivotally secured to the rear upright standard means, a plurality of longitudinally related pivotally connected link members forming at least a portion of said inverted U-shaped structure enabling said guard structure to be actuated from its operative position rearwardly to its non-operative collapsed position in which said guard structure is located rearwardly of the operator's station and adjacent the rear upright standard means all substantially within the maximum longitudinal dimension of the truck and at a maximum elevation substantially less than the elevation of the guard structure in operative position, and hinge means pivotally connecting each end of each link member to an adjacent end of an aligned link member, said hinge means including an upper hinged member adapted to resist downwardly directed forces on the guard structure and rearward hinged members adapted to resist rearwardly directed forces on the guard structure.

10. An overhead guard structure as claimed in claim 9 wherein first, second, third, and fourth hinged members are connected between adjacent ends of said link members and between the one end of one of said link members and the rear upright standard means at each side of said guard structure, said link members which form each side of said guard structure being of such varying configuration as to facilitate actuation as aforesaid from said operative position to said non-operative position.

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