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Huxley, III

[11] **3,750,846**

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[54] **LAZY TONG TYPE BOOM STRUCTURE WITH EXTENSION AID**

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Related U.S. Application Data

[63] Continuation of Ser. No. 57,477, July 23, 1970.

[52] **U.S. Cl.** **182/141,** 182/2, 182/158

[51] **Int. Cl.** **E04g 1/22,** E04g 3/10

[58] **Field of Search** 182/69, 208, 141, 182/148, 157, 158, 2; 214/83.1; 74/521; 254/122

[56] **References Cited**

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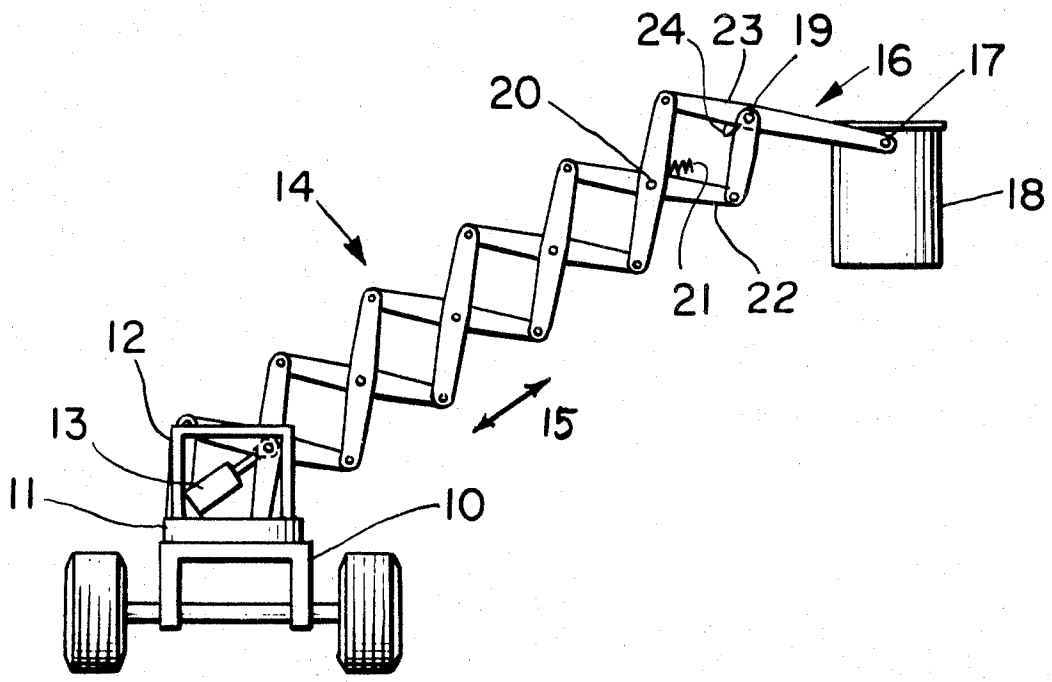
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[57] **ABSTRACT**

A boom structure including a plurality of crossed links having their centers and ends pivotally connected to define a lazy tong structure includes a compression spring positioned to exert a force between the next to last and last links making up the lazy tong structure when the structure is in collapsed position to aid extension of the structure. The spring has one end secured close to the central point of the next to last link and its other end is free. The opposing last link portion includes a guiding cone for receiving the free end of the compression spring when the structure is collapsed. When the lazy tong structure is extended, the compression spring effects initial extension of the next to last and last links while the initial crossed links at the base of the boom are separated by the driving force for extending the structure. A smooth unfolding of the respective links can thus be realized.

10 Claims, 3 Drawing Figures



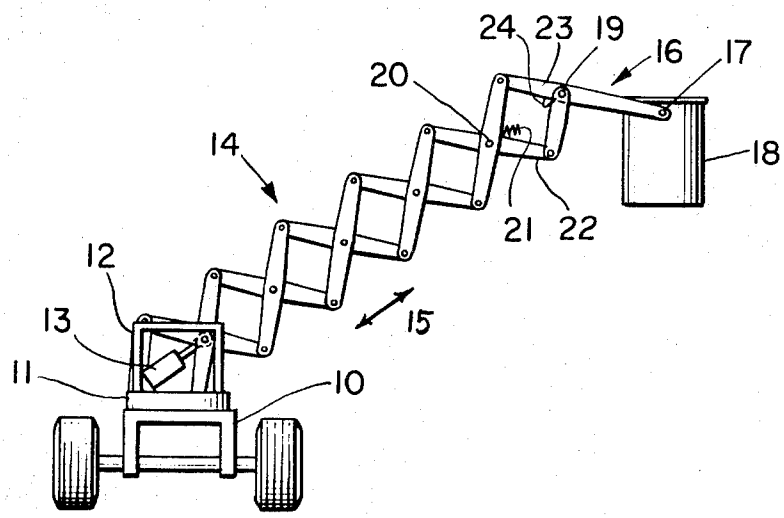


FIG. 1.

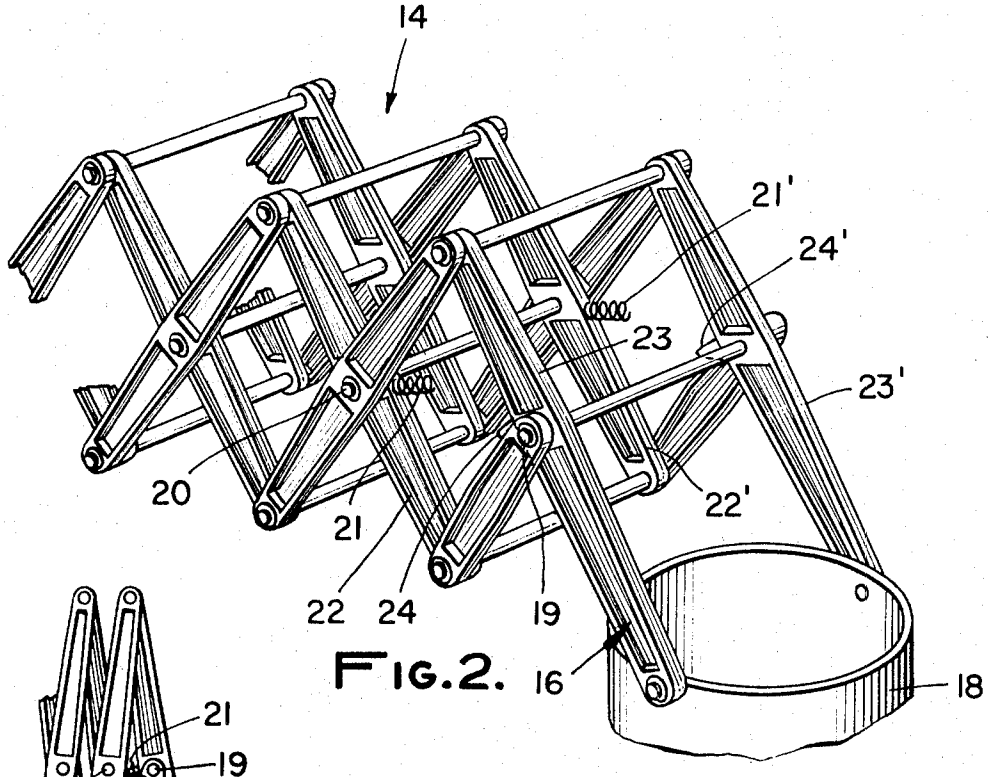


FIG. 2.

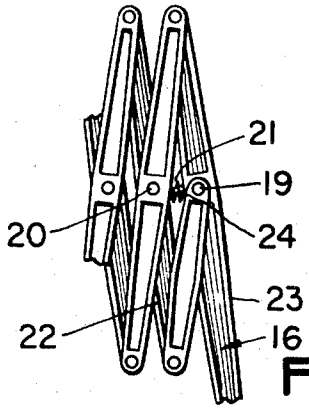


FIG. 3.

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LAZY TONG TYPE BOOM STRUCTURE WITH EXTENSION AID

This is a continuation, of application Ser. No. 57,477, filed July 23, 1970.

This invention relates generally to boom structures and more particularly to a lazy tong type of boom structure including an extension aiding device for facilitating initial extension of the boom from a collapsed position.

BACKGROUND OF THE INVENTION

Many different types of boom structures for positioning workers at various heights have been proposed and are presently in use. Examples of such use are in telephone line work, fruit picking operations in orchards, general maintenance work on buildings, and the like. One desirable boom design takes the form of a pair of lazy tongs each comprised of a plurality of outboard and inboard links crossing each other at their corresponding ends and centers to permit extension and retraction of the lazy tongs in unison and thus of a load-carrying structure at one end of the boom. An example of this type of boom is fully disclosed in U.S. Pat. No. 2,927,705 issued Mar. 8, 1960.

With the foregoing basic structure, one would expect that the greatest mechanical force necessary to initiate extension and retraction of the crossed links making up the lazy tong would occur when the unit is substantially fully extended and parallel to the ground. Actually, such is not the case. For example, consider the situation when the boom is fully retracted and in a nearly vertical position where the axis of the boom is elevated approximately 85° from the horizontal and where the angle between the inboard and outboard links is in the order of 5°. With a load at the end of the boom such as a man standing in a basket supported at the end, there is difficulty in initially extending the lazy tong structure. Thus, because of the flexibility of the crossed links, the boom does not extend uniformly with each section of the boom unfolding an equal amount. Rather, the boom extends in a sequential fashion beginning with the unfolding of the crossed links nearest the driving force at the base and progressing slowly towards the free end or load carrying end until the last crossed links unfold.

During the foregoing process, some of the crossed links may actually compress reducing the angle between the inboard and outboard links just before the section begins its turn to unfold. When this happens, the axial forces in the inboard and outboard links causing the unfolding are almost co-linear and in direct opposition and in this condition these forces can grow in magnitude causing binding until the links unfold through a critical angle and begin to extend. The result is that the crossed link section nearest the extending force means at the base unfolds the most and the cross link section nearest the free end or load carrying portion unfolds the least. The boom extends in this state until the forces become sufficiently large to cause the various sections to unfold past their critical angles at which time the boom extends with a lurch.

The reaction is similar to that of an over-center spring, the basket carrying a man jerking as if catapulted rather than traveling at a predetermined rate in a linear manner. In the absence of suitable corrective measures, the strains developed in the links during initial extensions can result in bending of the links beyond further use and actual breaking apart of the structure.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The foregoing difficulty is overcome in accord with the present invention by positioning a force providing means preferably in the form of a high pressure coiled compression spring between the central portions of the last and next to last links at the load carrying end of the boom structure. The pressure exerted by the spring when the structure is collapsed is made approximately equal to the total maximum load to be carried in the basket at the end of the boom.

Initially, the compressed length of the spring acts as a solid block prohibiting full collapsing of the last and next to last crossed links in retracted positions. Secondly, the spring acts as an expanding force for these links when the extension of the initial link members at the base begins. As the various cross links are successively extended from the base, a continuous positive force at the opposite free end of the boom provided by the spring assists in opening the last crossed links until the entire lazy tong structure has achieved a sufficient extension that the critical angle between the inboard and outboard links has disappeared. The entire boom then extends smoothly.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by refering to the accompanying drawings in which:

FIG. 1 is a highly diagramatic side elevation view of a lazy tong type boom structure incorporating the present invention;

FIG. 2 is an enlarged fragmentary perspective view of the end portion of the boom structure of FIG. 1; and

FIG. 3 is a side elevational fragmentary view of the structure of FIG. 2 in collapsed position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1 there is shown a portion of a vehicle **10** supporting a rotary mount **11** for a base support structure **12.** The structure **12** is coupled to first ends of a boom of the lazy tong type and includes a suitable force extension means which may comprise a screw or hydraulic mechanism **13** to effect unfolding of the boom.

The boom structure itself comprises a plurality of crossed links having their centers and ends pivotally connected to define a lazy tong structure as designated generally by the numeral **14.** The entire boom structure may be rotated about a vertical axis V passing through the support structure **12** and first end portion of the boom. Extension and retraction of the boom takes place in the direction indicated by the doubled headed arrow **15.** The second or free end of the boom **16** is pivoted at **17** to a load carrying means such as a basket **18.** The last center pivot point of the boom structure is designated **19** and the next to last center pivot point is designated at **20.** Unfolding of the last and next to last links centrally pivoted to these points is initially started by a force providing means in the form of a compression spring **21.**

Reeferring now to the more detailed view of FIG. **2,** the next to last inboard link is shown at **22.** A first end of the compression spring **21** is rigidly secured to the

central portion of this next to last link adjacent to the point that it is pivoted to the next to last center pivot point **20**. The other end of the coiled compression spring is free and oriented in such a manner as to exert a force on the central portion of the last link **23** at a point adjacent to the last center pivot point **19** when the structure is collapsed. In order that the free end of the spring will be captured and properly positioned to exert a force between the next to last and last links when collapsed, the last link **23** includes an opposing guide cone over which the free end of the compression spring is received. This cone is shown at **24**.

In the actual preferred construction of the lazy tong type boom, an additional plurality of crossed links having their centers and ends pivotally connected to define a lazy tong structure parallels the first plurality of links, the respective pivot points being defined by common cross-rods. Thus, the additional last two links corresponding at **22** and **23** are shown at **22'** and **23'** there being provided common pivot cross-rods terminating at the pivot points **20** and **19**. With the structure, there is provided a second compression spring **21'** and corresponding guide cone **24'** on the links **22'** and **23'** respectively so that a balanced arrangement is provided.

FIG. **3** illustrates the manner in which the compression spring exerts a force between the next to last and last links; that is, effectively between the cross-rods defining the next to last and last pivot points of the last section of the lazy tong structure. The compression springs are designed such that separation of the corresponding cones from the springs occurs only after the critical angle of the links at their end pivot points has passed so that the normal unfolding force transmitted from the base through the successive links can easily complete the extension of the structure.

OPERATION

In operation, assume first that the lazy tong structure is completely collapsed so that the last links assume the position illustrated in FIG. **3**. The compression springs when fully compressed act as a solid block preventing complete collapsing of the last crossed links. These springs when completely compressed, as mentioned, exert a load corresponding substantially to the maximum load in the basket. Thus, if a 300 pound load were to be carried in the basket, each of the springs would exert a 300 pound load on each side to compensate for the 300 pound load in the basket.

Assume that the lazy tong structure is now to be extended. When the extension hydraulic mechanism or extension screw begins to drive open the lower links, a continuous positive force is applied between the next to last and last crossed links assisting them to open. Unfolding forces thus commence at opposite ends of the boom structure and work towards the center of the lazy tong structure greatly facilitating the successive opening of the crossed links beyond critical angles so that a uniform and smooth extension of the entire structure can take place. After the critical angles have passed, the continued extension of the crossed links takes place, the last links being separated completely from the ends of the spring so that these spring ends are free floating.

Collapsing of the lazy tong structure is a reverse direction is smoothly effected since the last crossed links wil be cushioned by the guide cones receiving the the open ends of the springs and permitting a gradual closure until the springs are completely compressed.

It will thus be seen that by the simple provision of the compression springs between the last and next to last links of the lazy tong structure, serious problems encountered heretofore with the extension of the boom particularly when oriented close to vertical positions are overcome.

While the compression springs have been described as secured on the central portions of the next to last links adjacent to the center pivot points, it will be evident that the springs could be secured in a manner to provide a separating force between the crossed rods themselves defining the center pivot points to effect an equivalent action. Obvious changes such as the foregoing will occur to those skilled in the art without departing from scope and spirit of this invention.

What is claimed is:

1. A boom structure comprising: a plurality of crossed links having their centers and ends pivotally connected to define a lazy tong structure, a first end of said structure constituting the base of said boom and the second end terminating in a load carrying means; and a force providing means secured to the central portion of a next to last link pivoted to the next to last center pivot point, and oriented to exert a force on the central portion of a last link pivoted to the last center pivot point when the structure is collapsed, the next to last and last center pivot points being closest to each other in the collapsed position, said force providing means being free of the last link after a given partial extension has taken place, said extension being sufficient to enable the unfolding load, transmitted through the links of the lazy tong structure, to fully extend the last crossed links.

2. The structure of claim **1**, in which said force providing means comprises a compression spring having one end secured to said next to last link and its other end free of any connection, said last link including an opposing guide cone for receiving the free end of said compression spring when said lazy tong structure is collapsed.

3. The structure of claim **1**, in which said boom structure includes an additional plurality of crossed links having their centers and ends pivotally connected to define a lazy tong structure parallel to the first plurality of links, the respective pivot points including common cross-rods, said force providing means exerting a separating force between the links pivoted to the next to last and last cross-rods defining the next to last and last center pivot points of the lazy tongs respectively, when in collapsed position.

4. The structure of claim **3**, in which said force provided means comprises a pair of compression springs secured at first ends respectively to the central portions of the next to last links of the lazy tong structures, the other ends of the springs being free when the lazy tong structures are in extended positions.

5. The structure of claim **4**, in which the central portions of the last links include a pair of guide cones positioned to receive and compress the free ends of said pair of springs respectively when the lazy tong structures are collapsed.

6. A collapsible boom comprising

a plurality of pairs of crossed links including

first means for pivotally attaching each pair of links to one another at the location of their crossings and

second means for pivotally attaching the ends of each pair of links to the ends of an adjacent pair of links,

a first pair of links adjacent one end of the boom and mounting said boom on a support means,

a last pair of links, at the end of said boom opposite said first pair, for supporting a load carried by said boom,

means for extending and retracting said boom by causing said pairs of links to pivot about said first attaching means, and

means acting between at least two adjacent pairs of said links for preventing the complete retraction of said boom by said retracting means.

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

said preventing means also includes

means for aiding in the extension of said boom by exerting a separating force between two of said pairs of links at substantially the location of the said first attaching means in each of said pairs.

8. The boom of claim **6** wherein

said preventing means is located so as to act between said last pair of links and the next-to-the-last pair of links.

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

said preventing means also comprises

means for exerting a separating force between said last pair of links and the next-to-the-last pair of links.

10. The boom of claim **6** wherein

said preventing means comprises

spring means secured to one of said pairs of links adjacent said first attaching means thereof and acting against an adjacent pair of links adjacent said first attaching means thereof.

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