Aug. 15, 1967 C. A. BARNES ETAL 3,336,074

COLLAPSIBLE OVERHEAD GUARD FOR INDUSTRIAL LIFT TRUCK

Filed Dec. 3, 1965 2 Sheets-Sheet 1

FIG. 1

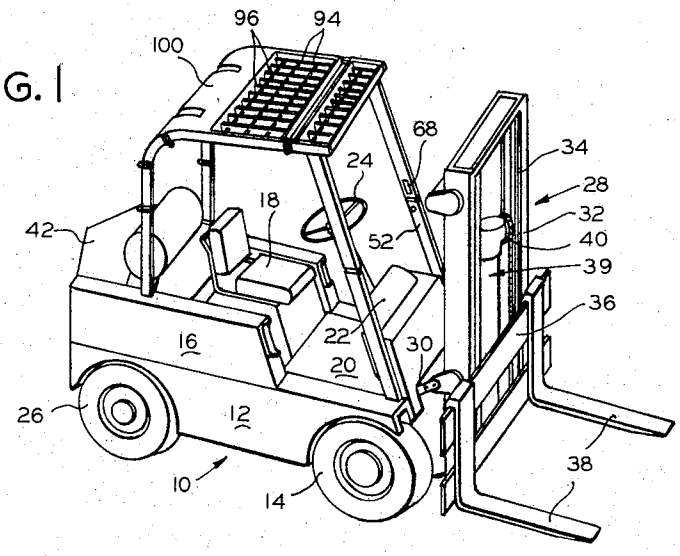


FIG. 2

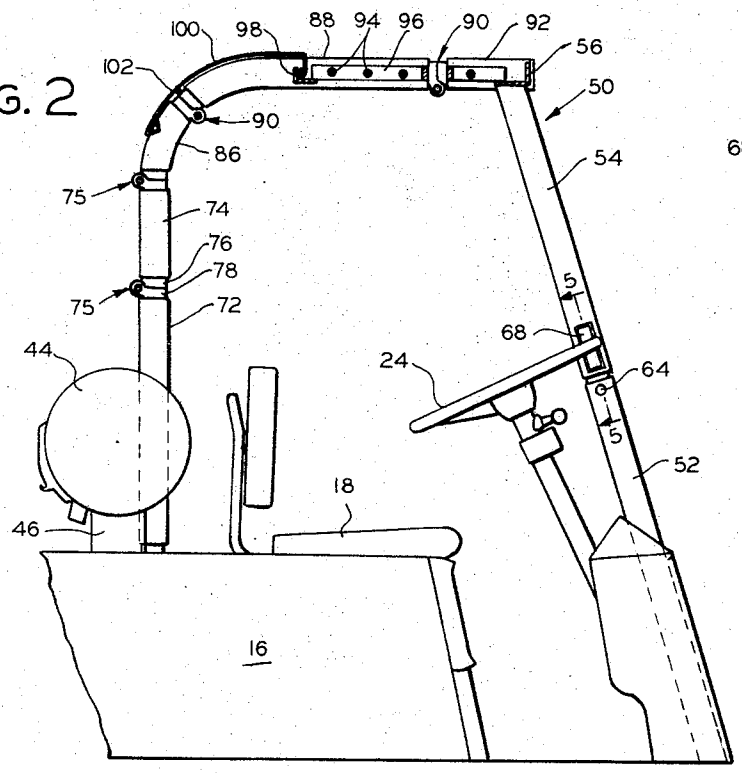
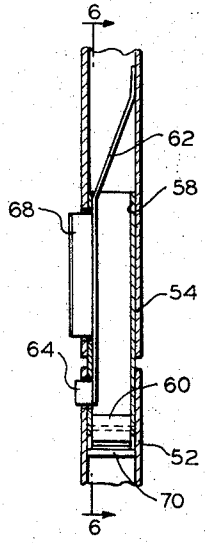


FIG. 5



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FIG. 3

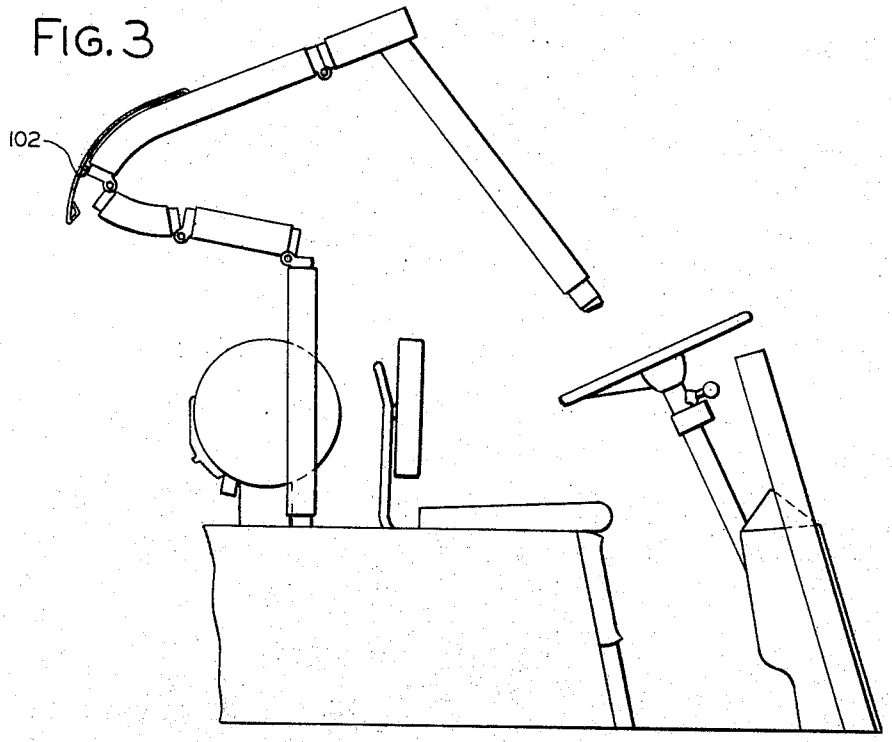


FIG. 4

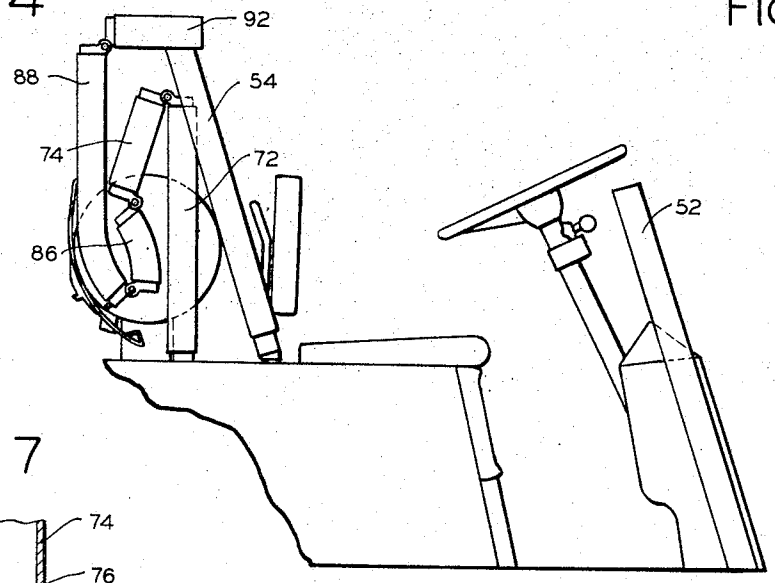


FIG. 6

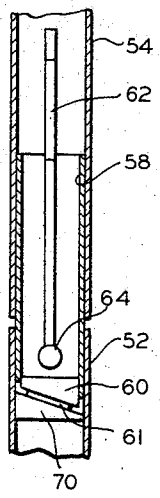
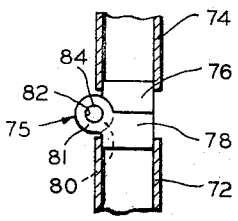


FIG. 7



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COLLAPSIBLE OVERHEAD GUARD FOR INDUSTRIAL LIFT TRUCK

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10 Claims. (Cl. 296—102)

ABSTRACT OF THE DISCLOSURE

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 elevating 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 elevation 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 overhead guard structure for an industrial 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 interefere 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 fore and aft 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 interdependently 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 stering 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 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 **38** which are adapted to engage beneath the load to be transported and raised. 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 side members 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 or by an equivalent term. The right-hand side of the overhead guard structure is shown in FIGS. 3 and 4 and the lefthand 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 tubes **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 of the axis of each pin **64** 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 adjacent ends of the pairs of 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 registrable with a press fitted pin **84**. Each hinge block member **76** has projecting from the end adjacent hinge part **80** a hollow thick walled tube registrable with openings **82** and insertable between projections **80** for receiving pin **84** in a non-press fit relation so that tubular members **74** are pivotable 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 block member corresponding to member **78** is secured in the end of each tubular member **86** 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 interconnected 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 my 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 to the compact nested inoperative position 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. 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 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 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 operator's station interconnecting said opposite side located U-shaped structures, said guard structure, including the overhead protective means, being actuatable 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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