The present invention relates to a vehicle stabilizing means, and more particularly to extensible outrigger arms for providing lateral support for heavy-duty mobile cranes, draglines and like equipment.

Although extensible outriggers are well known in the art, previous such outriggers have been unduly restrictive in the amount of lateral and downward extension possible and have required certain manual adjustments which are both time-consuming and, in some instances, dangerous.

Accordingly, a primary object of the present invention is to provide a new and improved extensible outrigger arm system for vehicles which overcomes the above disadvantages.

More specifically, an object of the invention is to provide outrigger arms that can be moved from their inoperative to their desired operative positions from a remote source by one person without requiring any manual adjustment.

Another object of the invention is to provide new and improved extensible outrigger arms having a greater downward adjustment than is possible with previously known outriggers.

Still another object of the present invention is to provide extensible outrigger arms having greater lateral stability in all positions of adjustment than previous outrigger arms.

A further object of the invention is to provide an extensible outrigger arm with a ground-engaging pad that is self-positioning and that is automatically collapsible to a vertical position upon retraction of the arm to its inoperative position.

Another object is to provide an outrigger arm having an oversize ground-engaging pad for providing a maximum load-bearing surface.

Another object is to provide an outrigger arm that is self-locking in any adjusted position of the arm and self-releasing for maximum safety.

In accordance with an illustrated embodiment, an outrigger arm of the invention comprises two telescoping sections including an outer section hinged at one end to one side of the vehicle frame and extends beneath the vehicle frame and beyond the opposite side thereof where an angularly mounted hydraulic cylinder supports in a depending manner the other end of the section for pivotal movement about the hinge axis. A second, inner section of the arm can be extended beyond the movable end of the outer section by a second, hydraulic cylinder mounted within the outer section. A normally horizontal ground-engaging pad pivotally mounted on the outer end of the inner section is engaged by a camming surface of a projecting end portion of the outer arm section when the inner section is fully retracted so as to collapse and maintain the pad in a vertical position when the equipment is moved. Subsequent extension of the inner arm section enables the pad to flop to its horizontal, ground-engaging position. A pivotal locking arm extends downwardly from the same sidewall of the frame as the arm-pivoting cylinder and becomes engaged in one of several notches formed by ratchet-like ribs provided on the upper surface of the outer arm section when the arm is pivoted downwardly from beneath the vehicle frame so as to prevent subsequent upward movement of the outrigger arm without disengaging the locking arm. An adjustable-tension spring device automatically releases the locking arm when the outrigger arm is lowered slightly, thus enabling subsequent raising of the outrigger. Guide means are provided on the frame for preventing lateral displacement of the outrigger in all positions thereof.

The above and other objects and advantages will become more apparent from the following description and the accompanying drawings wherein:

FIG. 1 is a side elevational view of a vehicle-supported crane structure fitted with outriggers in accordance with the present invention;

FIG. 2 is a rear-end elevational view of the vehicle of FIG. 1;

FIG. 3 is an enlarged view partly in section of a rear-end portion of the vehicle frame with the rear end plate removed to show the details of mounting of the rearmost pair of outriggers on the vehicle frame, the outriggers being shown in a retracted position;

FIG. 4 is a view similar to FIG. 3 but with the outrigger arms extended in a vehicle-supporting position, and with parts of the telescoping arm sections broken away to show the internal construction thereof;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 3 showing the guide means for preventing lateral displacement of the outrigger arms; and

FIG. 6 is an enlarged perspective view showing the self-releasing lock feature of the outrigger arms.

With reference to the drawings, FIGS. 1 and 2 illustrate schematically a mobile crane 10 including a crane boom 12 and cab 14 mounted on a turntable 16 for swiveling movement on a vehicle frame 18, the frame being supported when in transit by front and rear wheels 20. The frame carries two pairs of outrigger arms 22 including a first pair between the front and rear wheels of the vehicle and a second pair just behind the rearmost wheels of the vehicle for providing the vehicle with lateral stability when the crane is operating. It will be understood that although the outriggers are illustrated on a crane, they may be used with equal advantage on power shovels, log-loading equipment, and other heavy mobile equipment which requires additional lateral stability when the boom is operating.

FIGS. 3 and 4 illustrate the rear pair of outrigger arms 22a and 22b with the rear end plate 24 (see FIG. 2) of the vehicle frame removed to reveal the details of mounting of the arms on the frame 18. Referring specifically to the rearmost outrigger arm 22a, each arm includes a hollow, rectangular outer arm section 26 hingedly mounted at its inner end 28 on an upwardly projecting pair of ears 30 to a lower sidewall portion 32 of the vehicle frame 18 by a hinge pin 31. The arm section 26 extends laterally beneath the bottom wall 34 of the vehicle frame and beyond the opposite sidewall 36 thereof. A second arm section 38 is telescopically mounted within the first arm section 26 and is telescoped by a fluid-actuated power cylinder 40. The cylinder is hinged by an anchor at one end by mounting bracket 42 to the inner end of the outer arm section 26 and has a piston rod 44 which extends within the hollow interior of the second arm section where it is pinned at 46. A ground-engaging pad 48 is pivoted at 50 to a project-
ing outer end portion 51 of the inner arm section 38 and provides a bearing surface for transmitting to the ground at least a portion of the dynamic load of the vehicle when the vehicle-supported crane is operating. As shown best in FIGS. 3 and 4, a projecting end portion 52 extends outwardly from the lower, outer end of the outer arm section 37 and has an outer engaging surface 54 which engages the upper surface of the pad 48 to swing the latter upwardly to a generally vertical position and maintain it in such position when the inner arm section 38 is retracted to its full extent. Thus, retraction of the inner arm section automatically lifts the pad to a vertical position so that the pad clears the rearmost wheels 20 and reduces to a minimum the overall width of the vehicle when in transit. Subsequent extension of the inner arm section when setting up for operation allows the pad to flop to a horizontal disposition for engaging the ground surface since the center of gravity of the pad is positioned laterally outside of its pivotal axis 50 while the pad is collapsed. This is one of the features which permits the outriggers to be placed in their operative positions and collapsed to their inoperative positions by a single man while he remains at the controls of the vehicle.

As shown in FIG. 4, each of the ground-engaging pads 48 is of nonsymmetrical construction, with the laterally outwardly directed pad portions having a greater bearing surface than the laterally inwardly directed portions. This construction provides a maximum bearing surface area for each pad greater than that which could be provided if each of the pads were made symmetrically with respect to the pivot pin 50, since the size of the inwardly directed portion of the pad is limited by the clearance which must be provided between the pad and the ground when the pad is in its collapsed, vertical position.

A second fluid-actuated power cylinder 56 is provided for swinging each outrigger arm about its pivotal connection from a generally horizontal, collapsed position to a downwardly inclined position for supporting the vehicle. The cylinder 56 for the arm 22a is pivotally mounted at 58 to the upper side 36 of the vehicle frame 18 opposite the side 32 to which the same arm is pivotally mounted.

The cylinder 56 has a piston rod 60, upon which is pivoted at 62 to the outer end of the first arm section 26 at a position such that the longitudinal axis of the cylinder extends laterally outwardly and downwardly from the side 36 of the frame at an angle of approximately 45° to the sidewall of the frame and to the horizontal when the arms are approximately horizontal. Thus, upon extension of the arm 22a to a load-supporting position as shown in FIG. 4, the axis of the cylinder 56 remains in an angular disposition relative to the frame and arm. It has been found that by mounting the arm-pivoting cylinders 56 at a relatively large oblique angle relative to the vertical, or sidewall of the frame, rather than in a generally vertical position as in some prior art outrigger systems, a cylinder having a much longer stroke than usual can be employed for pivoting the outrigger arms, and thus a considerably greater vertical adjustment of the arms can be obtained than was heretofore possible without providing additional adjustment features. This is important in that the angularly mounted cylinders 56 provide the only necessary means of vertical adjustment of the outriggers, whereas in prior art devices utilizing vertical arm-pivoting cylinders it has been necessary to provide vertically adjustable pads in addition to the vertical movement of the arms in order to obtain the desired maximum vertical adjustment of the outrigger system.

Each outrigger arm also has a self-locking feature whereby the arms are automatically locked in any adjusted position thereof upon pivoting such arms in a downward direction so that in the event one of the arm-pivoting cylinders 56 should fail, the associated locking device will maintain such arm in approximately the same position it is in when failure occurs. As shown in FIGS. 3 and 4, the locking means includes a locking arm 64 for each outrigger arm, the locking arm for outrigger 22a being hinged at 66 to the outer sidewall 36 of frame 18 beneath the associated cylinder 56. A series of rib members 68 spaced apart along the upper surface of the outer arm section 26 define notches therebetween for receiving the lower end of the locking arm 64.

When the outrigger arm is horizontal, the lower end of the locking arm rests against the upper surface of the arm section 26 near the cylinder 56 and laterally outwardly of the ribs 68. However, as the outrigger arm is lowered by the cylinder 56 from its FIG. 3 position to its FIG. 4 position, the locking arm 64 swings downwardly by gravity so that its lower end rides along the upper surface of the arm section 26 over the ribs 68. When the outrigger arm is in its desired lowered position, it is then raised slightly to cause the lower end of the locking arm to lodge in the closest one of the notches so that the locking arm supports at least some, if not all, of the load that would otherwise be supported wholly by the cylinder 56. Thus, if the cylinder 56 should fail, the locking arm 64 would continue to support the outrigger arm 22a to prevent its collapse.

The locking arm has a self-releasing feature. This feature is shown best in FIG. 6, and includes a small projecting bracket 70 at the outer end of the cylinder 56 which bracket is provided with a keyhole slot 72 within which a length of chain 74 is adjustably secured. A tension spring 76 is attached at one end to one end of the chain and at the other end to the lower end of the locking arm 64. The tension in the spring is adjusted by adjusting the length of chain between the bracket and the spring. Prior to lowering the outrigger arm, a large amount of slack is provided in the chain portion so that the locking arm will drop into one of the notches when the outrigger is lowered to its desired position. After the locking arm is lowered, the tension in the spring is adjusted so that the slack is removed from the chain by sliding the chain to the enlarged portion of the slot and pulling on the finger ring 78 at the free end of the chain. Sufficient tension is placed on the spring when in its adjusted position so that when the outrigger is lowered slightly by extending the piston rod 60, the locking arm will spring out of the notch in which it is wedged to permit raising the outrigger to its retracted position.

Guide means are provided on the frame 18 to prevent each of the outrigger arms 22a and 22b from being displaced laterally as they are raised and lowered and while in their retracted position. As shown, the outrigger arms 22a and 22b are mounted in side-by-side relationship so that when at least in their collapsed position each one tends to prevent lateral displacement of the other in one direction. However, without the provision of guide means on the frame, lateral displacement of the outrigger arms in the opposite direction would not be prevented. The guide means for this purpose includes an inner guide member 80 which depends vertically from the bottom 34 of the frame 18 and which is reinforced laterally by an angular reinforcing member 82 to prevent lateral displacement of the arm 22b in a forward direction. The inner guide member 80 is mounted near the right-hand side of the frame as viewed in FIGS. 3 and 4 where the arm 22b undergoes its greatest vertical movement, although such member is not visible in such views. Another, outer guide member 84 extends vertically through the rear end plate 86 and has a shoulder 88 at the rear end of one of the outrigger arms 22a and 22b to prevent rearward lateral displacement of the rearmost outrigger arm 22a during the raising and lowering of such arm. A web reinforcing member 86 provides lateral support for the guide member 84.

In addition to the above guide members, the undersides of the outrigger arms 22a and 22b are provided in the region 82 and 89, respectively. The guide member 88 is attached to the underside of the first arm section 26 of arm 22a near its pivoted end to prevent lateral displacement of the arm 22b toward arm 22a when the former is lowered.
Similarly, the guide member 89 is attached in a corresponding position on the opposite arm 22b to prevent lateral displacement of arm 22a as the latter is lowered.

Although the foregoing description has been with regard primarily to the rearmost outrigger arm 22a, it is to be understood that each of the four outrigger arms 22 is of similar construction and is mounted in a similar manner to the vehicle frame. Moreover, the interrelationship of the forward pair of arms 22 is the same as that described heretofore with respect to the rear pair of arms.

Having illustrated and described a preferred embodiment of the invention, it should be apparent to those skilled in the art that the invention permits of modification in arrangement and detail. I claim as my invention all such modifications as come within the true spirit and scope of the appended claims.

I claim:

1. In a vehicle including a wheel-supported frame, vehicle-stabilizing means comprising:
   an outrigger arm including a first arm section pivoted to one side of said frame and extending beneath said frame beyond the opposite side thereof,
   a second arm section telescoping mounted within said first arm section,
   means within said first arm section for extending and retracting said second arm section,
   a ground-engaging pad mounted on the outer end of said second arm section,
   means on said frame for raising and lowering said first arm section about its pivotal axis,
   locking means including a locking arm on said opposite side of said frame and cooperative notch-defining means on said first arm section for locking said outrigger arm in a lowered position thereof,
   and adjustable tensioning means attached to said locking arm for releasing said locking arm from locking engagement with said notch-defining means upon a slight lowering of said outrigger arm relative to said frame.

2. In a load-handling vehicle including a mobile frame having opposite, longitudinally extending sides, a pair of extensible outrigger arms extending side-by-side in opposite directions beneath said frame and laterally beyond opposite sides thereof,
   each of said arms including a hollow first arm section pivoted at its inner end to said frame at one side of said frame and terminating at an outer end beyond the other side of said frame,
   and a second arm section telescoping mounted within said first arm section,
   a first power cylinder means within said first arm section for extending said second arm section beyond the outer end of said first arm section,
   a second power cylinder means pivoted to said other side of said frame and to said first arm section for swinging said first arm section about its pivotal connection to said frame,
   an arm-stabilizing means for restraining said arms against lateral movement when said arms are lowered into their frame-supporting positions,
   said stabilizing means including first rigid means extending downwardly from adjacent the inner end of each of said arms and slidably engaging the facings of the other side of the first arm section near the outer end thereof when said arms are in their lowered frame-supporting positions so that said first arm sections are mutually restrained against lateral movement toward one another,
   said stabilizing means including second rigid means extending downwardly from said frame and slidably engaging the outer side of each first arm section near the outer end thereof when each said arm is in its frame-supporting position so that said first arm sections are restrained against lateral movement away from one another,
   whereby said stabilizing means rather than said second cylinder means restrain said frame against longitudinal movement when said frame is supported on said arms.

3. In a load-handling vehicle including a mobile frame having opposite, longitudinally extending sides, a pair of extensible outrigger arms extending side by side in opposite directions beneath said frame and laterally beyond opposite sides thereof, each of said arms including a hollow first arm section pivoted at its inner end to said frame at one side of said frame and terminating at an outer end beyond the other side of said frame, and a second arm section telescoping mounted within said first arm section,
   a first power cylinder means within said first arm section for extending said second arm section beyond the outer end of said first arm section,
   a second power cylinder means pivoted to said other side of said frame and to said first arm section for swinging said first arm section about its pivotal connection to said frame,
   the improvement comprising,
   a ground-engaging pad pivoted to the outer end of said second arm section,
   said pad being disposed, by gravity, in a generally horizontal load-supporting position when said second arm section is extended outwardly beyond said first arm section,
   and means projecting outwardly from the outer end of said first arm section for engaging said pad and cumbering the same to a generally vertical position upon retraction of said second arm section fully within said first arm section.

4. In a load-handling vehicle including a mobile frame having opposite longitudinal extending sides, a pair of extensible outrigger arms extending side-by-side in opposite directions beneath said frame and laterally beyond said opposite sides,
   each of said arms including a hollow first arm section pivoted at its inner end to said frame at one side of said frame and terminating at an outer end beyond the other side of said frame,
   and a second arm section telescoping mounted within said first arm section,
   a first power cylinder means within said first arm section for extending said second arm section beyond the outer end of said first arm section,
   a second power cylinder means pivoted to said other side of said frame and to said first arm section for swinging said first arm section about its pivotal connection to said frame,
   said second power cylinder means being positioned with respect to said frame and said first arm section so that the longitudinal axis of said second power cylinder means extends laterally outwardly of and downwardly from said frame at an oblique angle to the horizontal and vertical in all positions of adjustment of the connected said outrigger arm,
   arm stabilizing means for restraining said arms against lateral movement when said arms are lowered into their frame supporting positions, including rigid means extending downwardly from said frame and slidably engaging the outwardly facing sides of both said first arm sections near the outer ends thereof when said sections are in their frame supporting positions so that said first arm sections are restrained against lateral movement away from one another,
   said stabilizing means further including rigid means on each of said first arm sections engaging the other said first arm section near the outer end thereof.
when said outrigger arms are in their lowered frame supporting positions so that said first arm sections are mutually restrained against lateral movement toward one another,

a ground engaging pad pivoted to the outer end of each said second arm section including means disposing said pad generally horizontally when said second arm section is fully extended,

and cooperative locking means on said first arm sections and on said frame for locking outrigger arms in lowered frame supporting positions.

References Cited by the Examiner

UNITED STATES PATENTS

3,021,015 2/1962 Bowman 212—145
3,021,016 2/1962 Noll et al. 212—145
3,073,458 1/1963 Wieschel 212—145

EVON C. BLUNK, Primary Examiner.

SAMUEL F. COLEMAN, Examiner.

A. L. LEVINE, A. H. NIELSEN,
Assistant Examiners.