United States Patent [19]

McCollum

[11] **3,877,544**

[45] **Apr. 15, 1975**

[54] **STRESS BALANCED EXTENDIBLE BOOM STRUCTURE**

[75] Inventor: **Fenwick Harris McCollum,** Los Angeles, Calif.

[73] Assignee: **Del Mar Engineering Laboratories,** Los Angeles, Calif.

[22] Filed: **July 13, 1973**

[21] Appl. No.: **379,097**

Related U.S. Application Data

[63] Continuation of Ser. No. 189,361, Oct. 14, 1971.

[52] **U.S. Cl.** **182/141;** 182/2; 52/109

[51] **Int. Cl.** **B66f 11/04**

[58] **Field of Search** 182/2, 69, 141, 148, 157; 52/109

[56] **References Cited**

UNITED STATES PATENTS

214,224	4/1879	Winters	182/69
391,188	10/1888	Piche	182/141
539,672	5/1895	Decker	182/141
3,095,061	6/1963	Gregory	182/2
3,470,981	10/1969	Huxley	182/141
3,486,583	12/1969	Wiklund	182/141

Primary Examiner—Reinaldo P. Machado

Attorney, Agent, or Firm—George Fred Smyth

[57] **ABSTRACT**

A lazy tong or scissor-type of extendible boom structure having one end mounted on a platform. The boom structure can be extended, elevated, and/or rotated independently by drive structure mounted on the platform and a load-carrying basket is mounted on the opposite end of the boom. The boom comprises a pair of parallel lazy tongs, each comprising pairs of beams which are pivoted to one another in scissorlike fashion, the pivoted beams opposite each other on the two lazy tongs forming one "bay." Stress transmitting rigid structural cross members are fixed between the inner beams of each bay and similar cross members are nested at interference-free positions and between the outer beams of each bay to balance the torque within the pair of lazy tongs and prevent rotation of the beams and consequent twisting of the extended boom when an asymmetrical load is applied thereto, such as by an off-center load in the platform or basket or by the locating of the platform base in a non-horizontal plane.

11 Claims, 6 Drawing Figures

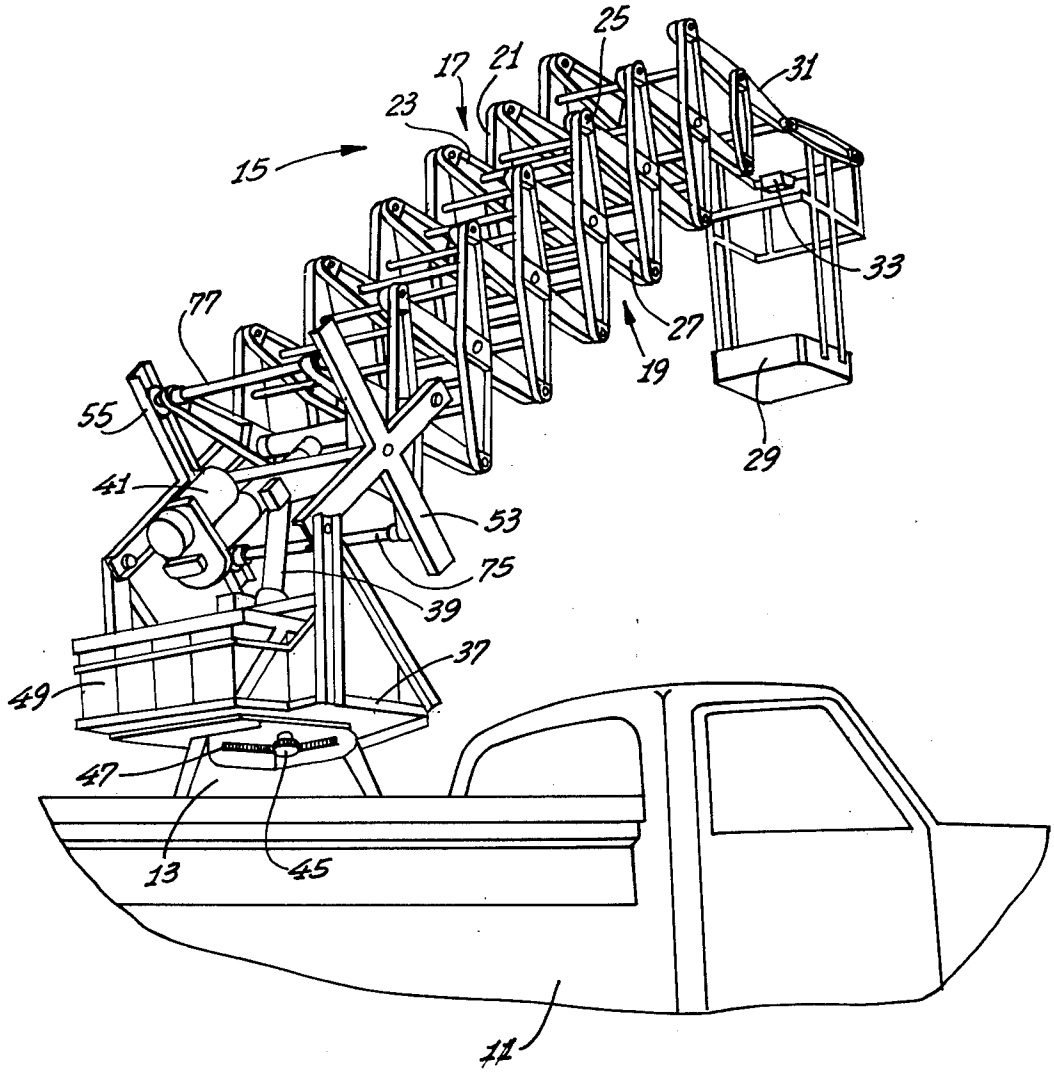


Fig. 4

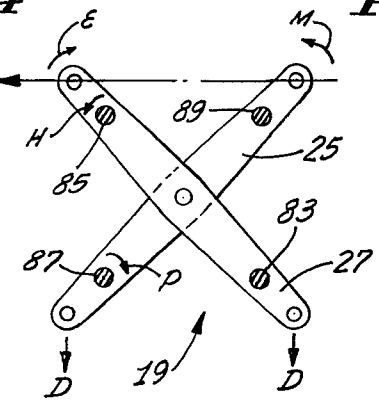


Fig. 5

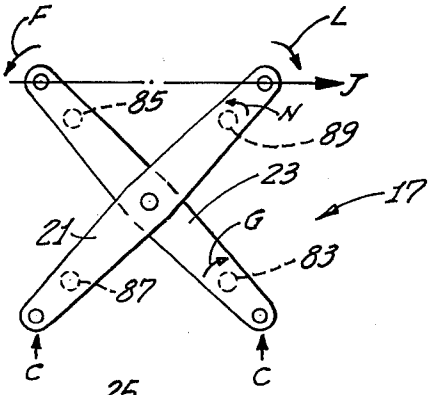


Fig. 1

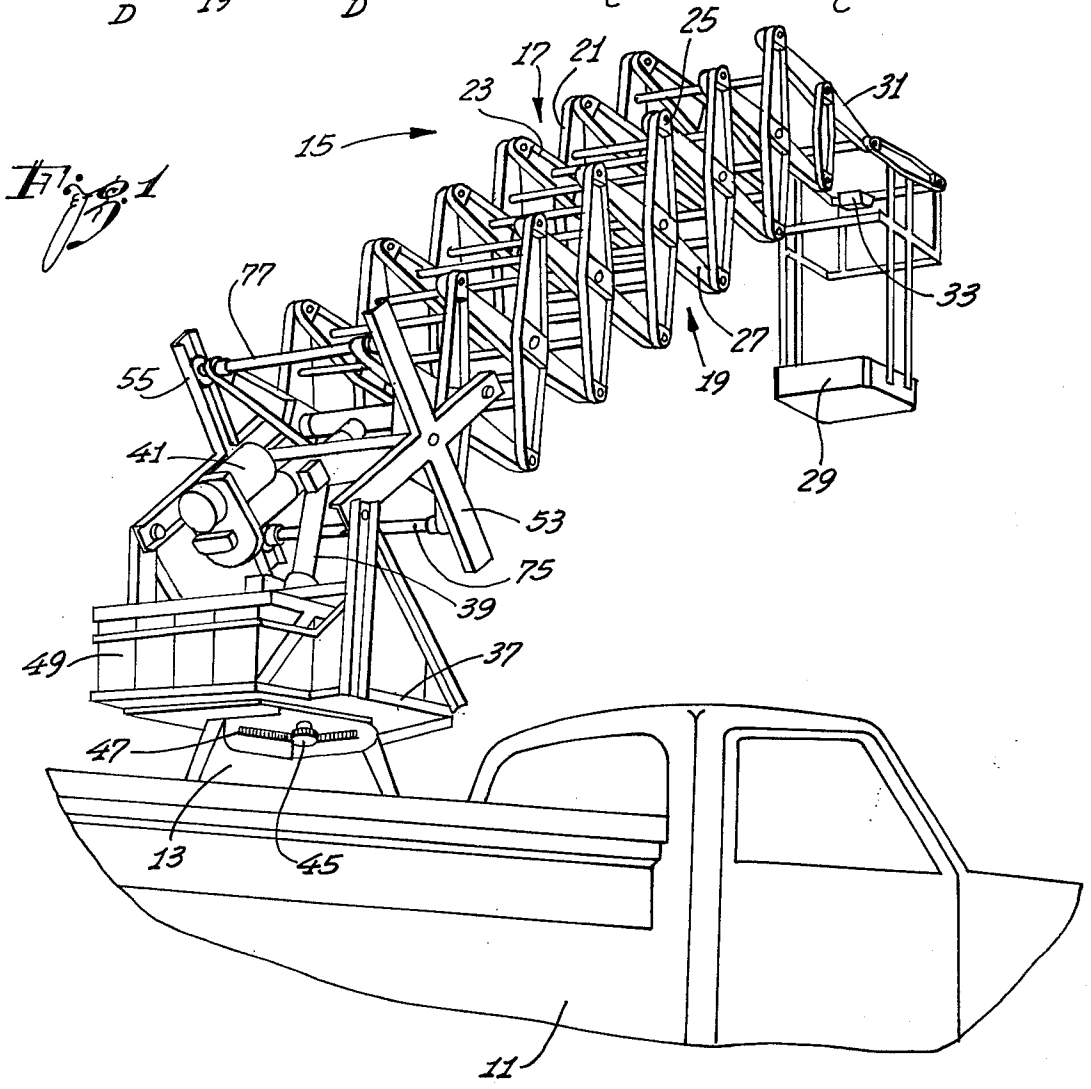


Fig. 2

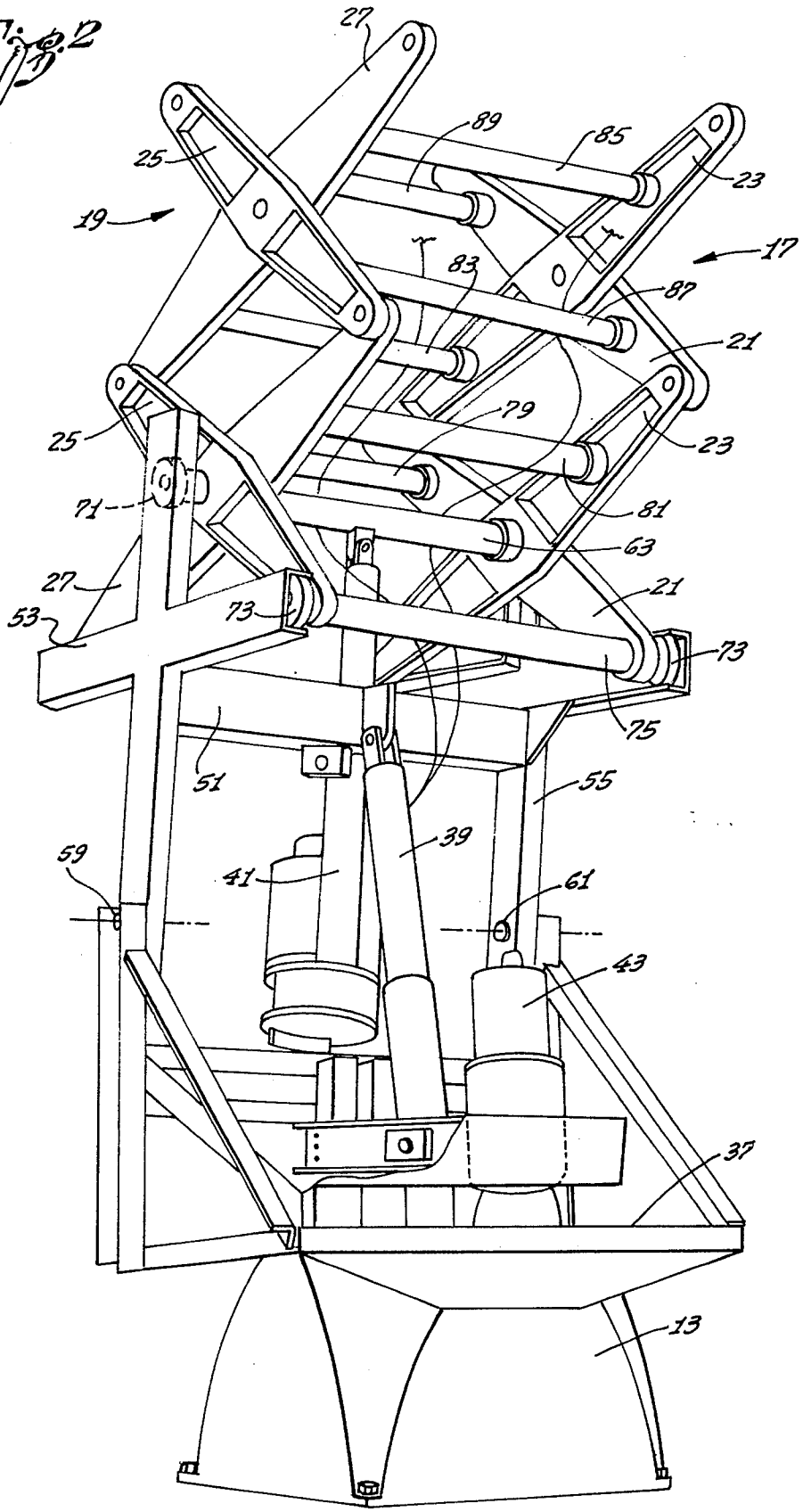

27
89
85
25
23
19
17
83
87
21
79
25
23
71
81
63
27
21
53
73
73
75
51
55
39
59
41
61
43
37
13

Fig. 3

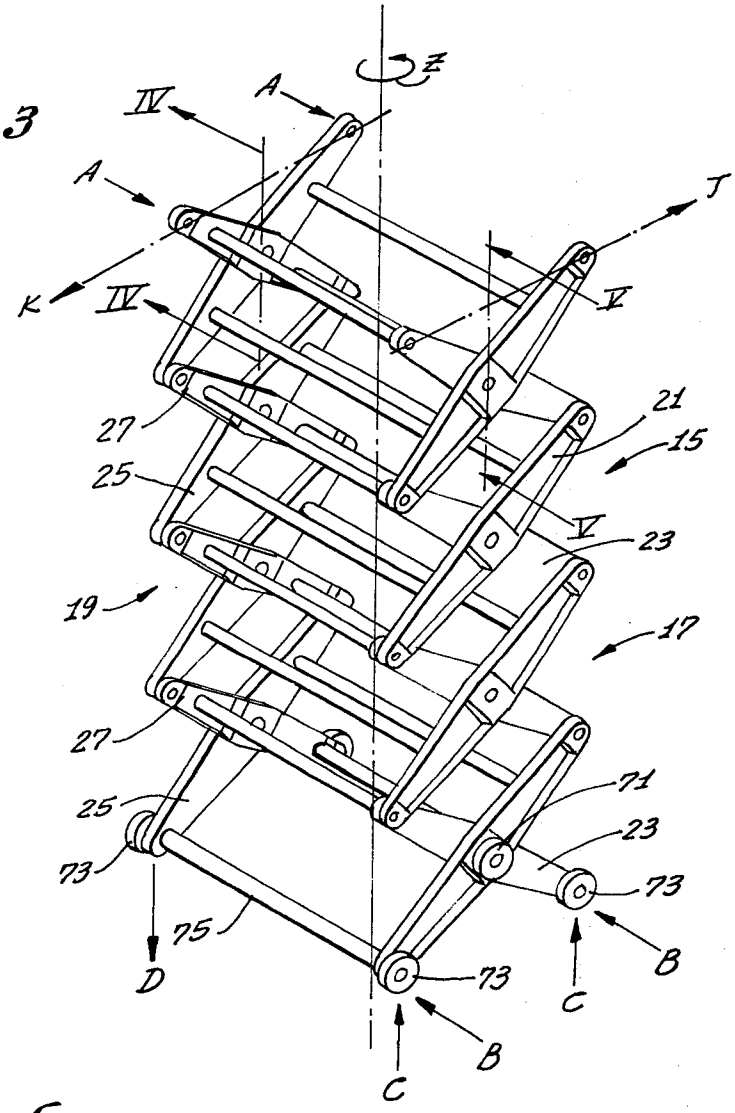
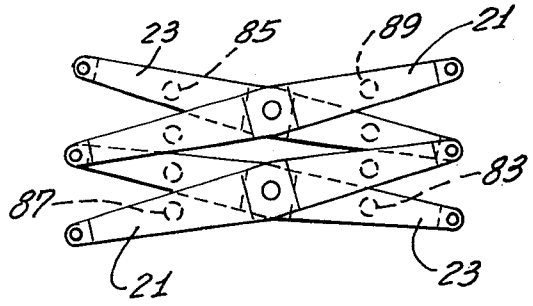

E
A
IV
A
J
K
IV
V
27
21
15
25
V
23
19
17
27
71
25
23
73
73
75
B
D
73
C
B
C

Fig. 6


23
85
89
21
83
87
21
23

STRESS BALANCED EXTENDIBLE BOOM STRUCTURE

This is a continuation of application Ser. No. 189,361, filed Oct. 14, 1971.

BACKGROUND OF THE INVENTION

The present invention relates to an extendible boom structure which can be utilized to position materials and/or personnel at desired distant positions relative to a base member.

If desired, the base member can be mounted on a truck or other movable device and the boom can be used for such things as repairing street lamps, building and maintaining electric and telephone systems, tree surgery, etc.

In the past, such extendible booms have usually comprised telescoping tubular systems or extendible boom structures such as those taught in U.S. Pat. No. 3,470,981 or in copending application Ser. No. 57,471, filed July 23, 1970 and assigned to the assignee hereof. Such extendible booms, arranged with suitable power and control systems and mounted on mobile bases have long been used for platform lifts, vehicle hoists, aircraft cargo leaders, etc., and often are formed, as illustrated in those references, utilizing parallel lazy tong assemblies which are interconnected by bars to ensure that the tongs move in unison.

In the usual terminology employed in the extendible boom art, a "bay" comprises two pairs of beams, one on each lazy tong, each pair being pivotally connected at the centers of the beams to form two parallel scissor-like structures. In the normal sense, the two structures are positioned at opposite sides of the boom in such a way that the inner beams of the structures are parallel to one another and the outer beams are also parallel to one another. In practice, the two pivot points may be joined by a rod extending therebetween which aids in holding the two structures together. Additional bays are added to the boom by pivotally attaching the bottoms of the beams of each such structure to the tops of the beams of the structure immediately below it. Since each structure acts like a scissors, when the bottoms of the beams of the lowest bay are forced toward one another, the tops of the beams are also forced toward one another. This action is transmitted through each of the bays, causing the boom to be elongated or extended in the direction in which the boom is turned and elevated. Thus, each side of the boom forms a lazy tong which cooperates with the lazy tong on the opposite side of the boom.

The prior art extendible booms have proven to be reasonably satisfactory when used to produce a straight vertical lift of equipment or personnel from ground level to a working height above ground level. When the boom is extended at an angle relative to horizontal, the results achieved have also been substantially satisfactory. However, experience has taught that if the load in the platform or basket is not centered so as to be equally distributed through the lazy tongs on each side of the boom, or if the truck-bed or base member is parked in a non-horizontal position, certain side loadings or forces acting against the boom will tend to collapse one of the lazy tongs while tending to extend the opposite tong. The results is at least dangerous and possibly disastrous for any personnel on the outer end of the boom; the boom tends to twist and may collapse

since the twisted boom is incapable of withstanding the forces exerted thereon by the uplifted weight.

In the past, in order to ensure that the two tongs moved together, and in an attempt to eliminate boom twist, the inner beams in each bay where interconnected by torsion bars fixed to the inner beams at or adjacent to both ends of the beams. However, it has been found that such torsion bars are inadequate to prevent the tendency for one of the tongs to extend and the other to collapse and for the outer beams to become misaligned when a relatively large asymmetrical load is applied at the outer end of an extended boom.

In fact, it has been determined that the torsion bars fixed between the inner beams of each bay actually aid in the creation of an even more undesirable condition, in addition to still allowing a small amount of such twist. The imposition of an asymmetrical load which tends to collapse the lazy tong assembly on the compression side and extend the assembly on the tension side of the boom is resisted by the bars which produce torsional moments in each bay, causing the entire boom structure to tend to rotate about its longitudinal axis. When there are only a few bays, this problem is not very serious since the degree of rotation imparted to the boom is rather small. However, with an increase in the number of bays, the rotation of the boom about its axis increases rapidly, thereby limiting the extended length of the boom. In its worst condition, during extension of a boom of this type having a very large length and an asymmetrical loading condition, the personnel bucket at the end of the boom could rotate 180° about the boom axis, with an obviously disastrous result.

Since such lazy tong or scissor-type booms are relatively easy to assemble and maintain, it is highly desirable to produce such a boom which is capable of withstanding such offset loading without allowing the boom to become twisted and unstable.

SUMMARY OF THE INVENTION

The present invention relates to structure which may be utilized with a lazy tong-type extendible boom to prevent the boom from becoming twisted or rotated about its axis in the event of an asymmetrical loading being imposed upon the boom arms. More specifically, the present invention relates to structure which may be utilized with such booms so as to equally distribute any asymmetrical loading between the boom arms or lazy tongs, in such a way as to create equal and opposite moments within the bays, thereby preventing them from attempting to collapse or extend. This may be accomplished by eliminating the induced twisting moments which cause instability and possible failure of the boom.

In one preferred embodiment of the invention, the inner and outer beams of each bay are interconnected by torsion bars which are fixed to corresponding beams on the opposite side of the bay.

In a preferred embodiment, the apparatus comprises torsion bars connecting the outer beams in each bay of the two lazy tongs assemblies and similar torsion bars connecting the inner beams. The torsion bars fixed to the outer beams are provided with a torsional spring rate substantially equal to that of the torsion bars connecting the inner beams in each bay. Whether or not the bars are rigid, it is important that their spring rates be substantially identical. Thus, the invention is applicable to "rigid" and "non-rigid" torsion members.

As a result, the twisting moments in each bay created by the outer beam torsion bars are equal and opposite to those produced by the inner beam torsion bars, thus eliminating unbalanced twisting moments and rotation of the boom.

As an additional advantage of this invention, it has been found that it now becomes possible to use a single boom-extending power system, located midway between the two lazy tong structures, to extend and retract the boom. Since the extendible boom is thus made more stable, the structure allows the achievement of a system in which elevation, extension, and rotation of the boom about the base can be independently controlled, allowing precise positioning of the platform or basket at the end of the boom.

Booms manufactured in accordance with the present invention can therefore be utilized to move personnel and equipment much greater distances from the base or platform upon which the boom is mounted. Of even greater importance is the fact that the personnel and/or equipment on the platform or basket of the boom are provided with a degree of safety heretofore unobtainable with prior art devices since the imposition of asymmetrical loads will not cause twisting or rotation of the boom which could result in failure and/or injury.

As an additional advantage of the invention, it will be realized upon reading the following description that the torsion bars on the inner and outer beams in successive bays will serve as convenient equally spaced ladder rungs if a workman should otherwise be stranded in the bucket of an extended boom during an equipment malfunction.

Further objects, advantages, modes, and embodiments of the present invention will readily be understood by those skilled in the art by reference to the following Detailed Description and accompanying drawings which illustrate what is presently considered to be one preferred embodiment of the best mode contemplated for utilizing the novel principles of the invention as defined by the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective illustration of an extendible boom formed in accordance with the present invention, illustrating the boom mounted on a truck and extended relative thereto;

FIG. **2** is a perspective view of a portion of the boom illustrated in FIG. **1**, enlarged so as to show more details of the control structure thereof;

FIG. **3** comprises an isometric illustration of four bays of such an extendible boom in a partially extended position;

FIG. **4** is a sectional illustration of one bay of a boom formed in accordance with the present invention as seen along a line IV—IV in FIG. **3**;

FIG. **5** is a view similar to FIG. **4**, taken along a line V—V of FIG. **3**; and

FIG. **6** comprises a side elevation of two bays of a boom such as that shown in FIG. **1** in the collapsed position.

DETAILED DESCRIPTION

As shown in FIG. **1**, a vehicle **11** supports a base structure **13** upon which an extendible boom, generally indicated at **15**, is supported. In the particular illustration of FIG. **1**, the boom **15** comprises two lazy tongs which, together, comprise an exemplary seven bays, each of which is made up of two beam structures **17** and **19**. Each beam structure **17** comprises an outer beam **21** and an inner beam **23** while each beam structure **19** comprises an outer beam **25** and an inner beam **27**. Inner beams **23** and **27** are parallel to one another and outer beams **21** and **25** are also parallel to one another. Thus, each pair of opposed beam structures **17** and **19** form one bay and, when a plurality of bays are combined as shown in FIG. **1**, a lazy tong is formed on each side of the boom as clearly illustrated.

At the outer end of the boom, a basket or platform **29** is suspended from the ends of a pair of parallel end beams **31** which extend from and are supported by the seventh or last bay. When the boom is in use, the basket **29** is suspended from the beams **31** in an upright position under the influence of gravity. If desired, a control panel **33** may be mounted on the basket to allow a workman in the basket to control the position thereof and a similar panel (not shown) may be mounted on the truck **11**.

Referring now particularly to FIGS. **1** and **2**, it can be seen that the base structure **13** supports a platform **37** upon which are mounted on elevation control unit **39**, an extension unit **41**, and a rotation unit **43**. Also, if desired, the platform **37** may support a bank of batteries **49** which may be utilized to operate the elevation, extension, and rotation control units **39**, **41**, and **43**.

The elevation unit **39** and extension unit **41** may comprise individual jackscrews or hydraulic devices but, whatever type of devices are selected, they may be individually operable, if desired, to provide more precise control of the boom. The rotation unit **43** may, for example, comprise an electric motor which drives a pinion gear **45**. If the motor is fixed to the platform **37**, the gear **45** will act against a ring gear **47** fixed on the support **13** to turn the platform and, thus, the boom. However, regardless of the type of structure used to rotate the boom, it may also be individually operable so as to provide precise boom control.

Elevation control unit **39** is attached at one end to a cross bar **51** which is fixed between dual perpendicular track assemblies **53** and **55**. The track assemblies are pivotally attached to the platform **37** at pivot points **59** and **61** so that when the elevation unit **39** is actuated the force which it exerts against the cross member **51** causes the track assemblies **53** and **55** to pivot upwardly. For example, as shown in FIG. **1**, the track assemblies are in a substantially intermediate position which is achieved as a result of partial actuation of the elevation system. In FIG. **2**, on the other hand, the track assemblies have been raised to the nearly vertical position by the assembly **39**. It will be realized that the unit **39** also controls the descent of the boom, which can, for example, be lowered to a substantially horizontal location.

Comparison of FIGS. **1** and **2** will also reveal that, as stated previously, the rotation assembly **43** can be selectively utilized, for example by actuation of a control in the panel **33** or by a similar located at ground level, to rotate the support platform **37** to any desired position so as to properly orient the boom **15** in that direction.

Referring once again to FIG. **2**, it can be seen that the beams on the opposite sides of the first bay are interconnected by a centrally located bar **63**. The extension unit **41** is attached to the bar **63** at its midpoint, and the bar is attached at each of its ends to both the inner

beams **23** and **27** and outer beams **21** and **25**, by means of bearings. Since the bar **63** is connected to all of the beams in the bay by means of bearings, when the extension unit **41** pushes against the bar **63**, the bar will not have any tendency to rotate relative to unit **41** but will push the pivot point on both sides of the bay upwardly. Due to the operation of structure to be described below, this causes the upper ends of the inner and outer beams on both sides of the bay to move toward one another in a scissorlike action. Of course, this results in the extension of the boom because the bottom ends of the pivoted sets of beams in the second bay are thus caused to be brought together and similarly to cause the upper ends of the pivoted beams in the second bay also to be brought toward one another. A comparison of FIGS. **2** and **6** will clearly illustrate that this causes the boom to be extended, achieving a result such as that shown in FIG. **1**.

The points of pivotal attachment of the bar **63** to the beams on each side of the first bay, and thus the points of pivotal attachment of the beams to one another, and controlled in motion by means of rollers **71** which extend from the pivot points on each side of the bay. The rollers **71** cooperate with the portions of the channels **53** and **55** which extend in the axial direction of the boom. Thus, the rollers **71** are free to move in the axial direction but are restricted against movement in any other plane.

On the other hand, the bottom ends of the four beams of the lowest bay are provided with rollers **73** which cooperate with those portions of the channels **53** and **55** which extend perpendicular to the axial direction of extension of the boom. In other words, rollers **73** are free to move in line of direction which is perpendicular to the extension axis of the boom but are restricted against traveling along any other plane relative thereto. The movement of the various portions of the first bay of the boom, as controlled by the extension unit **41**, is strictly limited along paths within predetermined planes. Consequently, the movement of every other bay of the boom will also be limited since the motion of each bay is strictly controlled by the motion of the bay immediately below it.

As is clearly illustrated in FIG. **2**, the outer beams **21** and **25** of the first bay are connected together by means of a torsion bar **75** located at the lower ends thereof. As shown in FIG. **1**, the lower ends of the inner beams of the first bay are similarly interconnected by a torsion bar **77** extending therebetween.

The torsion bars **75** and **77**, and other torsion bars described below, are fixed to the opposite beams to ensure the maintenance of the spacing between the beams, to ensure equal movement of opposed beams in each bay, and to properly and equally distribute forces exerted on each bay into the beams thereof. Near the upper ends of the beams of the first bay, the outer beams are again connected by a torsion bar **79** and the inner beams are connected by a torsion bar **81**. Thus, the torsion bars **75**, **77**, **79**, and **81** strengthen and distribute moments within the first bay.

Referring now to the second bay as shown in FIG. **2**, it is seen that a pair of torsion bars **83** and **85** connect the inner beams **23** and **27** while a second set of torsion bars **87** and **89** interconnect the outer beams. In other words the outer beams in each bay from the second outwardly are interconnected in the manner shown for the purpose described. Thus each bar maintains the spacing between the beams of the two tongs, ensures equal opening and closing of the beams in each tong, and, as described below, distributes moments exerted on the bays in substantially equal amounts.

It will be recalled that in the prior art only the inner beams in each bay were connected at both the upper and lower ends thereof, whereas the outer beams were not so interconnected. Thus, the present invention results in a system in which distribution of forces and moments is provided so as to prevent rotation of the boom about its axis.

This can be clearly illustrated by reference to FIGS. **3–5**. For example, when side loads A are applied to the outer end of the boom, for example, by asymmetric loading of the platform or bucket **29** or by the force of gravity acting on the bucket when the truck **11** is parked in a non-level position, a reaction force B is generated at the lower end of the boom. Thus, the forces A and B exert a moment on the boom which must be resisted by forces C and D. It will become clear from studying FIG. **3** that forces C tend to collapse the lazy tong assembly comprised of beam structures **17** at the same time that forces D tend to extend the lazy tong assembly comprised of beam structures **19**. In other words, the inner beams in each assembly **17** tend to rotate in a counterclockwise direction at the same time that the inner beams in the assembly **19** tend to rotate in a clockwise direction as viewed in the drawings. These rotational tendencies are illustrated by the arrows E and F shown in FIGS. **4** and **5**.

Since the inner beams are interconnected by the members **83** and **85**, thereby preventing their rotation in opposite directions, a torsional moment G, acting in a clockwise direction, i.e., opposite to the direction of rotational tendency of the beam, is introduced at each inner beam of the assembly **17** and an equal and opposite torsional moment H is introduced in the inner beam of each bay within the lazy tong assembly **19**. The torsional moment G acting within the lazy tong assembly **17** deflects that assembly in the direction indicated by the arrow J at the same time that the torsional moment H acts on the assembly **19** to deflect it in the direction indicated by the arrow K. It can thus be seen, by referring to the direction of the arrows J and K in FIG. **3**, that the entire boom structure therefore has a tendency to twist about its central axis Z in a counterclockwise direction as viewed from above.

This is the situation as it presently prevails in the prior art structures. In other words, the torsion bars connecting the inner beams prevent one lazy tong from extending while the other is retracting but, as a result, causes the entire boom to twist or rotate about its axis and create a dangerous condition which is now believed to be readily apparent in view of the above force analysis.

Under the loading conditions previously described, the outer members **21** of the lazy tongs **17** tend to rotate in a clockwise direction, as indicated by the arrow L in FIG. **5**, and the outer beams **25** of the lazy tongs **19** tend to rotate in the counterclockwise direction as indicated by the arrow M in FIG. **4**. These rotational tendencies may be resisted by the torsion bars **87** and **89** which exert a torsional moment N (FIG. **5**) acting in a counterclockwise direction on beam **21**, and a torsional moment P (FIG. **4**) acting in the clockwise direction on beam **25**.

If torsion bars **83, 85, 87,** and **89** are designed so as to have equal torsional spring rates and so that the sum of the torsional spring rate of any pair of bars connecting inner beams is equal to the sum of the torsional spring rate of any pair of bars connecting the corresponding pair of outer beams, the twisting of the entire structure will be eliminated. It is well known by those having an elementary knowledge of dynamics that when two bars or tubes of the same material, for example, are of different lengths, their spring characteristics differ merely as a result of the difference in length. In order to ensure that the shorter torsion bars **83** and **85** have the same spring rate characteristics as the longer bars **87** and **89** then, the latter two bars need be made only slightly larger in diameter than bars **83** and **85.** Of course, if tubes are used, this same result can be achieved by controlling the diameter and/or the wall thickness thereof. This difference in diameter is, for most materials, insufficient to be discerned in the scale in which the drawings have been made. The torsion spring rates might also be equated by the selection of different materials for the different length torsion bars. In other words, with equal spring rates, the torsional moments introduced by bars **83** and **85** will be equal and opposite to the torsional moments introduced by bars **87** and **89.** Consequently, the twisting moments on the entire boom structure will be balanced and any tendency of the structure to rotate about its axis will be eliminated. In other words the rotational moment illustrated by the arrow Z in FIG. **3** will be exactly offset by a rotational moment which is equal to that illustrated by the arrow but extends in the opposite direction.

As a further advantage of the invention, the use of the torsion bars connecting the inner and the outer beams of each bay allow the satisfactory use of the single extension unit **41** to extend both lazy tongs of the boom, since the torsion bars **83, 85, 87,** and **89** allow the tongs to resist the forces C and D, thus keeping equal forces at each end of the bar **63** balanced about its midpoint where the extension unit **41** is attached. This, of course, reduces the weight and cost of the entire unit. In other words, this invention provides structure for resisting the twisting action of a boom under asymmetrical loading, including rigid members connecting the outer beams of the two lazy tong assemblies, the rigid members having comparable rigidity to similar members connecting the inner beams in the assemblies. As a result, equal and opposite twisting moments are created in each bay under conditions of asymmetrical loading, thereby eliminating unbalanced twisting moments within each bay.

As an added benefit of the use of this invention, it will be realized that if there should be any equipment malfunction while the boom structure is substantially extended, a person riding in the bucket will be able to climb down the boom, using the torsion bars in each bay as rungs of a ladder, thereby substantially increasing his safety.

Thus, the applicant has provided an embodiment of a new and improved concept in the art of extendible booms, which concept yields a true advancement in that art due to the increase in safety and elimination of the possibility of structural failure. Many modifications and alternations of the above-described embodiment will now become apparent to those skilled in the art, but such modifications, alternations, additional embodiments, etc., will not, merely as a result of any differences with the above-described embodiment, exceed the true scope of the invention as defined in the following claims.

Therefore, I claim:

1. A boom for locating a basket suspended from the end thereof at a predetermined position in which an asymmetrical load may be applied to said boom comprising

a pair of lazy tongs arranged in parallel relationship, each including

a plurality of bays comprising

an inner beam,

an outer beam,

means near the centers of said inner and outer beams for pivotally connecting them together,

means interconnecting said pair of lazy tongs to prohibit rotation of said boom about the central axis thereof when an asymmetrical load is applied thereto by said basket, which load tends to extend one of said lazy tongs and retract the other comprising

first torsion transmitting means fixed between the inner beams in each bay intermediate and pivot connection means and each end thereof and

second torsion transmitting means fixed between the outer beams in each bay intermediate said pivot connection means and each end thereof, said first and second torsion transmitting means being so constructed as to have equal torsional spring rates, and

means at the outermost bay for supporting and mounting a basket thereon.

2. The boom of claim **1** including

means acting only along the central axis of said boom for selective extension and retraction thereof regardless of whether said boom is subject to uniformly distributed or asymmetrical loads.

3. The boom of claim **1** including

mounting means to which said boom is attached for support thereof, and

independently actuatable means for elevating, rotating, and extending said boom.

4. A boom comprising

a pair of lazy tongs forming

a plurality of pivotally connected bays, each bay including

a pair of parallel inner beams, one in each lazy tong,

a pair of parallel outer beams, one in each lazy tong, and

means pivotally connecting the inner beam and the outer beam of each lazy tong in each bay near the centers of said inner and outer beams,

means for suspending support apparatus from the outermost bay of the boom, whereby asymmetrical loading may be imposed on the boom, thereby causing one lazy tong to tend to retract and the other to extend,

a pair of first torsion transmitting means extending between the inner beams in each bay and fixed thereto to prevent rotation of said inner beams upon the application of asymmetrical loading forces to said support means, and

a pair of second torsion transmitting means extending between the outer beams in each bay and fixed thereto to prevent rotation of said lazy tongs about the central axis of said boom upon the application

of asymmetrical loading forces to said support means, said first and second means being so constructed as to have identical torsional spring rates.

5. The boom of claim **3** including

a support means,

guide means mounted on said support means, and

means on the lowermost beam for cooperating with said guide means to control the extension and retraction of said boom.

6. In a boom comprising a pair of parallel lazy tongs, each including a plurality of bays comprising an inner and outer beam, which support a work platform in suspension therefrom at the outer ends thereof and including apparatus for preventing the collapse of one lazy tongs and the extension of the other as a result of asymmetrical loading being applied to said boom,

means for preventing the rotation of said boom about the central axis thereof as a result of torsion forces generated by said collapse and extension means comprising

at least one torsion transmission member extending between and fixed to the outer beams in each bay of said boom, and

at least one torsion transmission member extending between and fixed to the inner beams in each bay of said boom, the torsional spring rate of said lazy tong extension and collapse prevention means in any given bay being equal to the torsional spring rate of said boom rotation prevention means in the same bay.

7. The boom of claim **6** including

a support means upon which the inner ends of the boom is mounted, and

means on said support means for exerting forces along the central axis of said boom to uniformly extend and retract the latter regardless of asymmetry of uniformity of loading of said boom by said platform.

8. The boom of claim **7** wherein

said force exerting means comprises

a single drive means and

means, situated generally along the central axis of said boom, connecting said single drive means to a cross member, and

a cross member in the lowermost bay of said boom pivotally attached to the lazy tong on each side of the boom for transmitting extension and retraction forces from said connecting means to said lazy tongs.

9. The device of claim **6** including

means mounted on said support means for independently altering the rotational location of said boom relative to said support means.

10. The device of claim **6** including

means mounted on said support means for independently altering the angle of elevation of said boom relative to said support means.

11. In a boom comprising a pair of parallel lazy tong, each including a plurality of bays comprising an inner and outer beam, from which a load bearing member is suspended at the outer end of the boom, which load bearing member may subject one lazy tong to collapsing forces and the other lazy tong to extension forces as a result of asymmetrical force loading, the method of prohibiting such non-uniform movement of the lazy tongs while also prohibiting the rotation of the outer end of the boom relative to the inner end thereof about the central axis of the boom comprising the steps of

transmitting torsional forces exerted on the inner beam of each lazy tong in each bay to the opposite inner beam in the other lazy tong in the same bay via members having a first length and a first total spring rate, and

transmitting torsional forces exerted on the outer beam of each lazy tong in each bay to the opposite outer beam in the other lazy tong in the same bay via members having a second, longer length but said first total spring rate.

* * * * *