Feb. 6, 1962 S. BOWMAN 3,019,913

OUTRIGGERS FOR POWER SHOVELS, CRANES OR THE LIKE

Filed Aug. 15, 1960 2 Sheets-Sheet 1

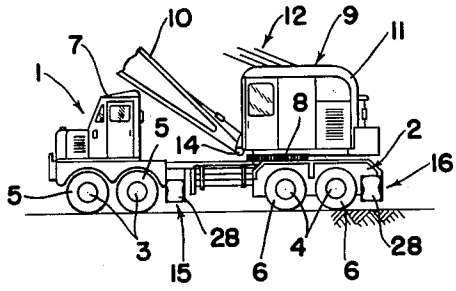


FIG. 1

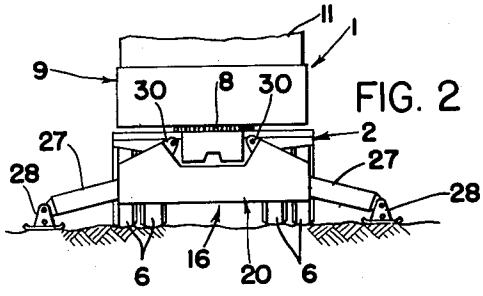


FIG. 2

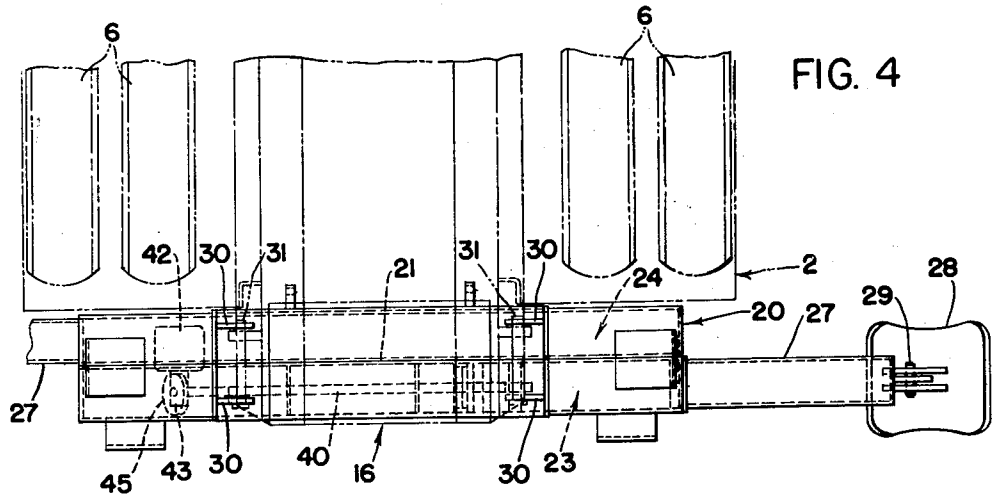


FIG. 4

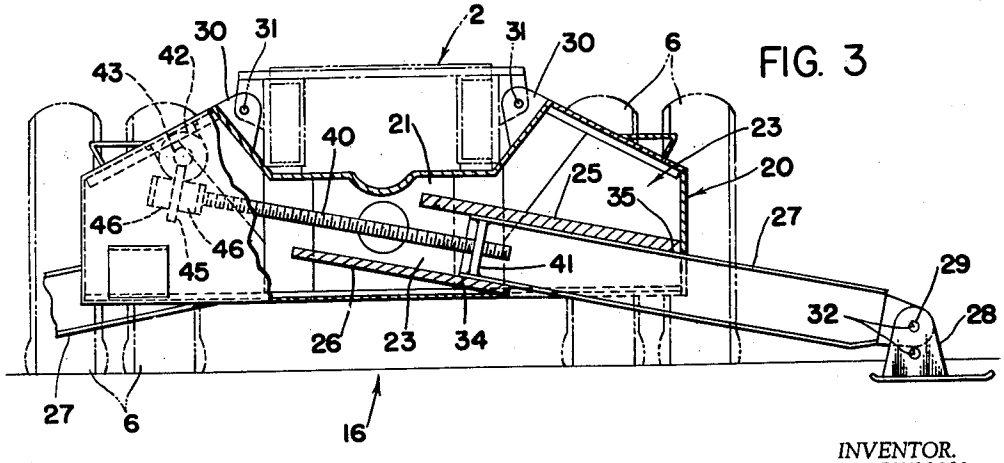


FIG. 3

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FIG. 6

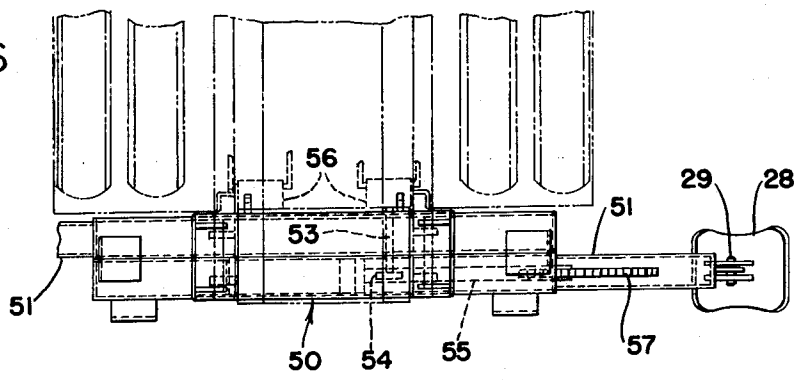


FIG. 5

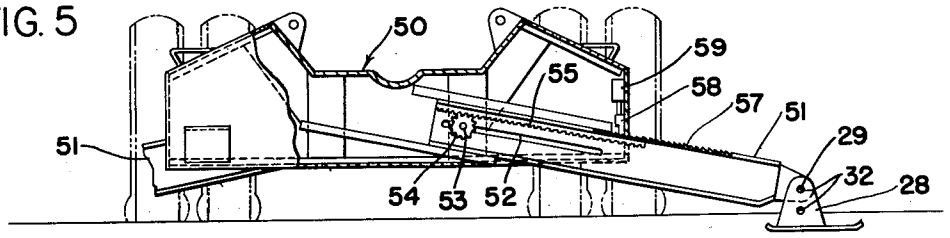


FIG. 8

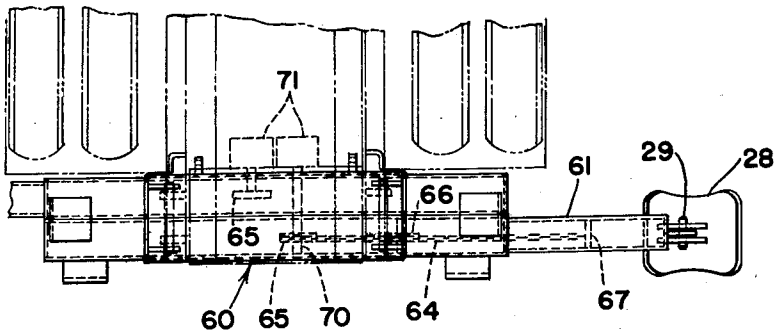
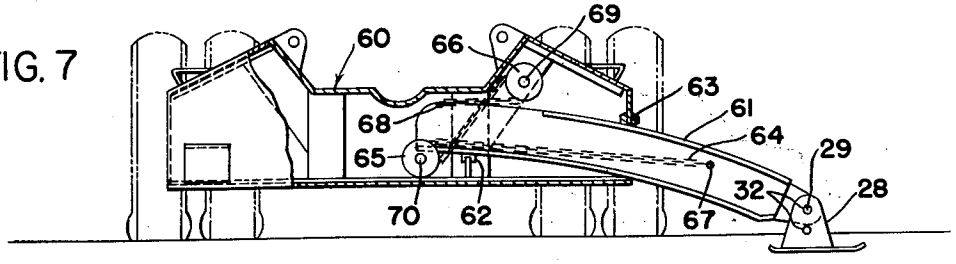


FIG. 7



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OUTRIGGERS FOR POWER SHOVELS, CRANES OR THE LIKE

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Filed Aug. 15, 1960, Ser. No. 49,624
20 Claims. (Cl. 212—145)

The present invention relates generally as indicated to outriggers for power shovels, cranes, or the like, and more particularly, to automatic power-operated outriggers that embody certain improvements over those disclosed in the A. O. Felkner U.S. Pat. No. Re. 24,482, reissued June 3, 1958 (original U.S. Pat. No. 2,740,538, dated April 3, 1956), and in my copending U.S. application, Serial 803,597, filed April 2, 1959.

Heretofore, it has been a prevalent practice to provide power shovels, cranes, and like equipment with outriggers that are in the form of horizontally slidable beams contained in boxes mounted on the frames of such equipment and adapted to be pulled manually out of such boxes and to have blocks inserted under their outer ends, some outrigger beams being provided with jack screw actuated floats at their outer ends to eliminate the need of such blocking up. It is also known to provide horizontal power-operated outrigger beams moved out as by hydraulic cylinders and provided with screw jack floats that are power operated as by means of rotary hydraulic motors.

A disadvantage of such known outriggers is the relatively great length of time which it takes to extend the outrigger beams and to either actuate the floats thereof, or to block up the outer ends of the outrigger beams.

Accordingly, it is a primary object of this invention to provide an automatic power-operated outrigger which is provided with beams that slope downwardly and outwardly so that, when protracted from opposite sides of the frame of the equipment, they move both down and out to ground-engaging position, the beams having ground-engaging floats pivotally mounted thereon arranged to automatically swing to ground-engaging position when the beams are moved out from the opposite open ends of the outrigger box and to be folded or swung up to generally vertical position closing the ends of said box when the beams are moved into said box.

It is another object of this invention to provide an outrigger as aforesaid, having a beam which is moved to ground-engaging position and to retracted position within the beam box, or housing, through positive mechanical power means, the latter preferably being of the self-locking or irreversible type so as to securely lock the outrigger beam against collapse at any extended position.

It is another object of this invention to provide an outrigger of the character indicated which may be used as a jacking means for lifting the carrier from the ground for tire or wheel changes, or for lifting the wheels from soft spots in the ground, whereby planks or the like may be inserted under the wheels.

It is another object of this invention to provide an outrigger of the character indicated which enables leveling of the carrier on sloping ground thereby eliminating uphill swinging of the boom and thereby decreasing swing clutch wear and tear and relieving long booms of hazardous side loadings.

It is another object of this invention to provide an outrigger of the character indicated which may be operated from the driver's cab and/or from the crane cab.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, this being indicative, however, of a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:

FIG. 1 is a side elevation view of a motor crane which has two sets of outriggers in accordance with the present invention installed transversely respectively at the rear and between the front and rear axles of the carrier frame, the beams thereof being shown in fully retracted positions with the floats thereof folded up to constitute closures for the open-ended outrigger boxes, each box containing a pair of beams disclosed in side-by-side relation for extention transversely from the opposite sides of the carrier frame;

FIG. 2 is a fragmentary rear elevation view on slightly enlarged scale showing the outriggers in extended ground-engaging positions;

FIG. 3 is a fragmentary rear elevation view partly in cross-section showing an outrigger beam arranged to be actuated by self-locking worm and screw drive means;

FIG. 4 is a top plan view of the outrigger assembly shown in FIG. 3;

FIGS. 5 and 6 are rear cross-section and top plan views of another embodiment of this invention wherein a self-locking worm drive and a gear and rack arrangement are provided for actuating each outrigger beam; and

FIGS. 7 and 8 are rear cross-section and top plans of yet another embodiment wherein a self-locking worm drive and a chain and sprocket wheel arrangement is provided for actuating each outrigger beam.

Referring now more particularly to the drawings and first to FIGS. 1 and 2, there is shown therein a motor crane 1 comprising a carrier frame 2 provided with front and rear axles 3 and 4 upon which front and rear wheels 5 and 6 are mounted. Adjacent the front end of the frame 1 there is mounted the driver's cab 7 and on an intermediate portion of the frame, usually above or forward of the rear axles 4, is a turntable 8 on which the crane assembly 9 is mounted for turning about a vertical axis. Said crane assembly 9 includes a boom 10 and a crane cab 11 in which the crane operator manipulates the controls (not shown) and cables 12 for swinging the boom 10 about the turntable axis and for raising and lowering the boom 10 about the boom pivot 14.

The carrier frame 2 also has mounted transversely therebeneath between the front and rear axles 3 and 4, and to the rear of the rear axles 4, the respective outrigger assemblies 15 and 16. As known in the art, outrigger assemblies 15 and 16 are provided on equipment of this nature so that heavy loads handled by the boom on either side of the crane may be safely handled without danger of tipping, and without imposing excessive loads on the springs, axles, and tires.

In the ensuing description and drawings reference is made particularly to the outrigger assembly 16 which is mounted at the rear end of the carrier frame 2 and it is to be understood that the other outrigger assembly 15 which is mounted between the front and rear axles 3 and 4 is of the same general construction as the rear assembly 16 so as not to require separate illustration and description.

It should also be noted that dual controls are preferably provided so that the outriggers 15 and 16 may be manipulated either through the rear window of the driver's cab 7 or from within the crane cab 11.

As shown in FIGS. 3 and 4, the outrigger box or

housing 20 is of generally rectangular cross-section with a vertical partition 21 therein providing two compartments 23 and 24, the compartment 23 being open at its right end and the compartment 24 being open at its left ends. Longitudinally slidably mounted in each compartment between the guide plates 25 and 26 is a rectangular cross-section beam 27. The outer end of each beam 27 has a float 28 pivotally mounted thereon by means of the pin 29 so as to be swung up to vertical position against the end of the outrigger housing 20. The housing 20 is formed with lugs 30 by which it is detachably pinned by pins 31 to the carrier frame 2.

In the construction shown in FIGS. 3 and 4 each beam 27 is preferably straight, and is guided in the box compartment for sliding along a path that slopes down and out from the respective open end at a relatively small angle such as, for example, 10–12° whereby, as the beams 27 are moved outwardly of the housing 20, the outer ends simultaneously move downwardly and outwardly to ground-engaging position. Each float 28 is provided with two sets of vertically spaced holes 32 so that it may be positioned on the pin 29 to best suit the ground conditions at the site where the outriggers 15 and 16 are to be used.

By reason of the small angle of slope of the beams 27 as aforesaid, they are thereby frictionally locked against inadvertent retraction by the upward reaction of the ground against the floats 28. Thus, in the position shown in FIG. 3, for example, the upward ground reaction at the float pivot 29 results in a force couple at relatively widely spaced apart points 34 and 35 and, moreover, by reason of the degree of slope, the longitudinal force component is insufficient to overcome the much larger normal component multiplied by the coefficient of friction.

As a further safety feature to prevent collapse of the beams 27 by jarring or vibration, they are each extended and retracted by a screw 40 which has threaded engagement with a nut 41 welded or otherwise fixed across the inner end of each beam 27. Thus, the screw actuating means itself provides for self-locking against longitudinal movement of the beams 27 except by turning of the screws 40. Furthermore, each screw 40 may be driven in opposite directions by a reversible motor 42 having a worm 43 on its drive shaft engaging a worm wheel 45 on said screw 40. The reversible motors 42 for the respective beams may be electric motors, if desired, but preferably, the motors are hydraulic motors which may conveniently be driven by utilizing the same fluid pressure system that is employed for the power steering mechanism of the crane 1, since that pressure system is not being used at the same time that the outriggers 15 and 16 are manipulated. The screws 40 are rotatably, but axially fixedly, mounted in bearings 46.

Referring now to FIGS. 5 and 6 there is here again provided an outrigger box or housing 50 of generally the same construction as that in FIGS. 3 and 4, to provide rectangular openings at its ends for longitudinal sliding movement of the outrigger beams 51 in downward and outward directions to ground-engaging position. In this case, however, each beam 51 has a longitudinally extending slot 52 through which extends the drive shaft 53 for the drive pinion 54 which meshes with a gear rack 55 affixed to the beam 51. As is apparent, the driving of the drive pinions 54 in opposite directions will protract and retract the respective beams 51 from and into the housing 50. Here again, as in FIGS. 3 and 4, the beams 51 are self-locking in any extended position owing to the small downward and outward angle of slope thereof as previously explained. Furthermore, as a safety feature, the shafts 53 for the drive pinions 54 may be provided with worm drive reversible motors 56, preferably hydraulic motors for the reasons aforesaid.

As a still further safety feature, the upper side of each outrigger beam may be formed with ratchet teeth 57 which are engaged by a spring-actuated pawl 58, and to facilitate disengagement of the pawl a single-acting hydraulic cylinder 59 may be provided in each end of the housing 50.

Referring now to the construction shown in FIGS. 7 and 8, it comprises again an outrigger housing 60 quite similar to those shown in FIGS. 3 to 6. In this case, it is preferred to use curved outrigger beams 61, each of which may have, for example, a 16′ radius of curvature and arranged to provide for a force multiplication of about 2:1, that is, for each 2′ of horizontal extension of the beams 61 the floats 28 thereof move down about 1′. The curved beams 61 are of hollow rectangular cross-section and the housing 60 is provided with two sets of friction shoes 62 and 63 therewithin, one set for each beam. The shoes 62 are mounted to engage the bottom sides of the respective beams 61 and the shoes 63 are mounted to engage the top sides of the respective beams 61, such zones of engagement being spaced apart lengthwise of the beams as shown. These shoes 62 and 63 by reason of their wide spacing and angular relation, serve not only as beam guides, but also as wedge locks to immovably support the beams 61 in any extended position. Thus, upward ground reaction at the float pivots 29 will be ineffective to cause inward collapsing movement of the beams 61 and it is, of course, through these guide and locking shoes 62 and 63 that the aforesaid force multiplication of about 2:1, for example, is achieved.

In FIGS. 7 and 8 each beam is extended and retracted through a chain 64 and a pair of sprocket wheels 65 and 66, one end of the chain 64 being hooked, or connected, to the beam at 67 adjacent its outer end and the other end of the chain 64 being connected to the beam at 68 adjacent its inner end and being wrapped over the sprocket wheels 65 and 66 as shown. The sprocket wheel 66 is an idler journalled in the housing on fixed shaft 69, and the other sprocket wheel 65 is the drive sprocket wheel which, again, for safety purposes, is driven by shaft 70 from a worm drive reversible motor 71, again the drive motor preferably being a hydraulic motor for reasons aforesaid. It can be seen from FIG. 7 that when the right drive sprocket 65 is turned in a counterclockwise direction, the outer end of the chain 64 will be pulled inwardly toward the left to pull the beam 61 into housing 60. On the other hand, when the right drive sprocket 65 is turned in a clockwise direction the inner end of the chain 64 will be pulled toward the right to extend the beam 61 to ground-engaging position.

For purposes of leveling, the crane or other equipment is provided with a bubble level (not shown) and by thus leveling the equipment there is a substantial saving in swing clutch wear and tear, since uphill swinging of the boom is eliminated. Such leveling also relieves long booms of hazardous side loadings. Another feature of this invention is that one or both sides of the carrier 2 may be lifted from the ground to provide for quick jacking up of the wheels 5 and 6 for tire changes or for lifting the wheels out of soft spots in the ground. Because there are two longitudinally spaced beams on each side of the crane, the crane also may be leveled fore and aft.

In general, for highway travel, the outrigger beams are fully retracted and the floats 28 automatically fold back flush against the ends of the boxes and housings for maximum road clearance, as best shown in FIG. 1, for example. However, for frequent on the job moves the beams need only be retracted until the floats 28 have about 8″ of ground clearance and such retraction may be effected in a matter of twenty seconds or less, whereupon the machine 1 may be moved to the next position, whereupon in another twenty seconds or less the beams are extended to ground-engaging position to start productive work. Thus, the total time for move-ups would only be forty seconds or less plus the travel time.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In an outrigger of the type which is characterized by the provision of a beam and actuating means therefor which are adapted to be mounted on a carrier for longitudinal movement of said beam by said actuating means simultaneously outwardly and downwardly from a retracted position clearing the ground to an extended position whereat an end thereof is engaged with the ground; the combination therewith of support means on said carrier engaging the top and bottom sides of said beam at points that are located to resist upward swinging of said beam by upward reaction of the ground against such one end and to provide frictional locking of said beam in extended position without aid of said actuating means; said actuating means comprising a reversible motor and self-locking power transmission means operatively connected between said motor and said beam as a further safety feature against inadvertent collapse of said beam from extended position.

2. The outrigger of claim 1 wherein said power transmission means includes a worm drive.

3. The outrigger of claim 1 wherein said power transmission means includes a screw driven by said motor and having threaded engagement with a nut secured to said beam.

4. The outrigger of claim 1 wherein said power transmission means includes a driven pinion gear meshing with a longitudinal gear rack secured to said beam.

5. The outrigger of claim 1 wherein said power transmission means includes a pinion gear driven by said motor and meshing with a longitudinal gear rack secured to said beam, said beam being additionally provided with ratchet teeth, and said support means having a movable ratchet pawl engageable with said teeth to lock said beam in any extended position.

6. The outrigger of claim 1 wherein said power transmission means includes an inextensible flexible element having its ends connected to said beam at longitudinally spaced points, and means engaged with said element to alternately apply tension on such ends to extend and retract said beam.

7. In an outrigger of the type which is characterized by the provision of a beam and actuating means therefor which are adapted to be mounted on a carrier for longitudinal movement of said beam by said actuating means simultaneously outwardly and downwardly from a retracted position clearing the ground to an extended position whereat an end thereof is engaged with the ground; the combination therewith of support means on said carrier engaging the top and bottom sides of said beam at points that are located to resist upward swinging of said beam by upward reaction of the ground against such one end and to provide normal reaction forces thereat which when multiplied by the coefficient of friction of said support means and said beam exceeds the force component of such upward reaction acting longitudinally of said beam thereby locking said beam in extended position without aid of said actuating means; said actuating means comprising a reversible motor and self-locking power transmission means operatively connected between said motor and said beam as a further safety feature against inadvertent collapse of said beam from extended position.

8. In an outrigger of the type which is characterized by the provision of a beam and actuating means therefor which are adapted to be mounted on a carrier for longitudinal movement of said beam by said actuating means simultaneously outwardly and downwardly from a retracted position clearing the ground to an extended position whereat an end there is engaged with the ground; the combination therewith of guide means on said carrier engaging the top and bottom sides of said beam at points that are located to provide frictional locking of said beam in extended position without aid of said actuating means; said actuating means comprising a reversible motor and self-locking power transmission means operatively connected between said motor and said beam as a further safety feature against inadvertent collapse of said beam from extended position.

9. An outrigger comprising a hollow housing open at one end and adapted to be mounted in transverse, generally horizontal position on a carrier; a beam in said housing having a ground-engaging float at an end thereof; guide means in said housing respectively engaging the top and bottom sides of said beam at longitudinally spaced points serving to guide said beam for longitudinal movement through such open end from a retracted position in said housing to an extended position whereat said float is moved out and down simultaneously to ground-engaging position spaced to one side of the carrier; and actuating means in said housing operative to move said beam to extended position and back to retracted position; said actuating means comprising a reversible motor and self-locking power transmission means operatively connected between said motor and said beam as a further safety feature against inadvertent collapse of said beam from extended position.

10. The outrigger of claim 9 wherein said power transmission means includes a worm drive.

11. The outrigger of claim 9 wherein said power transmission means includes a screw driven by said motor and having threaded engagement with a nut secured to said beam.

12. The outrigger of claim 9 wherein said power transmission means includes a drive pinion gear meshing with a longitudinal gear rack secured to said beam.

13. The outrigger of claim 9 wherein said power transmission means includes a pinion gear driven by said motor and meshing with a longitudinal gear rack secured to said beam, said beam being additionally provided with ratchet teeth, and said housing having a movable ratchet pawl engageable with said teeth to lock said beam in any extended position.

14. The outrigger of claim 9 wherein said power transmission means includes an inextensible flexible element having its ends connected to said beam at longitudinally spaced points, and means engaged with said element to alternately apply tension on such ends to extend and retract said beam.

15. An outrigger assembly comprising a hollow housing open at both ends and adapted to be mounted in transverse, generally horizontal position on a carrier; a pair of beams disposed in side by side relation in said housing and each having a ground engaging float at one end thereof; guide means in said housing respectively engaging the top and bottom sides of each beam at longitudinally spaced points serving to guide said beams for longitudinal movement through the respective open ends from retracted positions in said housing to extended positions whereat said floats are moved out and down to ground-engaging positions on opposite sides of the carrier; and power means operative to independently move said beams as aforesaid; said power means comprising reversible motors and self-locking power transmission means operatively connected between the respective motors and beams to preclude inadvertent collapse of said beams from extended positions.

16. The outrigger assembly of claim 15 wherein said power transmission means includes a worm drive.

17. The outrigger assembly of claim 15 wherein said power transmission means includes a screw driven by said motor and having threaded engagement with a nut secured to said beam.

18. The outrigger assembly of claim 15 wherein said

power transmission means includes a drive pinion gear meshing with a longitudinal gear rack secured to said beam.

19. The outrigger assembly of claim 15 wherein said power transmission means includes a pinion gear driven by said motor and meshing with a longitudinal gear rack secured to said beam, said beam being additionally provided with ratchet teeth, and said housing having a movable ratchet pawl engageable with said teeth to lock said beam in any extended position.

20. The outrigger assembly of claim 15 wherein said power transmission means includes an inextensible flexible element having its ends connected to said beam at longitudinally spaced points, and means engaged with said element to alternately apply tension on such ends to extend and retract said beam.

No references cited.