An automatic horizontal positioning device for a load handling vehicle such as a truck crane, comprising sensing means for sensing tilting of the vehicle having a weight causing contacts of limit switches to close when the vehicle is tilted, magnet valves adapted to be operated in response to the sensing means to supply hydraulic pressure to head ends of vertical outriggers at the lowered portions of the vehicle, and pressure switches for changing over said magnet valves to shut off the hydraulic pressure to the head ends of the vertical outriggers when pressure in the head end chambers exceeds a predetermined value resulting from the abutment of the extended outriggers against the ground, whereby the vehicle body is always maintained in its horizontal position.

4 Claims, 7 Drawing Figures
1 AUTOMATIC HORIZONTAL POSITIONING DEVICE FOR LOAD HANDLING VEHICLE

BACKGROUND OF THE DISCLOSURE

1. Field of the Invention
This invention relates to an automatic horizontal positioning device for a load handling vehicle such as a truck crane having a plurality of outriggers equipped on front and rear portions on both sides thereof.

2. Description of the Prior Art
In operation of a crane at the place as a field under construction where the ground is not flat, that is, inclined or uneven, the vehicle body becomes unstable and tends to be tilted, in that event the crane operation itself may become very dangerous. To avoid this in order to maintain the vehicle stable, it has been suggested that a truck crane is provided on its front and rear portions on both sides with outriggers which hold the vehicle in crane operation.

With such a construction, the outriggers would be individually adjusted to correct the tilting of the vehicle or the floating of the outriggers. The term "floating" of outriggers as used herein is intended to designate a status of outriggers out of contact with the ground and ineffective as outriggers. Such a kind of load handling vehicle with outriggers to be adjusted individually is very difficult in operation of the outriggers for bringing the vehicle into a desired position or its horizontal position.

SUMMARY OF THE INVENTION

In order to overcome the above disadvantage in the prior art, the automatic horizontal positioning device for a load handling vehicle having a plurality of outriggers equipped on front and rear portions on both sides thereof, according to the invention, comprises sensing means for sensing tilting of a body of the vehicle, means responsive to said sensing means to change over the passages for supplying hydraulic pressure to said outriggers, and pressure responsive means responsive to the pressure in the outrigger to operate said changeover means, whereby when said vehicle body is tilted or said outriggers are floating said sensing means causes the required outriggers to operate to maintain said vehicle body in its horizontal position.

In the preferred embodiment of the invention, the horizontal positioning device comprises a bracket upstandingly fixed to a stationary base mounted on a body of the vehicle, a weight rockably hanging from said bracket, limit switches arranged around said weight corresponding to the positions of respective outriggers to form slight clearances between said weight and contacts of said limit switches when said vehicle body is horizontal, magnet valves included in respective conduits for supplying pressurized fluid to said outriggers for changing over the oil passageways to the head end and rod end chambers, said each limit switches being included in the electric circuits of said magnet valves, and pressure switches responsive to the increase in hydraulic pressure in the respective head end chambers of said outriggers, whereby when said vehicle body is tilted or said outriggers are floating said limit switches cause the required outriggers to operate to maintain said vehicle body in its horizontal position.

An object of the invention is to provide an automatic horizontal positioning device for a load handling vehicle capable of always holding the vehicle in safe condition by the automatic operation of the outriggers in the event of tilting of the vehicle and floating of the outriggers.

The invention will be more fully understood by referring to the following detailed specification and claims taken in connection with the appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a truck crane on which the automatic horizontal positioning device according to the invention is installed;
FIG. 2 is a plan view of FIG. 1;
FIG. 3 is a detailed front elevation of sensing means employed in the device according to the invention;
FIG. 4 is a plan view of FIG. 3;
FIG. 5 shows a hydraulic circuit used in the device according to the invention;
FIG. 6 shows a relation of a pressure switch to an outrigger; and
FIG. 7 illustrates the electric circuit system employed in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, a truck crane 1, on which a horizontal positioning device according to the invention is installed, comprises a rear body 2, a swivel slide 3 mounted thereon, a crane 4 the lower end of which is pivotally secured to the slide 3 elevatably and degradably, four vertical outriggers 5 arranged on front and rear portions on both sides of the body 2, and four horizontal outriggers 6 which serve to project the vertical outriggers 5 beyond the sides of the body 2.

A stationary base 7 is fixed onto the body 2 and is provided with a bracket 8 upstandingly fixed to the base 7 for suspending a weight. The bracket 8 has at its upper end a horizontal portion 8a from which a weight 10 is rockably suspended by means of a hook 9 (clearly shown in FIG. 3).

Referring to FIG. 4, four limit switches LS1 to LS4 are arranged on the base 7 corresponding to the positions of respective outriggers 5 so as to respond to tilting of the vehicle body to cause the vertical outrigger or outriggers to extend or retract such that the vehicle body is brought into its horizontal position. Contacts 11a of the limit switches are positioned to form slight clearances 12 with the peripheral surface of the weight 10 depending from the bracket 8 when the vehicle body is horizontal.

These limit switches are, therefore, maintained in inoperative with the contacts being opened when the vehicle body is kept horizontal, but are brought into operative due to the rocking movement of the weight 10 when the vehicle body has been tilted, whereby the required outrigger or outriggers are operated to restore the tilted body into its horizontal position.

FIG. 5 illustrates a hydraulic circuit for use in the device according to the invention, which comprises an oil pump 13, an engine 14, a reservoir 15, and conduits 16 for supplying pressurized oil to chambers at head ends and rod ends of piston and cylinder assemblies for the vertical and horizontal outriggers 5 and 6, these conduits including magnet valves for changing over the oil passageways to the head end and rod end chambers. The circuit further includes a relief valve 17. Referring to FIG. 7, oil under pressure to be supplied to the horizontal outriggers 6 is controlled by the magnet valves.
each having a solenoid SOL₁-SOL₄ and oil under pressure to the vertical outriggers 5 is controlled by the magnet values each having a solenoid SOL₅-SOL₈.

With the arrangement, after a power source switch or main switch SWₐ (FIG. 7) has been closed, any one of switches SW₁-SW₈ for changing over the magnet valves is closed to one side, for example upwardly as viewed in FIG. 7 to change over the magnet valve as shown in FIG. 5 from the shut-off position A to the position B wherein the vertical or horizontal outrigger 5 or 6 starts to extend its piston rod.

On the other hand, any one of the switches SW₁-SW₈ is closed to the other side, that is, downwardly as viewed in FIG. 7 to change over the magnet valve as shown in FIG. 5 from the position B to the position C wherein the vertical or horizontal outrigger 5 or 6 starts to retract its piston rod.

Referring to FIGS. 5 and 6, a pressure switch PS is provided in the conduit 16 communicating with the head end chamber of each vertical outrigger 5. The pressure switch operates at the moment the oil pressure in the head end chamber exceeds the predetermined pressure resulting from the fact that the extended outrigger has abutted against the ground to ensure that required outriggers are extended to prevent the part of the vehicle body from being raised too far and the vehicle body is maintained in its horizontal position.

The operation of the device according to the invention will be explained hereinafter.

In order to bring the truck crane 1 into an operating position, the power source switch SWₐ as shown in FIG. 7 is first switched on to light a pilot lamp PLₐ and then the magnet valve switches SW₁-SW₈ are switched on to the same side to extend the horizontal outriggers to their maximum extent.

An automatic horizontal positioning switch SWᵇ is then switched on to close the contacts of four-pole relays AR₀₁-AR₀₄ causing the pressure switches PS₁-PS₄ to operate in response thereto so that the solenoids SOL₀₁-SOL₀₄, SOL₁₁-SOL₁₃ and SOL₁₅ become conductive permitting the respective magnetic valves to change over with the result that the vertical outriggers begin to extend. In this condition, a pilot lamp PLᵇ is being lighted. When the outriggers abut against the ground so that the pressure in the head end chambers reaches the predetermined value, the pressure switches PS₁-PS₄ are opened. In this way the vehicle body is securely held on the ground through the outriggers. So long as the vehicle body is horizontal, the pilot lamp PLᵇ is not lighted.

If the rear body 2 is tilted, the weight 10 will close the limit switch LS causing the solenoid SOL₄ to become conductive thereby changing over the magnet valve permitting extension of the vertical outrigger at the lowered portion of the body.

In this manner, when the rear body has become horizontal by the extension of the required outrigger, the weight 10 is out of contact with the limit switch LS to stop the extension of the outrigger and therefore the vehicle body can be maintained in a horizontal position. Then the pilot lamp is not lighted which indicates the fact that the horizontal positioning operation of the device has been accomplished.

As can be seen from the above description, according to the invention, the tilting of a vehicle body and the floating of outriggers are electrically detected and then the outriggers are immediately operated to cause the vehicle body to automatically return into its horizontal position and securely held in it the position. In the operating cycle of a load handling vehicle on which the device is installed, the vehicle body can be held in its horizontal position and the floating of outriggers can be corrected quickly and reliably. The horizontal positioning device according to the invention is easy in operation, simple in construction and inexpensive to be manufactured in comparison with the prior art devices and further provides greater safety in crane operation.

While I have described my invention in detail in its preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof.

I claim:

1. An automatic horizontal positioning device for a load handling vehicle having a plurality of outriggers equipped on front and rear portions on both sides thereof, comprising sensing means for sensing tilting of a body of the vehicle, means responsive to said sensing means for changing over passages for supplying hydraulic pressure to said outriggers, and pressure responsive means responsive to the pressure in the outriggers to operate said change-over means, said pressure responsive means comprising a pressure switch in the conduit communicating with a head end chamber of each vertical outrigger; whereby when said vehicle body is tilted or said outriggers are floating said sensing means causes the required outriggers to operate to maintain said vehicle body in its horizontal position.

2. An automatic horizontal positioning device for a load handling vehicle as set forth in claim 1, wherein said sensing means comprises a bracket fixed to a rear body of the vehicle and having at its upper end a horizontal portion from which a weight is rockably suspended by means of a hook to form slight clearances between the peripheral surface of the weight and contacts of limit switches arranged correspondingly to the positions of said outriggers.

3. An automatic horizontal positioning device for a load handling vehicle as set forth in claim 1, wherein said means responsive to said sensing means comprise magnetic valves including solenoids.

4. An automatic horizontal positioning device for a load handling vehicle having a plurality of outriggers equipped on front and rear portions of both sides thereof, comprising a bracket upstandingly fixed to a stationary base mounted on a body of the vehicle, a weight rockably hanging from said bracket, limit switches arranged around said weight correspondingly to the positions of respective outriggers to form slight clearances between said weight and contacts of said limit switches when said vehicle body is horizontal, magnetic valves included in respective conduits for supplying pressurized fluid to said outriggers for changing over the oil passageways to the head end and rod end chambers, each of said limit switches being included in the electric circuits of said magnet valves, and pressure switches responsive to the increase in hydraulic pressure in the respective head end chambers of said outriggers, so that when said vehicle body is tilted or said outriggers are floating said limit switches cause the required outriggers to operate to maintain said vehicle body in its horizontal position.

* * * * *