Sept. 12, 1967 B. F. BARKLEY ETAL 3,341,029

EXTENSIBLE BOOM CONSTRUCTION

Filed Oct. 6, 1965 2 Sheets-Sheet 1

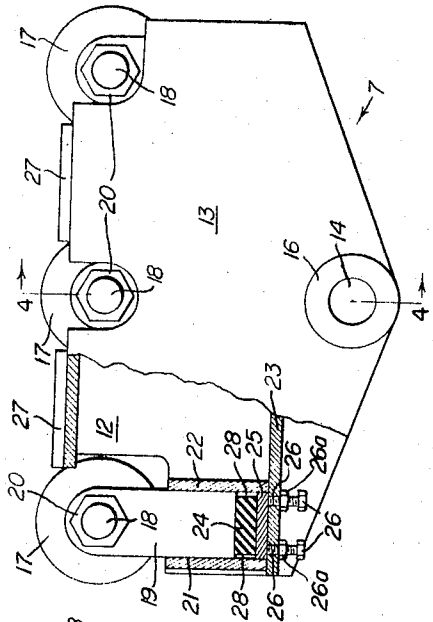


FIG. 3.

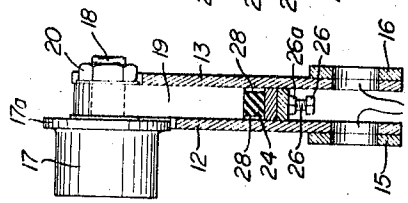


FIG. 4.

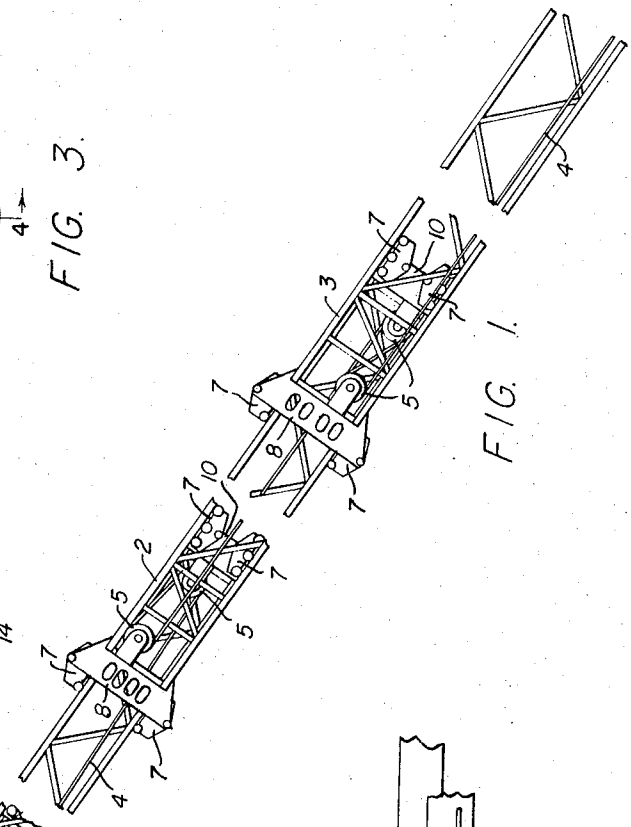
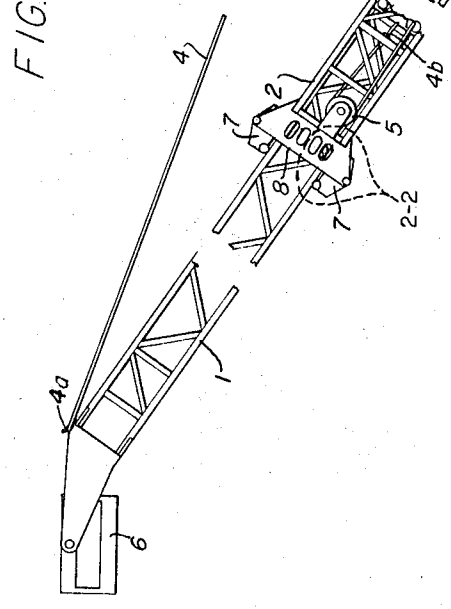


FIG. 1.



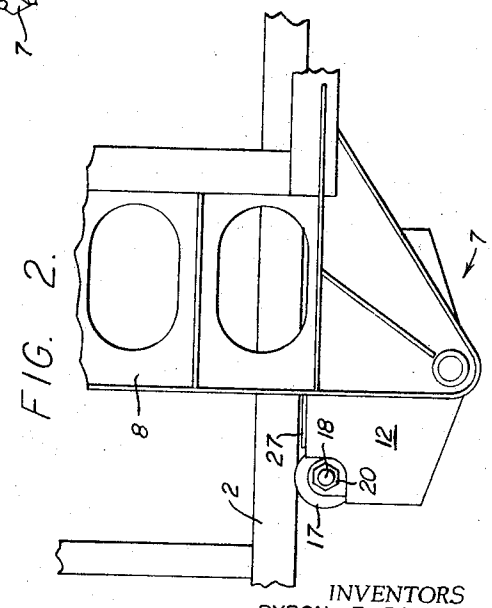


FIG. 2.

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EXTENSIBLE BOOM CONSTRUCTION

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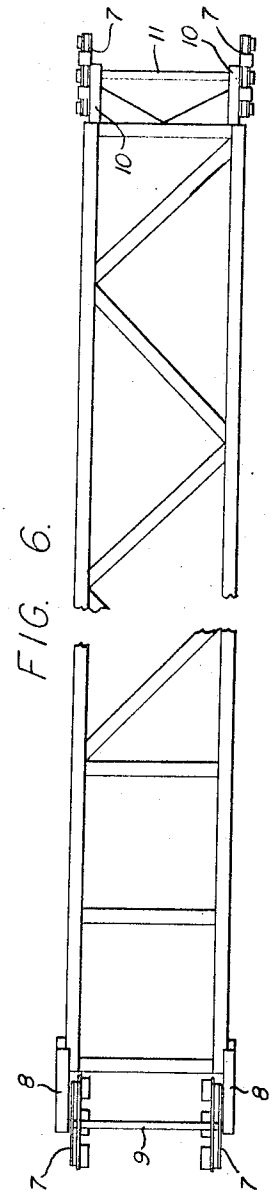


FIG. 6.

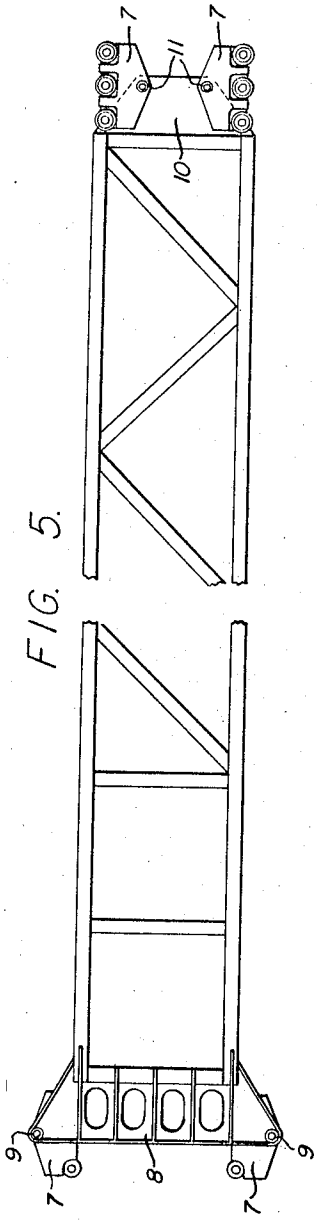


FIG. 5.

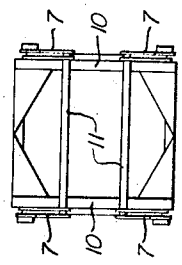


FIG. 8.

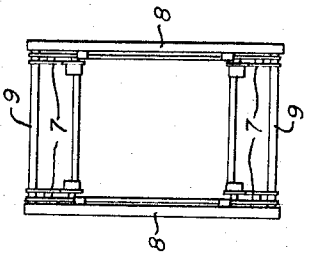


FIG. 7.

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EXTENSIBLE BOOM CONSTRUCTION

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Filed Oct. 6, 1965, Ser. No. 493,449
16 Claims. (Cl. 212—55)

This invention relates to extensible booms, and is particularly concerned with booms adapted for pivotal mounting so as to be movable upwardly and downwardly and laterally about a fixed point and through angles varying widely between the sub-horizontal and the vertical.

An instance requiring an extensible boom to be moved through such widely varying angles is the use of such a boom on a crane to position a personnel carrier basket, so that workmen therein can intall or repair power lines. For most such operations, it is necessary to extend the boom up from the ground at a rather steep angle, but, in stringing a power line across a ravine, canyon, river, etc., or in repairing such a power line, it is frequently necessary to position the crane somewhat above or at substantially the same elevation as the power line and to place the boom in a more or less horizontal position. Because of deflection of the cantilevered boom due to gravity, tremendous forces are exerted through the bearing surfaces between sections. If the usual rollers are employed to reduce friction between the sections as such sections are extended and retracted relative to one another, these forces are transmitted from section to section through contact areas of extremely limited extent. The resulting localized concentrations of force place undue stresses on the structural components of the sections and on the roller bearings.

It is an object of the present invention to provide an extensible boom having roller bearings to facilitate easy extension and retraction during normal conditions of reduced deflection loading means for distributing stresses to large areas of the structural components of the sections making up the boom during conditions of increased deflection loading.

An important feature of the invention is the provision of both rollers and slide blocks arranged between the interfitted sections of an extensible boom, with means for transferring from the rollers to the slide blocks those forces that are due to deflection loading when the boom is in a substantially horizontal position, thereby distributing such forces over greater area.

There is shown in the accompanying drawings a specific embodiment of the invention representing what is presently regarded as the best mode of carrying out the generic concepts in actual practice. From the detailed description of this presently preferred form of the invention, other more specific objects and features will become apparent.

In the drawings:

FIG. 1 is a view in side elevation of anextensible boom construction conforming to the invention;

FIG. 2, an enlarged, fragmentary view of the portion of FIG. 1 comprehended by the line 2—2, and showing a typical roller and slide-plate arrangement;

FIG. 3, a similar but further enlarged view of the roller and slide-plate arrangement alone, with a portion being partially broken away to show, in vertical section, details of the roller mounting;

FIG. 4, a vertical section taken on the line 4—4 of FIG. 3;

FIG. 5, a view in side elevation of one of the intermediate sections of the boom of FIG. 1, an intermediate portion being broken out for convenience of illustration;

FIG. 6, a similar view in top plan;

FIG. 7, an end elevation looking from the left in FIG. 5; and

FIG. 8, a similar view looking from the right in FIG. 5.

Referring now to the drawings:

In the illustrated preferred embodiment, the extensible boom is made up of a telescoping tip section 1, one or more intermediate telescoping sections 2, and a base section 3 that is pivotally mounted at one of its ends to a mobile crane or other support structure (not shown). Any suitable means for mounting the boom and for extending and retracting the telescoping sections can be employed, but a preferred arrangement is fully disclosed in our co-pending application for Patent Ser. No. 493,450, filed Oct. 6, 1965, and entitled "Extensible Boom Crane."

With this arrangement, the angular position of the boom is varied by taking up or releasing a cable (not shown). The boom is lengthened, i.e. extended, and is shortened, i.e. retracted, by means of one or more operating cables 4, each of which has one end tied or otherwise fastened to the free end of the tip section 1, as shown at 4*a* in FIG. 1, and the other end tied or otherwise fastened, as at 4*b*, to the rear frame member of tip section 1. The intermediate portion of each operating cable 4 is passed around a series of pulleys 5 carried at the forward and rearward ends of the respective boom sections and around a winch drum (not shown). When the winch drum is rotated in one direction, the lower reach of the cable 4 is wound onto the drum and the upper reach is simultaneously payed out, thereby extending the boom; when rotated in the opposite direction, upper reach of the cable is wound onto the drum and the lower reach is simultaneously payed out, thereby retracting the boom.

Although the invention is here illustrated as being applied to a telescoping boom it will be apparent that it can as well be used in connection with extensible booms made up of sections that are interfitted in other ways for extension and retraction.

As illustrated, a personnel carrier basket 6 is suspended from tip section 1. This basket is especially useful for positioning men and equipment during installation or repair of power lines, but other accessories that will enable the boom to be used for other purposes, for example, as a hoist or a drag line, could as well be used to replace the basket.

In accordance with the present invention, anti-friction roller and slide plate assemblies, shown generally at 7, are attached to the telescoping and base sections so that they will act as bearings during extension and retraction of the boom.

Although the roller and slide plate assemblies can be arranged and fixed to the sections in any suitable manner, a preferred arrangement for the illustrated telescoping boom includes a pair of brackets 8, FIGS. 5 and 6, welded or otherwise fixed to each side of the received end of each of the intermediate and of the tip telescoping sections. Shafts 9 extend through upper and lower portions of each pair of brackets to provide pivot axes for roller and slide plate assemblies at the four corners of the section, respectively. The receiving end of each of the intermediate telescoping sections 2 and of base section 3 are similarly fitted with a pair of brackets 10 and with shafts 11 extending between upper and lower portions of the brackets, to provide pivot axes for roller and slide plate assemblies at the four corners of the section, respectively.

Each roller and slide plate assembly includes a pair of support plates 12 and 13, FIGS. 2 and 3, that have holes 14 therethrough, through which the shafts 9 or 11 are passed. Bosses 15 and 16, having holes therethrough, surround and reinforce the holes 14 in support plates 12 and 13, respectively.

A plurality of rollers 17, each having a flanged edge 17*a*, and an axle shaft 18 journaled through one end of a piston, 19, with a lock nut 20 threaded onto the axle

shaft to hold it in position. The pistons **19** slide in box-like cylinders formed between the surfaces of support plates **12** and **13** and between spacers **21** and **22** that are fixed between the plates. Rotation of the pistons is prevented by the matching flat surfaces of each piston and its cylinder.

A cross member **23** is also positioned between plates **12** and **13** to close the end of the cylinder in which the piston is slidable, and a resilient cushion **24** positioned between the cross member **23** and the piston **19** provides an abutment against which the piston will rest. A backing member **25** is slidable within the box and is positioned between cushion **24** and cross member **23** such that rotation of set screws **26** which are threaded through cross member **23** and which are held in place by lock nuts **26***a*, will change the position of the cushion, and the extent to which the piston can move in the cylinder.

Slide plates **27** are fixed to and extend across the gap formed between support plates **12** and **13** between the rollers **17**. The slide plates are cantilevered beyond plate **12** to present a flat surface that will engage with the longitudinal structural members on which the rollers **17** travel whenever cushion **24** is sufficiently collapsed. The slide plates are constructed of a durable material that will easily slide on the structural members making up the sections of the boom. Graphite impregnated bronze has been found highly suitable for the purpose, but other materials such as nylon and teflon can be used, and lubricants can be applied to the slide plates to decrease friction losses, if desired.

In use, the tip and intermediate sections are telescoped inside the base section **3** such that the flanges **17***a* of the rollers each engage the edge of a longitudinal structural angle member of an adjacent section, with the roller face traveling on the structural angle member. The pivoted mounting of the roller and slide plate assemblies on axis **9** or **11** allows the roller and slide plate assemblies to be rotated so that the sections can be easily interfitted.

The telescoping sections are reciprocated in the manner previously described, with the rollers providing substantially friction-free bearings between the sections. However, should the boom be extended horizontally, or at such an angle that the deflection loading tends to bend the boom and to overload the rollers, the sliding pistons will compress cushions **24** and deform them into spaces **28** provided between the cushion and spacers **21** and **22**, until the slide plates **27** come in contact with the structural angle member. The deflection loading is then distributed through both the rollers and the slide plates. The stresses transmitted are not localized, but are spread over a larger area, and the possibility of failure of the structural angle members or of the rollers is greatly reduced.

The amount of deflection loading that must occur before the slide plates become effective to distribute the load can be varied by adjusting set screws **26** to change the position of cushion **24**. Thus, if the set screws are turned in as far as possible a maximum bending of the boom will be required to compress the cushion sufficiently for the slide plates to come in contact with the structural angles on which their associated rollers travel. If, the screws are turned out as far as possible, as illustrated in FIG. 3, only a minimum amount of bending of the boom will be required to place the slide plates in contact with the structural angle members.

The amount of deflection loading required before the slide plates become effective to distribute the load can also be varied in accordance with the properties of the material used for cushions **24**. A resilient polyurethane has been found suitable as a cushion material, for example, and the degree of compression of this material varies in accordance with its durometer hardness. Thus, by selecting a material of desired durometer hardness, the desired resistance to compression can be obtained.

Furthermore, other materials such as rubber, and other resilient means such as springs, hydraulic cylinders, etc. can be used if desired.

Although the roller and slide plates have here been illustrated as having three rollers, with the slide plates between them, it should be obvious that more or fewer rollers, and more or fewer slide plates can be employed.

Whereas there are here specifically set forth certain preferred procedures and apparatus which are presently regarded as the best mode of carrying out the invention, it should be understood that various changes may be made and other procedures adopted without departing from the inventive subject matter particularly pointed out and claimed herebelow.

We claim:

1. An extensible boom for a crane or the like, comprising in combination:

a plurality of elongate boom sections interfitted for longitudinal extension and retraction to lengthen and shorten the boom;

rollers normally mounting the several sections for anti-friction movement relative to one another;

slide plates arranged between said sections to permit sliding movement of the several sections relative to one another under conditions of extreme loading of the boom; and

supporting means normally maintaining said rollers in boom section supporting positions but collapsible under conditions of extreme loading of the boom to permit the boom sections to engage and slide on said slide plates for load distribution.

2. An extensible boom according to claim **1**, wherein said supporting means comprises a piston inserted in a cylinder, and a compression pad located under said piston, said compression pad being compressed under conditions of extreme loading to permit the boom sections to engage and slide on said slide plates for greater load distribution.

3. An extensible boom according to claim **2**, wherein the cross section of the compression paid is smaller than the cross section of the cylinder, and the pad is arranged in the cylinder so that there is a space in a direction normal to the direction of the compressing force on at least one lateral side of the pad to permit pad deformation and lateral expansion as it is compressed.

4. An extensible boom according to claim **2**, wherein the supporting means further comprises a spacer and adjustment means therefor located at the bottom of the cylinder under the compression pad.

5. An extensible boom according to claim **3**, wherein the compression pad is polyurethane.

6. An extensible boom according to claim **3**, wherein the cylinder, piston and compression pad are each rectangular in cross section.

7. An extensible boom for a crane or the like, comprising

at least two boom sections interfitted for extension and retraction of one of the sections relative to the other;

roller means normally supporting said one section for anti-friction movement relative to the other section;

means collapsible under extreme loading for normally supporting said roller means in boom-section-supporting position; and

slide bearing means positioned to be contacted by the said one section upon collapse of the collapsible means under extreme loading, said slide bearing means being adapted to provide a bearing surface for continued extension and retraction of the said one section with respect to the other section after such collapse.

8. An extensible boom in accordance with claim **7**, wherein the collapsible means comprises a pad of a normally rigid but resiliently deformable material.

9. A collapsible boom in accordance with claim **7**, wherein

the roller means, the collapsible means, and the slide bearing means comprise a unit;

a plurality of said units are interconnected in aligned relationship to form a roller and slide assembly; and

at least one said roller and slide assembly is pivotally connected intermediate its length to an end of the other boom section into which the one section is retracted and from which the one section is extended.

10. A collapsible boom in accordance with claim **9**, wherein

at least one roller and slide assembly is pivotally connected intermediate its length to an end of the said one boom section movable within the other boom section.

11. An anti-friction assembly for supporting an extensible and retractable boom section or similar structure, comprising:

a structural support;

at least one roller mounted on said support;

at least one slide plate mounted on said support so that the roller in its normal position projects outwardly beyond the plate; and

supporting means normally maintaining said roller in its outwardly projecting position, but collapsible under conditions of extreme loading to permit the load to engage said slide plate for load distribution.

12. An anti-friction assembly according to claim **11**,

wherein the supporting means comprise at least one piston inserted in a cylinder having a closed end, and a compression pad at the closed end of said piston.

13. An anti-friction assembly according to claim **12**, wherein the cross section of the compression pad is smaller than the cross section of the cylinder, and the pad is arranged in the cylinder so that there is a space in a direction normal to the direction of the compressing force on at least one lateral side of the pad to permit pad deformation and lateral expansion as it is compressed.

14. An anti-friction assembly according to claim **12**, wherein the compression pad is a normally rigid but resiliently deformable plastic material.

15. An anti-friction assembly according to claim **12**, wherein the closed end of the cylinder is adjustable in position toward and away from the piston.

16. An anti-friction assembly according to claim **12**, wherein the cylinder, piston, and compression pad are each rectangular in cross section.

References Cited

UNITED STATES PATENTS

2,064,756	12/1936	Janeko	308—6
3,029,954	4/1962	Grant	212—144
3,097,892	7/1963	Newbury	308—6

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