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Eiler et al.

[11] **3,802,136**

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[54] **EXTENDIBLE CRANE BOOM FORMED OF TELESCOPIC BOX-SHAPED SECTIONS**

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[52] **U.S. Cl.** **52/115,** 52/118, 212/55

[51] **Int. Cl.** **E04h 12/34**

[58] **Field of Search** ..... 52/115, 118, 111, 123, 52/116; 212/46 A, 55; 182/63, 141

[56] **References Cited**

UNITED STATES PATENTS

2,713,402	7/1955	Balogh	52/115
3,481,490	12/1969	Eiler	212/55
D224,129	7/1972	Sterner	212/55 X
3,398,645	8/1968	Nansel	52/115 X
2,647,022	7/1953	Smid et al.	52/114 X
3,000,473	9/1961	Reynolds	182/63 X
2,508,835	5/1950	Moon et al.	52/118 X
R22,746	4/1946	McDougall	52/118 X
2,920,725	1/1960	Emmons	52/118
3,664,458	5/1972	Sterns	182/63 X

FOREIGN PATENTS OR APPLICATIONS

1,055,159	2/1954	France	52/118
1,181,101	6/1959	France	52/118
870,387	3/1953	Germany	52/111
1,122,682	1/1962	Germany	52/118

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Assistant Examiner—Leslie A. Braun
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[57] **ABSTRACT**

A crane boom is formed of a longitudinally extending base section and a plurality of extendible boom sections movable between a retracted position telescoped within the base section and a fully extended position where the boom sections extend serially outwardly from the base section. Each extendible boom section has a U-shaped configuration formed by a pair of longitudinally extending laterally spaced parallel box-shaped members joined at one end by a bending resistant transverse member. The box-shaped members have a trapezoidal cross section sized so that adjacent box-shaped members nest within one another. Each box-shaped member is constructed by welding two U-shaped sections together to provide the closed cross sectional shape. Rollers are arranged within the boom to support the individual sections as they are extended and retracted. The extendible boom sections are moved outwardly and inwardly by hydraulic piston cylinders, with one hydraulic piston cylinder associated with each of the extendible boom sections. The hydraulic piston cylinders are located between and extend along the box-shaped members of the extendible boom sections.

15 Claims, 14 Drawing Figures

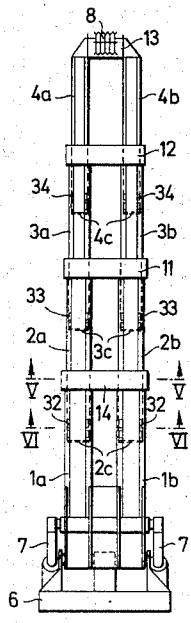


FIG. 4

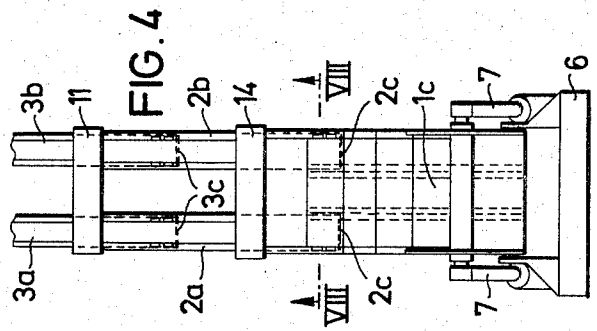


FIG. 3

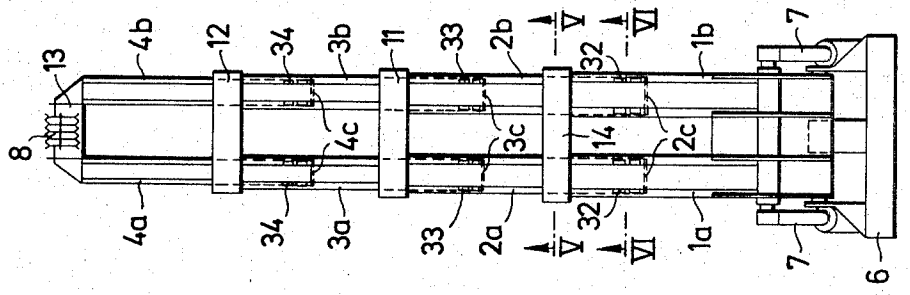


FIG. 2

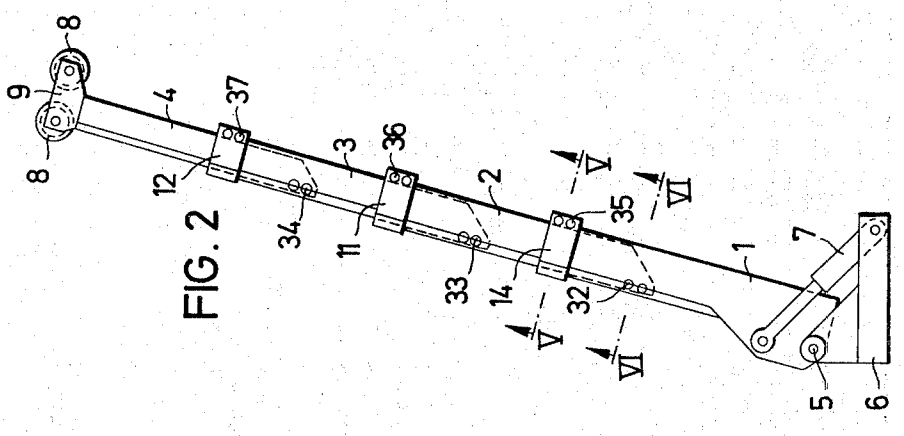
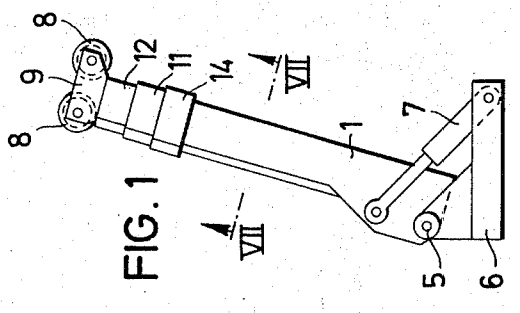


FIG. 1



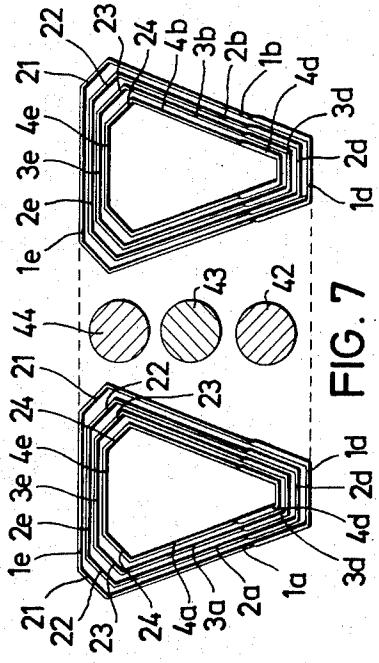


FIG. 7

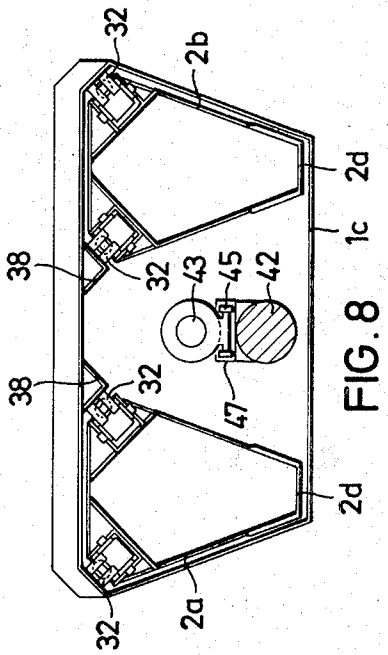


FIG. 8

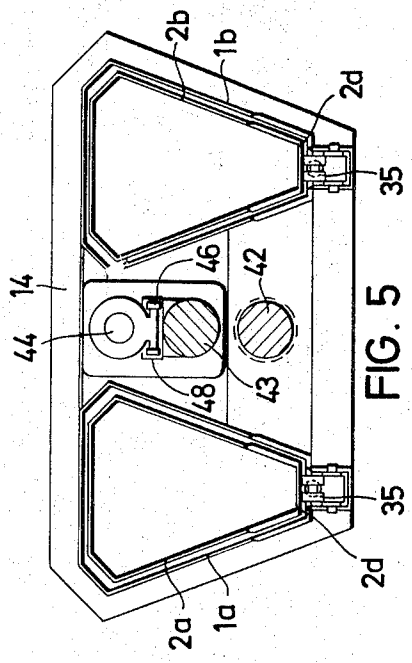


FIG. 5

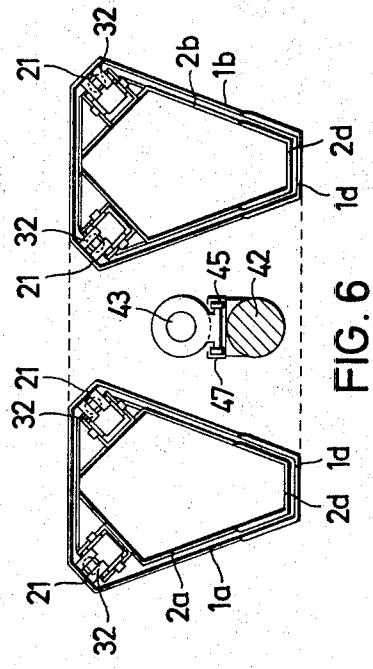


FIG. 6

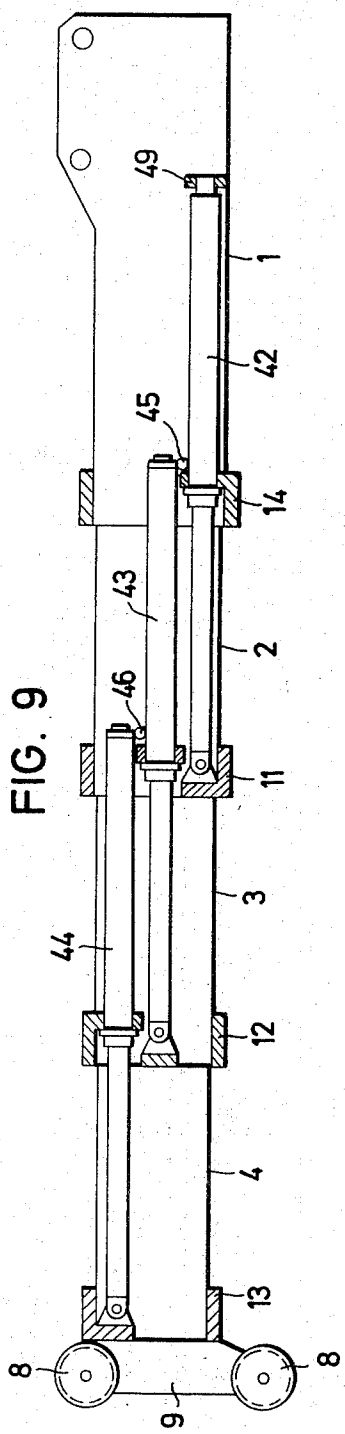


FIG. 9

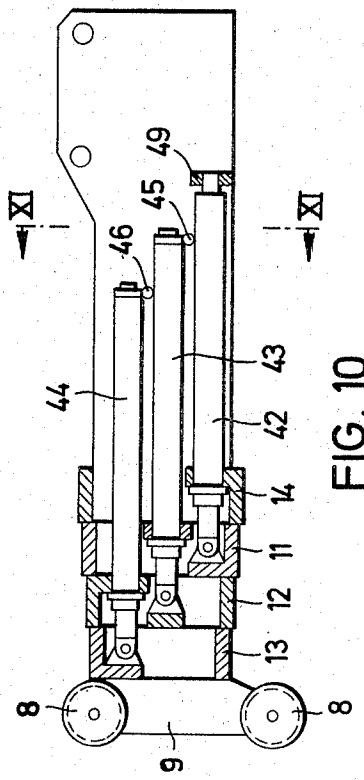


FIG. 10

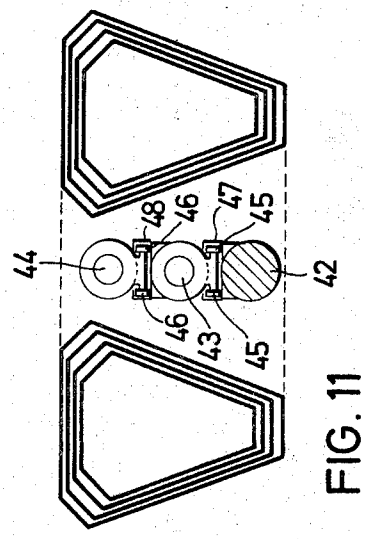


FIG. 11

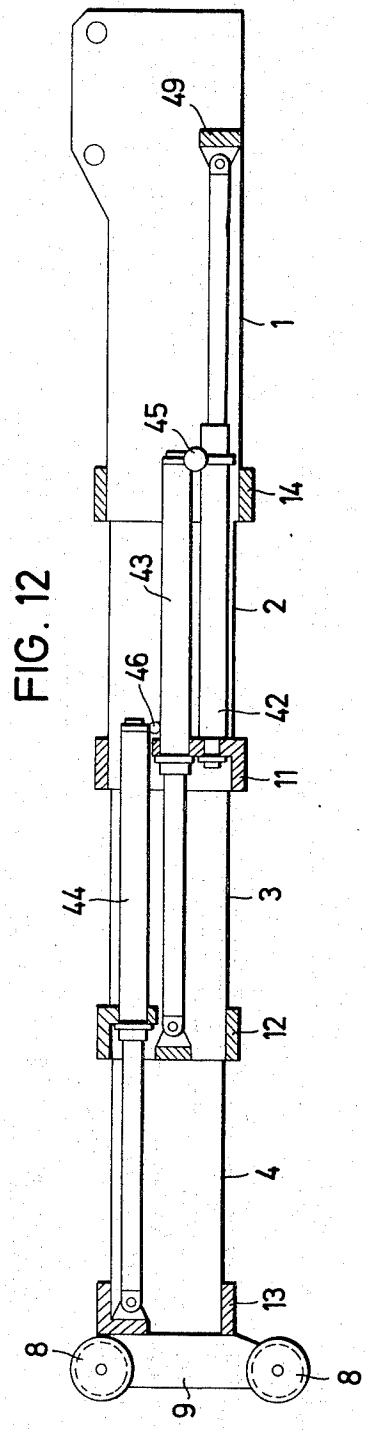


FIG. 12

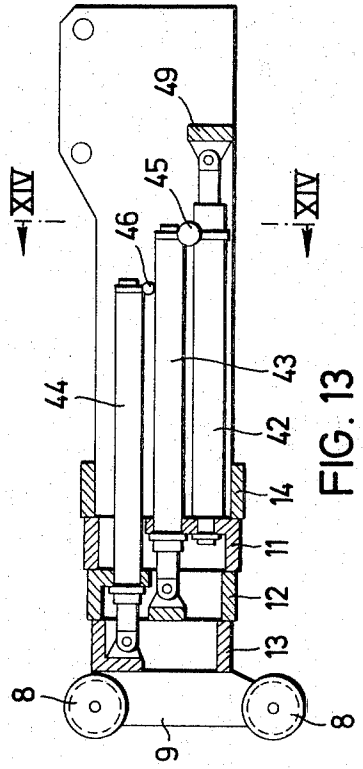


FIG. 13

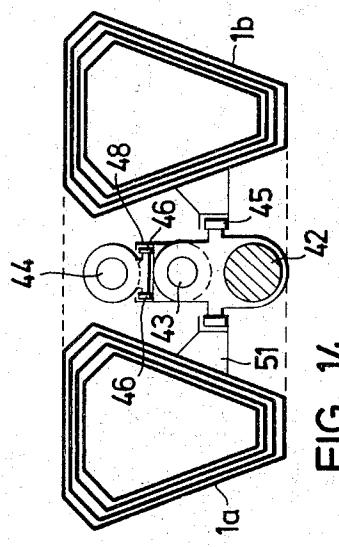


FIG. 14

EXTENDIBLE CRANE BOOM FORMED OF TELESCOPIC BOX-SHAPED SECTIONS

SUMMARY OF THE INVENTION

The present invention is directed to a telescopically arranged longitudinally extendible crane boom and, more particularly, it concerns the individual extendible boom sections which are formed of a pair of longitudinally extending laterally spaced box-shaped members.

Crane booms formed of a welded box-shaped construction have been successfully employed for providing more favorable static conditions which afford the absorption of high bending forces. However, it has been noted that such booms exhibit a so-called "soft" characteristic in respect to lateral forces when heavy weights are lifted and, as a result, they tend to yield in the lateral direction which causes a laterally directed bending moment to develop. Such a laterally directed bending moment causes a lateral deflection in the longitudinal axis of the boom especially when the boom is completely extended and such a bending moment can be absorbed or eliminated only with considerable difficulty through the use of brackets.

Accordingly, it is the primary object of the present invention to provide an extendible crane boom which is suitable for lifting extremely heavy loads and in which laterally directed bending moments are absorbed and stabilized.

Therefore, in accordance with the present invention, the boom is formed of a plurality of individual telescopically arranged sections with each section formed of a pair of box-like members joined together at one end by a bending resistant member to afford suitable restraint against lateral deflection. Further, the individual box-like members of the boom sections are guided one within the other to afford adequate support as the boom sections are extended and retracted. To provide the desired effect, each of the extendible boom sections is formed of a substantially U-shaped frame the legs of which are constructed of box-shaped members connected at one end by a bending resistant transverse member. Further, each of the extendible boom sections more remote from the base of the boom are telescopically received within and guided by the extendible boom section closer to the base of the boom. With this arrangement a bending resistance is established in the horizontal direction.

With the present invention a boom construction is provided which utilizes a relatively small amount of material and provides a relatively wide laterally extending guide for the individual sections which is particularly resistant to lateral bending moments. The transverse members which connect the pair of box-shaped members in each boom section aid in affording a stable and bending resistant structure independent of the telescopic arrangement of the individual boom sections.

For guiding the individual box-shaped members of the telescopically arranged boom sections within one another, it has proven to be advantageous if the free ends of the box-shaped members, that is the ends spaced from the transverse member, are provided on their upper surfaces with rollers or gliding shoes which, in association with running or sliding surfaces within the box-shaped members of the next adjacent boom section in the direction of the base of the boom, afford a guiding and supporting action as the boom sections are extended and retracted. Further, the lower surfaces of each of the box-shaped members are provided with running or sliding surfaces which ride on rollers or guiding shoes supported in the transverse member of the boom section closer to the base of the boom. By this arrangement, the individual box-shaped members can be supported within one another so that the forces between them are handled in a simple manner. During use exceedingly high forces develop in the boom, particularly in the portion of the boom exposed to compressive forces. For effectively transmitting the high forces from one boom section to the next located closer to the base of the boom, the box-shaped members of each extendible boom section are provided with a trapezoidal cross sectional configuration. Advantageously, the upper and lower sides of the trapezoid are formed in parallel relationship to one another and the lower side or chord is narrower than the upper side or chord. With this arrangement it is possible to construct the lower side of the box members, that is the side exposed to compressive forces, in the manner of a support or guide surface which extends in parallel relationship with the upper side so that the forces in each case are introduced into the outer end of each boom section in a direction which is in parallel with the direction of the action of the load with the outer end of each boom section acting as a support or bearing for the next more outwardly arranged section.

The centering action for the individual box-shaped members of each boom section is advantageously provided by running or gliding surfaces on the upper sides of the boom sections which ride along rollers or gliding shoes arranged on the upper side of the next adjacent boom section. Preferably, the running or gliding surfaces are provided at a predetermined angle to the parallel direction of the upper and lower sides with the rollers arranged in parallel relationship with the predetermined angle. In constructing the individual box-shaped members of each boom section, it has been found to be particularly advantageous if each box-shaped member is formed of two U-shaped longitudinally extending sheet metal sections welded together along their free edges and, preferably, the welding seam is located in the neutral plane between the region of tensile and compressive forces in the boom section. With such an arrangement it is possible to adapt the lower portion of each of the box-shaped members to the load requirements to be experienced by choosing a thicker section for the lower part of the box-shaped member so that its entire cross section is not over-dimensioned with regard to its wall thickness. It should be appreciated that the lower chord or portion of the box-shaped members is subjected to greater loads as compared to the remaining surfaces, due to the bending forces experienced and the arrangement of the guide rollers. The arrangement of the telescopic boom sections provided by the present invention affords an exceedingly high stability and increased support capacity. Moreover, a significant advantage is achieved by the arrangement of the boom section in that a space is provided for the means for extending and retracting the individual boom sections. Accordingly, since the individual box-shaped members of each boom section are spaced apart laterally, the space between them affords a central arrangement for the means used in extending and retracting the boom, such means are preferably hydraulic piston

cylinders. With such hydraulic piston cylinders located in the space between the box-shaped members they are very easily accessible and can be serviced in a very simple manner. Further, if it is necessary to do so, the hydraulic piston cylinders can be easily replaced without any disassembly of the boom. Due to the relative movement of and the force transmission through the individual box-shaped members, which is advantageously achieved through the bending resistant transverse member which connects the box-shaped members, many different embodiments are possible and some of these are illustrated in the embodiments of the invention shown in the drawing.

In addition to the extendible boom sections described above, the base boom section, which is connected through at least one luffing cylinder and a rockable bearing with a bracket or support arrangement well known in the art, can be constructed in two basic arrangements in accordance with the present invention. In one embodiment, the base section can be constructed in accordance with the arrangement of the telescopic boom sections, that is it can be formed of two laterally spaced box members disposed in parallel with one another with a transverse member connecting their ends remote from the base of the boom in a bending resistant manner. Alternatively, the base section can be provided as a single box-like member closed on its upper and lower surface so that in the retracted position of the boom all of the hydraulic piston cylinders are enclosed by the single box-shaped member and a particularly simple protective enclosure is provided for the hydraulic piston cylinders against the ambient atmosphere and any other influences which may be experienced.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a side elevational view of a crane boom embodying the present invention with the boom shown in a fully telescoped position;

FIG. **2** is a side elevational view of the boom shown in FIG. **1**, however, with the boom illustrated in its fully extended position;

FIG. **3** is a front elevational view of the boom shown in FIG. **2**;

FIG. **4** is a partial front elevational view, similar to FIG. **3**, but with an alternate arrangement for the base portion of the boom;

FIG. **5** is a sectional view taken along the line V—V in FIGS. **2** and **3**;

FIG. **6** is a sectional view taken along the line VI—VI in FIGS. **2** and **3**;

FIG. **7** is a sectional view taken along the line VII—VII in FIG. **1**;

FIG. **8** is a sectional view taken along the line VIII—VIII in FIG. **4**, further, in FIGS. **5** to **8** the position of the hydraulic piston cylinders is indicated though not shown in FIGS. **1** to **4**;

FIG. **9** is a sectional side view of the extended boom showing one embodiment of the arrangement of the hydraulic piston cylinders;

FIG. **10** is a view similar to FIG. **9**, however, with the boom in its fully retracted position;

FIG. **11** is a sectional view taken along the line XI—XI in FIG. **10**;

FIG. **12** is another sectional view of the extended boom showing an alternate arrangement of the hydraulic piston cylinders;

FIG. **13** is a view similar to FIG. **12**, however, the boom is shown in the fully retracted position; and

FIG. **14** is a sectional view taken along the line XIV—XIV in FIG. **13**.

DETAILED DESCRIPTION OF THE INVENTION

In the drawing an extendible boom is shown which consists of a base boom section **1** and three extendible and retractable boom sections **2**, **3** and **4** which, as shown in FIG. **1**, can be telescopically arranged within the base section **1**, and, as shown in FIG. **2**, can be extended in a serial arrangement from the base section **1**. As shown in the drawing, boom section **2** extends immediately outwardly from base section **1** while boom section **3** extends from boom section **2** and boom section **4** extends from boom section **3**.

At its lower or base portion, the base boom section **1** is connected in a pivotal manner, by means of a bearing **5**, to a bracket or support plate **6**. In turn, the support plate is connected to a foundation or frame, not shown. A luffing cyinder **7** is connected at one end to the lower end of the base boom section **1** and at its other end to the support plate **6** for pivoting the boom about a horizontal axis. The extendible or telescopic boom section **4**, located most remote from the base boom section in the fully extended position, note FIG. **2**, has a support member **9** at its outer-most end on which guide rollers or pulleys **8** are mounted.

As illustrated in FIGS. **3** and **4**, each of the telescopic boom sections **2**, **3** and **4** is formed of a pair of laterally spaced box members **2***a*, **2***b*, **3***a*, **3***b*, **4***a* and **4***b*, arranged in parallel relationship and at their ends more remote from the base of the boom, each pair of box-shaped members is interconnected by a bending resistant transverse member **11**, **12** and **13** so that each individual telescopic boom section forms a inverted U-shaped frame. As indicated in FIG. **1**, the box-shaped members of each telescopic boom section **2**, **3** and **4** are telescopically guided within one another so that in the retracted position the telescopic boom member **4**, located most remote from the base boom section in the extended position, is the most inwardly located with the telescopic boom sections **3** and **2** and the base boom section **1** being concentrically disposed about it, in turn. Further, in the retracted position, the transverse end members **14**, **11**, **12** and **13** are in contacting serial arrangement.

In FIGS. **3** and **4**, two possible embodiments are shown for the construction of the base boom section **1**.

As shown in FIG. **3**, the base boom section **1** can be formed in the same manner as the telescopic boom sections **2**, **3** and **4**, that is, with two laterally spaced box-shaped members **1***a*, **1***b* extending in parallel relation with one another and connected at their ends spaced from the lower end of the boom by a transverse member **14**. However, an alternative arrangement is shown

in FIG. 4, where the base boom section is constructed as a single box-shaped member 1*c*, closed on its top and bottom sides and reinforced in a bending resistant manner by a transverse member 14 at the outer end of the box-shaped member from the base of the boom. The arrangement shown in FIG. 3 affords a very considerable savings in material, while the arrangement in FIG. 4 has the advantage that in the fully retracted position all of the movable parts of the extendible boom are protectively enclosed by the single box-shaped member 1*c*.

As mentioned above, and as is illustrated in FIGS. 5 to 8, each of the individual longitudinally extending parts of the telescopic boom sections 2, 3 and 4 has a box-shaped cross section transverse to the longitudinal direction of the boom.

To prevent cross sectional deformation in the individual box-shaped members 2*a* . . . 4*b*, inspite of the large loads to which the boom incorporating the present invention may be subjected, it is advantageous to provide at least one stiffening member 2*c*, 3*c* and 4*c* at the ends of the box-shaped members closer to the base of the boom, that is the ends opposite the transverse members 11, 12 and 13. Such end reinforcement increases the load limit of the boom without increasing the wall thicknesses of the individual box-shaped sections of the boom. Known telescopic booms which have used box-shaped members have not been able to incorporate such end reinforcement because the hydraulic cylinders which effect the extension and retraction of the sections had to be guided within the box members. In the present arrangement, as will be clear from the subsequent description, it is not necessary to locate the hydraulic piston cylinders within the box-shaped members.

A particularly favorable arrangement of forces and transmission of forces is achieved with the embodiment shown in the drawing, that is, with the individual box-shaped members 2*a* . . . 4*b* having an approximately trapezoidal cross section, as shown in FIGS. 5 to 8. Each of the box-shaped members, including those of the base boom section 1, where it is formed of a pair of laterally space box-shaped members 1*a*, 1*b*, is constructed of two U-shaped sheet metal sections, a lower U-shaped section 1*d*, 2*d*, 3*d*, and 4*d* forming the lower part of the box-shaped member while the upper part is formed by an inverted U-shaped section 1*e*, 2*e*, 3*e*, and 4*e*. The lower U-shaped sections 1*d*, 2*d*, 3*d* and 4*d* have outwardly diverging legs as they extend upwardly from the base of the box member which is arranged in parallel relationship with the upper or top surface of the box member. Conversely, the U-shaped sections 1*e*, 2*e*, 3*e* and 4*e* have inwardly converging sides as they extend downwardly from the upper part of the box-shaped members. In each box-shaped member 1*a* . . . 4*b* the upper and lower U-shaped sections are welded together along the free edges of the legs of the sections to provide the closed trapezoidal cross sectional shape. As indicated in FIG. 7, the lower U-shaped sections 1*d*–4*d* have a greater wall thickness than the upper U-shaped sections 1*e*–4*e*, that is, the lower portions of the boom sections exposed to compressive forces have a greater wall thickness than the upper portions which are exposed to tensile forces. The upper sections 1*e*–4*e* are provided with inclined surfaces 21, 22, 23 and 24 which extend longitudinally along the upper edges of the upper sections connecting the top surface with the side surfaces. The inclined surfaces 21, 22, 23 and 24 are nested one within the other and provide rolling or gliding surfaces which preferably extend at an angle of 45° to the upper surface of the boom sections, or the inclined surfaces are provided as supports for rollers or glide shoes which are arranged at the same angle. As can be seen in FIG. 2, each of the box-shaped members of the telescopic boom sections 2, 3 and 4 is provided at its end closer to the base of the boom and on the upper side of the box-shaped section with two roller pairs 32, 33 and 34 which ride along on the inner side of the inclined surfaces 21, 22 and 23 of the next inwardly located boom section. According to FIG. 6, and for improving the guiding characteristics of the boom, each roller of a roller pair may consist of a double roller which is preferably adjustably mounted in both planes.

At the location of the transverse members 14, 11 and 12, each of the boom sections 1, 2 and 3 is provided with a roller pair 35, 36 and 37 which has a construction corresponding to that of the roller pairs 32, 33 and 34, however, the axis of the rollers is arranged in parallel relationship with the lower surface of the lower U-shaped sections of the box-shaped members. The lower U-shaped sections 2*d*, 3*d* and 4*d* of the telescopic boom sections 2, 3 and 4 ride on the roller pairs 35, 36 and 37, respectively

In the embodiment shown in FIG. 4, in which the base boom section 1, as described above, is a single box-shaped member, the guides or roller units are constructed in a corresponding manner. As shown in FIG. 8, the rolelr units 32 of the telescopic boom section 2 are provided in contact with support surfaces 38 on the box-shaped member 1*c*. The support surfaces 38 are disposed at the angle of inclination of the roller axes, since the box-shaped member 1*c* does not contain the configuration of the box-shaped members 1*a*, 1*b* as shown in FIG. 3.

As mentioned above, with the present arrangement an exceedingly advantageous arrangement of the means for moving the telescopic boom sections 2, 3 and 4 between the retracted and extended positions is provided preferably by hydraulic piston cylinders. As indicated in FIGS. 5 to 8, 11 and 14, the hydraulic piston cylinders are located in the space between the laterally separated box-shaped sections of each telescopic boom section. Each of the extendible telescopic sections 2, 3 and 4 is provided with a hydraulic cylinder 42, 43 and 44, respectively. In the embodiment shown in FIGS. 8 to 11, the hydraulic cylinders in the retracted position are arranged substantially vertically above one another and the piston rod portion of the hydraulic piston cylinders each extends in the same direction, that is, toward the top or outer end of the boom. In this arrangement the cylinder tubes or housings, which are heavier than the piston rods, are located closer to the base of the boom so that a more favorable center of gravity position is obtained. The free ends of the piston rods of each of the hydraulic piston cylinders 42, 43 and 44, that is, the ends extending outwardly from the housings, are in each case secured to the transverse member 11, 12 and 13 of the corresponding boom sections 2, 3 and 4, and the ends of the housings from which the piston rods extend are connected to the transverse members 14, 11 and 12, respectively. The free ends of the housings of the hydraulic cylinders 43 and 44 each has a guide roller 45, 46, respectively,

which ride in guides **47, 48,** formed in the housings of the hydraulic piston cylinders **42** and **43** located in the adjacent boom section closer to the base of the boom. Further, the end of the housing of the hydraulic piston cylinder **42** is connected to a support **49** within the base boom section **1.** The manner in which the hydraulic piston cylinders extend and retract the telescopic boom sections **2, 3** and **4** can be readily understood from the illustration provided in FIGS. **9** and **10.**

A reinforcement of the guidance for the hydraulic piston cylinders can be effected in a particularly advantageous manner in accordance with the embodiment shown in FIGS. **12** to **14.** In the embodiment shown in FIGS. **12** to **14,** the hydraulic cylinder **42** located closer to the base of the boom in the extended position is arranged in a reversed position as compared to the other hydraulic piston cylinders **43** and **44,** that is, the free end of the piston rod extends from the housing toward the base of the boom and is connected to the support **49,** while the end of the housing opposite the end from which the piston rod extends is secured to the transverse member **11** of the next outwardly arranged telescopic boom section **2.** Since in this embodiment it is not possible to secure the housing of the hydraulic piston cylinder **42** at the transverse member **14,** in FIG. **14** the inwardly facing side walls of the box-shaped members **1***a* and **1***b* each contains a support guide **51** within which rollers **45** are engaged, the rollers, as shown, extend outwardly in a suitable manner into the guides. The construction of the support guides **51** is applicable to a boom where the base boom section **1** is formed of a pair of box-shaped members. Where the base boom section **1** is formed as shown in FIG. **4,** that is by a single closed box-shaped member **1**c, the support guides are arranged in a somewhat similar manner supported on the lower wall of the box-shaped member **1**c.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A longitudinally extendible crane boom comprising a first boom section forming the base of said boom and a plurality of second boom sections telescopically positionable within said first boom section and extendible from said first boom section in a serially arranged manner, each of said second boom sections having a first end and a second end spaced longitudinally from the first end thereof with said first end located closer to the base of said boom than said second end thereof, each said second boom having a U-shaped configuration comprising a pair of longitudinally extending laterally spaced members and the bight portion of the U-shaped member comprising a member secured to and extending transversely of one end of said longitudinally extending members, said longitudinally extending members fitted in the retracted position within said longitudinally extending members of said boom sections located closer to the base of said boom in the extended position, wherein the improvement comprises that said longitudinally extending members are box-shaped with each having a trapezoidally shaped cross-section and in the horizontal position of the boom and upper and lower sides of the trapezoidally shaped cross-section are arranged in parallel and said lower side being narrower in the transverse direction than said upper side, said transverse member is a bending resistant member, and each said second boom section comprises a hydraulic piston cylinder extending in the longitudinal direction of said boom and said hydraulic piston cylinders of said second boom sections are located in the longitudinally extending spaces between said box-shaped members of said second boom sections.

2. A longitudinally extendible crane boom, as set forth in claim **1,** wherein said box-shaped members of said second boom sections are disposed in parallel relationship to one another.

3. A longitudinally extendible crane boom, as set forth in claim **1,** wherein said transverse member connecting the ends of said box-shaped members is located at the ends of said box-shaped members more remote from the base of said boom.

4. A longitudinally extendible crane boom, as set forth in claim **3,** wherein at least one stiffening member is provided on the ends of said box-shaped members located opposite the ends thereof to which said transverse members are secured.

5. A longitudinally extendible crane boom, as set forth in claim **3,** wherein said first boom section comprises a single longitudinally extending box-shaped member and a bending resistant member secured to and extending transversely of the end of said single box-shaped member outwardly from the base of said boom, rollers are positioned on the upper surfaces of the ends of said second boom members spaced from the end at which said transverse member is located, said rollers arranged to run on the upper inner surface of the adjacent said boom section located closer to the base of said boom in the extended position, guides are provided on the inner upper surface of said box-shaped member of said first boom section with said guides disposed at an angle of 45° relative to the upper surface of said box-shaped members of said second boom sections, and said guides being arranged to contact said next outwardly located said second boom section.

6. A longitudinally extendible crane boom, as set forth in claim **1,** wherein said first boom section comprises a pair of longitudinally extending laterally spaced box-shaped members having the axes thereof disposed in parallel relationship and a bending resistant member secured to and extending transversely of the ends of said box-shaped members at the end of said first boom section spaced outwardly from the base of the boom.

7. A longitudinally extendible crane boom, as set forth in claim **1,** wherein said first boom section comprises a single longitudinally extending laterally closed box-shaped member and a bending resistant member secured to and extending transversely of the end of said single box-shaped member spaced outwardly from the base of said boom.

8. A longitudinally extendible crane boom, as set forth in claim **1,** wherein rollers are positioned on the upper surfaces of the ends of said second boom members spaced from the end at which said transverse member is located, said rollers arranged to run on the upper inner surfaces of the adjacent said boom section located closer to the base of said boom in the extended position, rollers positioned on each of said transverse members of said second boom members with said rollers located on the lower side of said transverse members, and each said second boom section having a running surface on its underside for running on said rollers

of said transverse members of the adjacent said boom section closer to the base of said boom.

9. A longitudinally extendible crane boom, as set forth in claim **8,** wherein said lower side of each of said box-shaped members of said second boom sections forms a running surface which cooperates with said rollers on said transverse member of the adjacent said boom section located closer to the base of the boom in the extended position, the axes of said rollers on said transverse member are disposed in parallel relationship with the lower sides of said box members of said second boom sections and the upper sides of each of said box members of said second boom sections has a pair of surfaces along the opposite edges thereof arranged at an inclined position to the upper surface and extending from the upper surface to the side surfaces of said box-shaped members and the inclined surfaces arranged at an acute angle to the upper and lower surfaces of said box-shaped members with each inclined edge surface of said upper side forming a running surface in contact with said rollers on the first ends of said second boom sections which said rollers have their axes extending in parallel relationship with the inclined edge surfaces of the upper side.

10. A longitudinally extendible crane boom, as set forth in claim **1,** wherein each said box-shaped member of said second boom sections in the horizontal position of the boom comprises an upper U-shaped longitudinally extending sheet metal section and a lower U-shaped longitudinally extending sheet metal section with the openings of said upper and lower U-shaped sections facing toward one another and the longitudinal edges of the free ends of said upper and lower U-shaped sections being welded together.

11. A longitudinally extendible crane boom, as set forth in claim **10,** wherein said lower U-shaped section having a greater material thickness than said upper U-shaped section.

12. A longitudinally extendible crane boom, as set forth in claim **1,** wherein each said hydraulic piston cylinder comprises a housing and a piston rod extendible from said housing, the free end of each said piston rod which projects from said housing is connected to said transverse member of one of said second boom sections and its housing is secured at its end from which said piston rod projects to said transverse member of said second boom section next closer to the base of said boom in the extended position.

13. A longitudinally extendible crane boom, as set forth in claim **12,** wherein each said housing of said hydraulic piston cylinders has a longitudinally extending guide, and a roller positioned on the next outwardly disposed housing at the end spaced from the end from which the piston rod extends so that said roller rides in said guide as said second boom sections are extended and retracted.

14. A longitudinally extendible crane boom, as set forth in claim **1,** wherein the innermost said hydraulic piston cylinder in the extended position of said boom is secured at the end of its housing opposite the end from which said piston rod extends to said transverse member of said second boom section located adjacent said base boom section in the extended position of said boom and the free end of said piston rod is secured to said base boom section.

15. A longitudinally extendible crane boom comprising a first boom section forming the base of said boom and a plurality of second boom sections telescopically positionable within said first boom section and extendible from said first boom section in a serially arranged manner, each of said second boom sections having a first end and a second end spaced longitudinally from the first end thereof with said first end located closer to the base of said boom than said second end thereof, each said second boom having a U-shaped configuration with the legs of the U-shaped configuration comprising a pair of longitudinally extending laterally spaced members and the bight portion of the U-shaped member comprising a member secured to and extending transversely of one end of said longitudinally extending members, said longitudinally extending members fitted in the retracted position within said longitudinally extending members of said boom sections located closer to the base of said boom in the extended position, wherein the improvement comprises that said longitudinally extending members are box-shaped with each having a trapezoidally shaped cross-section and in the horizontal position of the boom the upper and lower sides of the trapezoidally shaped cross-section are arranged in parallel and said lower side being narrower in the transverse direction than said upper side, said transverse member is a bending resistant member, said first boom section comprises a pair of longitudinally extending laterally spaced box-shaped members having the axis thereof disposed in parallel relationship and said bending resistant member secured to and extending transversely of the ends of said box-shaped members at the end of said first boom sections spaced outwardly from the base of the boom, each said second boom comprises a hydraulic piston cylinder extending in longitudinally direction of said boom and said hydraulic piston cylinders of said second boom sections are located in longitudinally extending spaces between box-shaped members of said second boom sections, a support guide secured to and extending inwardly from the inwardly facing side surfaces of said box members of said first boom section, and rollers secured to the sides of said innermost hydraulic piston cylinder in the extended position of said boom and fitted into said support guides on said box members of said first boom section.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,802,136 Dated April 9, 1974

Inventor(s) Peter Eiler and Hans Weiskopf

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading of the patent, insert:

--[30] Foreign Application Priority Data

January 26, 1971 Germany.....P 21 03 570.1-22--

Signed and sealed this 22nd day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks

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