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Wu

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[54] **EXTENSIBLE MATERIAL HANDLING BOOM**

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[52] **U.S. Cl.** **52/118,** 52/115, 212/55, 214/513

[51] **Int. Cl.** **B66c 23/00**

[58] **Field of Search** 52/114–118, 52/111; 182/2, 141, 145; 214/513; 212/55

[56] **References Cited**

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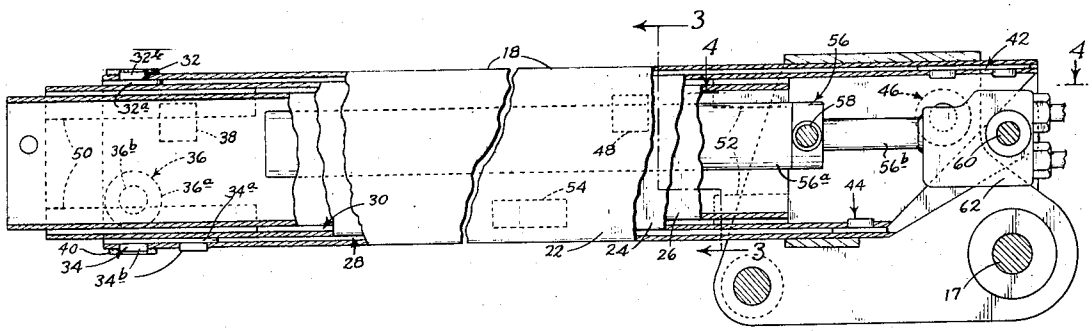
[57] **ABSTRACT**

An extension-limited telescopic boom assembly for material-handling apparatus. The assembly includes nested inner and outer boom sections which, because of special projecting parts provided on and anchored to the sections, can extend but a limited distance, and can be assembled and disassembled from but one end of the assembly.

1 Claim, 4 Drawing Figures



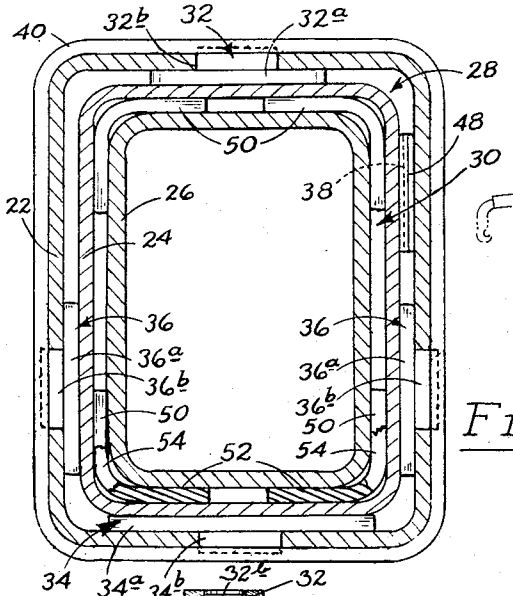


Fig. 3.

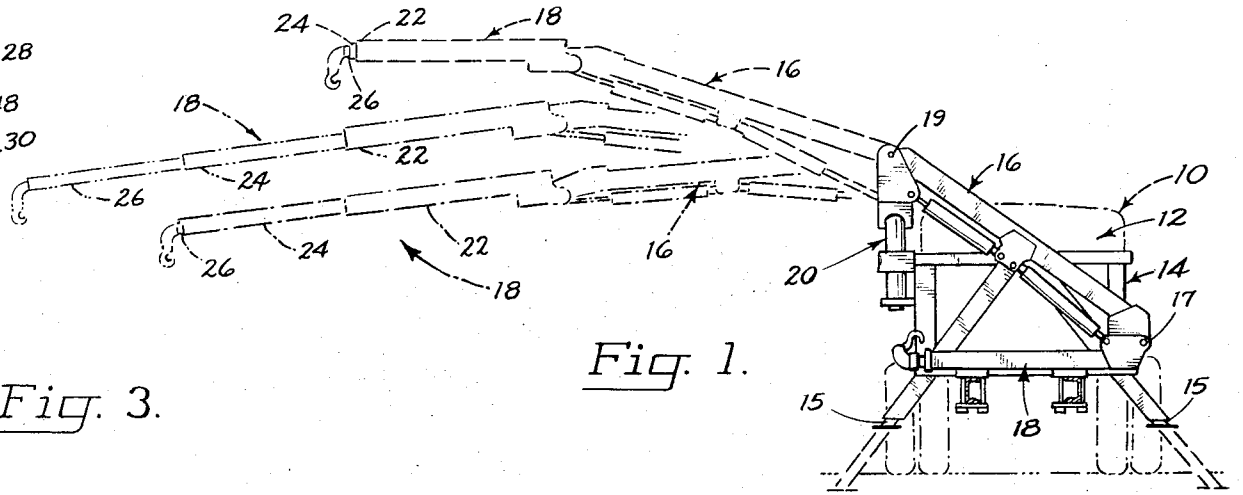


Fig. 1.

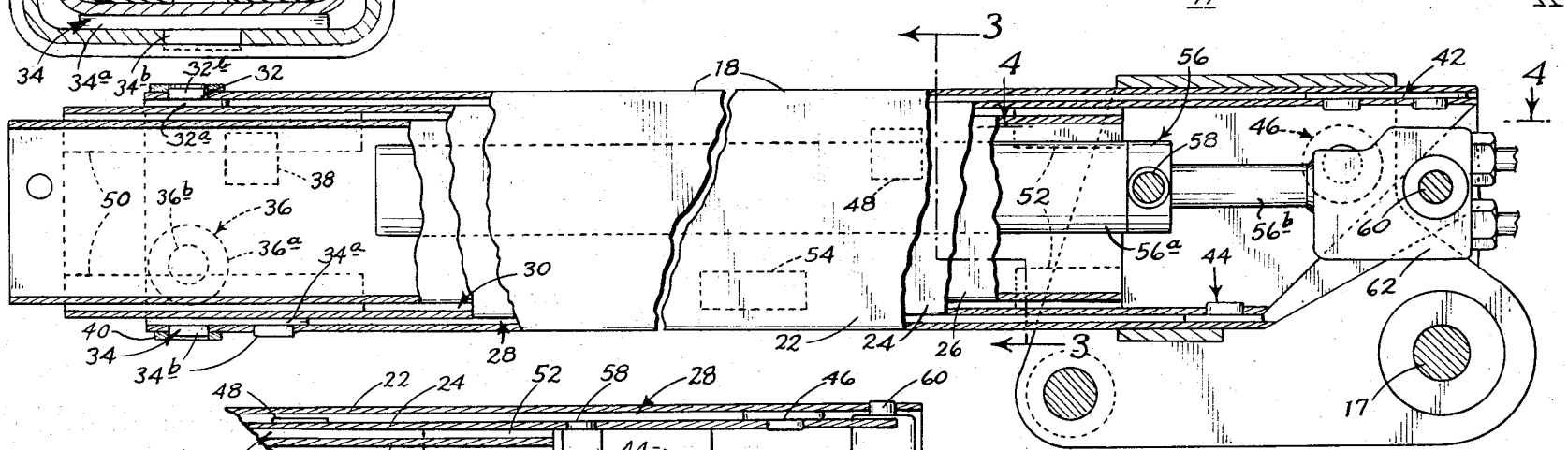


Fig. 2.

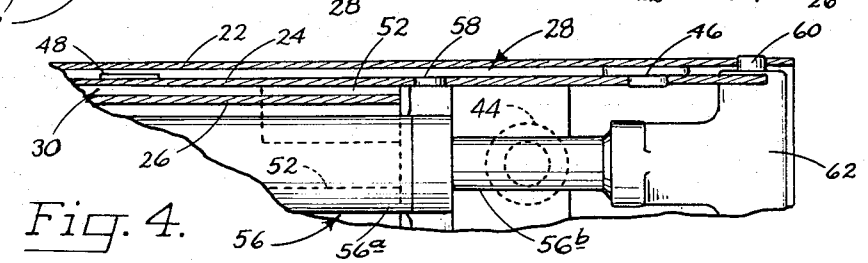


Fig. 4.

EXTENSIBLE MATERIAL HANDLING BOOM

BACKGROUND AND SUMMARY OF THE INVENTION

This invention pertains to a telescopic boom assembly for material-handling apparatus. More particularly, it pertains to such an assembly which is simple and compact, and wherein the telescopic sections, of which there may be two or more, are provided with novel rigidly joined projecting parts that extend into a clearance space between the sections—such projecting parts functioning both to limit the overall extension of the assembly, and to permit relatively foolproof assembling and disassembling of the sections from but one end of the assembly.

In certain applications, there is a need for a telescopic boom assembly having features such as those outlined generally above. One such application relates to portable-type material-handling loaders of the kind, for example, that may be mounted on a truck's frame for traveling and use with the truck. Such a loader may typically be used in various relatively remote job locations, for many different kinds of loads, and by a variety of persons of different skill levels. Under such circumstances, it is desirable that the loader, and any telescopic boom assembly used therein, not only be sufficiently versatile to handle the anticipated sorts of loads, and be compact enough when folded up to be conveniently stowed on the truck, but also be constructed in such a way as to minimize the chances of a performance failure and to simplify field repair operations should such be necessary.

A general object of the present invention, therefore, is to provide a novel boom assembly which offers these desired features and advantages.

More specifically, an object of the invention is to provide a versatile and compact telescopic boom assembly which can be used safely and reliably in handling many different kinds of loads, and which can relatively easily be disassembled and reassembled for repair purposes when out in the field. According to a preferred embodiment of the invention, the proposed boom assembly comprises at least a pair of nested relatively reciprocable boom sections, including an inner section received slidably within an outer section. The assembly may be thought of as having outer and inner ends—the outer end being the end which may accommodate mounting of the desired load-gripping or engaging device, and the inner end being the end accommodating mounting of the assembly on a frame, or another boom assembly, etc.

Featured in the proposed boom assembly are novel projection means which are mounted on the nested boom sections in such a manner that these sections can be assembled and disassembled in but one direction (i.e. from but one end of the overall assembly), and which, with the assembly all together, reliably and positively limit the overall extension obtainable in the assembly. Thus, mounted on the inside of the outer boom section according to the invention, preferably adjacent or toward the outer end thereof, are one or more projecting parts adapted to extend into the clearance space which exists between the sections with the assembly together. Similarly, mounted on the outside of the inner boom section, preferably adjacent or toward the inner end thereof, are one or more projecting parts, also

adapted to extend into the clearance space between the sections. These projecting parts, when viewed along a line substantially paralleling the longitudinal axis of the assembly, include parts that overlap one another.

According to one modification of the invention, the projecting parts are solidly joined (as by welding) to the boom sections, and are constructed to perform multiple functions in the overall assembly. For example, these parts, in addition to being arranged at least partially to overlap one another as indicated, are constructed to act as bearings between the sections. In addition, and where the boom sections have angular transverse cross-sectional configurations, one or more of the projecting parts are constructed to span a corner in such a configuration to provide reinforcement for the corner.

According to another modification of the invention, separate projecting parts are employed to provide the different functions of overlapping with one another and of transmitting forces between the sections. In such a case, the projecting parts taking care of the former function (i.e., overlapping), are preferably metal plates anchored (as by welding) to the proper boom sections. The parts taking care of the latter function (i.e., acting as bearings), conveniently comprise loosely mounted elements made of a suitable bearing material installed in a manner whereby they are captured in proper place in the overall assembly. Such construction is particularly advantageous in situations where considerable bearing wear is expected, since it permits ready replacement of worn bearing parts.

With constructions such as those just outlined, it will be apparent that the several desired features mentioned above are conveniently obtained. With at least portions of the projecting parts rigidly joined to the sections, and overlapping one another as described, the overall length-extension producible in the assembly is automatically and positively limited. This, of course, is an important safety feature. In addition, the fact that such an overlapping relationship exists, ensures that the boom sections, if disassembled for repair purposes, cannot be reassembled in the wrong relative positions. More specifically, the important overlapping relationship mentioned limits disassembling and reassembling of the boom sections to occurring at but one end of the assembly, and to taking place with the boom sections oriented in but one set of relative positions.

The space occupied by the fully contracted assembly may be relatively small, and thus the assembly may be easily stowed when not in use. The novel features in the invention may, of course, be incorporated in an assembly having more than two sections, and in fact, an assembly having three sections, constructed as contemplated herein, is described below.

DESCRIPTION OF THE DRAWINGS

These and other objects and advantages attained by the invention will become more fully apparent as the description which follows is read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a simplified rear-end elevation of a truck, on the frame of which is mounted a material-handling loader incorporating a telescopic boom assembly constructed according to the present invention—parts in the loader being shown in several different relative positions;

FIG. 2 is an enlarged fragmentary side elevation illustrating details of the proposed telescopic boom assembly, with such assembly shown fully contracted, and removed from other portions of the loader of FIG. 1; and

FIGS. 3 and 4 are fragmentary views taken generally along the lines 3—3 and 4—4, respectively, in FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Turning now to the drawings, and referring first to FIG. 1, indicated generally in dash-dot outline at **10** is a rear outline view of a conventional flatbed-type truck. Suitably mounted on the frame of truck **10**, immediately behind the cab therein, is a loader, or load-handling apparatus, **12**. Loader **12** includes a frame **14**, and mounted thereon a pair of adjustable lateral ground-engaging stabilizers **15**, and main and jib booms **16, 18**, respectively. Booms **16, 18** are pivoted together at **17**, and are supported on frame **14** through a pivot connection **19** and a spindle **20**. Main boom **16** is a nonextensible-type boom. Jib boom **18** is an extensible, or telescopic, assembly constructed according to the invention.

The main and jib booms are shown in solid outline in FIG. **1** in what might be thought of as folded-up and stowed positions on the truck. In dashed outline, dash-dot outline, and dash-double-dot outline, the booms are shown in three different unfolded and extended positions which are typical of positions that they might occupy under different circumstances in a load-handling operation. These positions will be more fully explained shortly.

Referring to FIGS. **1** and **2** together, as previously mentioned jib boom **18** comprises a telescopic assembly. More specifically, it comprises such an assembly which includes three nested boom sections indicated at **22, 24, 26.** Section **22** is the outermost section, section **24** the intermediate section, and section **26** the innermost section. As between sections **22, 24,** section **22** may be thought of as the outer section, and section **24** as the inner section. Similarly, as between sections **24, 26,** section **24** may be thought of as the outer section, and section **26** as the inner section.

Referring again to the three unfolded boom positions illustrated in FIG. **1**, and considering particularly the condition of boom **18,** the dashed lines illustrate this boom in a fully contracted condition, the dash-dot lines illustrate it in a partially extended condition (namely, with section **24** fully extended from section **22,** and with section **26** fully contracted in section **24**), and the dash-double-dot lines illustrate boom **18** fully extended. Although the jib boom parts may be constructed to have different dimensions and possible extensions, depending upon the particular application, boom **18,** when fully contracted as illustrated in the dashed lines in FIG. **1** has an overall length of about 6½ feet, when extended as illustrated in dash-dot lines has a length of about 10½ feet, and when fully extended has a length of about 15 feet.

Considering the details of boom **18,** these are illustrated in FIGS. **2–4.** As is apparent from FIGS. **2** and **3,** each of the sections in the boom comprises an elongated hollow tube having a generally rectangular, or angular, cross-sectional configuration. The cross-sectional dimensions of the three sections, or tubes, are, of course, different. Those of tube **22** are the largest, those of tube **24** the next largest, and those of tube **26** the smallest. Preferably, the differences in respective cross-sectional dimensions are such that the tubes, when assembled as illustrated, readily nest as shown with one another, with ample clearance spaces provided about and between adjacent tubes. More specifically, a clearance space **28** (which has a generally rectangular cross-sectional configuration) exists between tubes **22, 24.** A similar clearance space **30** exists between tubes **24, 26.** Preferably, the relative cross-sectional dimensions and proportions of the various tubes and clearance spaces are substantially as illustrated in FIG. **3.**

Tubes **22, 24, 26** preferably are formed of a suitable sturdy metal, such as steel.

In boom **18,** it is intended that tube **26** be extended and contracted manually with respect to tube **24.** It is not intended, however, that such extension and contraction be done under circumstances of the boom supporting a load. By way of contrast, it is intended that tube **24** be extended and contracted under power relative to tube **22.** And it is also intended that such extension and contraction be produceable both under circumstances of the boom supporting a load, and under circumstances of the boom not supporting any load. With such the case in boom **18,** it will be apparent that the types of bearings required to transmit forces between the two different adjacent pairs of tubes are different. More specifically, bearings used between tubes **24, 26** will be subjected to relatively light wear, and for most applications need not be made replaceable. However, those employed between tubes **22, 24** will be subjected to considerably greater and heavier wear, and preferably should be made to be easily replaced.

Because of these considerations regarding extension and contraction between the tubes, boom **18** embodies two different modifications of the present invention — one of these modifications being employed in conjunction with tubes **22, 24,** and the other modification being employed in conjunction with tubes **24, 26.** Put another way, and as will become apparent from the description which follows, the manner in which tubes **22, 24** are mounted in the assembly relative to one another is slightly different from the manner in which tubes **24, 26** are mounted relative to one another — such differences taking into account the different performance (extension-contraction) characteristics required between these two sets of adjacent tubes.

Referring for a moment particularly to FIG. **2,** the left and right ends of tubes **22, 24, 26** in the figure are referred to herein as the outer and inner ends, respectively, of the tubes. Although the precise shapes of the tubes' opposite ends are not critical, it will be noted that the outer ends of the tubes herein are similarly shaped, whereas the inner ends thereof differ from one another. More specifically, the outer ends of the tubes, and the inner end of tube **26,** terminate in a plane which is substantially normal to the boom's longitudinal axis. The inner ends of tubes **24, 26** are cut off at the angles and in the manners indicated. With the particular inner end constructions illustrated, it will be noted that, viewing from the inside of the boom assembly (where such is cut away at the right side of FIG. **2**), portions of the inner end side walls of tubes **24, 26** are exposed. The reason for such construction will be more fully explained shortly.

Considering first the structural relationship between tubes **22, 24,** mounted adjacent the outer end of tube

22, as contemplated herein, is projection means which extends into clearance space 28. This projection means includes upper and lower bearing parts 32, 34, respectively, side bearing parts 36, and a plate 38. Bearing parts 32, 34, 36, which are formed from a suitable conventional bearing material such as molybdenum disulfide, are intended to be readily replaceable, and accordingly are loosely mounted on tube 22 (as will be explained). The upper and side bearing parts are similar in configuration, each being generally circular, and including a large diameter portion, such as portions 32*a*, 36*a*, which is disposed in clearance space 28, formed integrally with a small diameter portion, such as portions 32*b*, 36*b*, which extends freely into a suitable accommodating bore provided in the wall of tube 22. Lower bearing part 34 includes a generally rectangular portion 34*a* disposed in clearance space 28, formed integrally with a pair of projecting circular parts 34*b* which are freely received in a pair of suitable accommodating bores provided in the wall of tube 22. The inwardly facing surfaces of these bearing parts slidably engage the outside of tube 24. With boom 18 assembled as shown, it will be obvious that bearing parts 32, 34, 36 are captured in the assembly.

Projecting plate 38 preferably comprises a steel plate welded to the inside face of the far side wall of tube 22 in FIG. 2.

A reinforcing band 40 surrounds and is welded to the outer end of tube 22.

Mounted on intermediate tube 24, toward the inner end thereof, is projection means including upper and lower bearing parts 42, 44, respectively, a pair of side bearing parts, such as part 46, and a plate 48. Bearing parts 42, 44, 46 are made of substantially the same material as parts 32, 34, 36, with parts 44, 46 substantially the same in configuration as parts 32, 36, and part 42 substantially the same in configuration as part 34. Bearing parts 42, 44, 46 are loosely mounted on tube 24 in manners similar to the mountings provided on tube 22 for parts 32, 34, 36. The outwardly facing surfaces of parts 42, 44, 46 slidably engage the inside of tube 22.

Plate 48 is substantially the same in construction as plate 38, and is welded to the outside far face of tube 24 in FIG. 2. More particularly, plate 48 is located at substantially the same elevation as plate 38, and has sufficient thickness whereby it extends far enough across the gap between tubes 22, 24 to overlap with plate 38 (as these two plates are viewed along a line extending axially of the boom). This situation can be seen clearly in FIG. 3, where it will be noted that plate 48 partially obscures plate 38.

Considering now the structural relationship between tubes 24, 26, mounted on tube 24, according to the invention, on the inside and adjacent the outer end thereof, is projection means comprising four bent or angular plates indicated at 50. These plates extend into clearance space 30 and are welded to tube 24. In particular, and as can be seen clearly in FIG. 3, plates 50 are disposed in positions spanning the four corners of the other end of tube 24. The inside faces of plates 50 slidably engage the outside of tube 26.

Joined to tube 26 as contemplated herein, toward the inner end and on the outside thereof, is projection means comprising a set of four bent or angular plates 52, and a set of two angular plates 54. Plates 52, 54 are similar in construction and configuration to previously-mentioned plates 50. Plates 52, 54 also extend into clearance space 30, with plates 52 welded to the outside of the inner end of tube 26, and plates 54 joined to the outside of the tube somewhat outwardly of its inner end. As can be seen in FIG. 3, plates 52 span the outsides of the four corners of the inner end of tube 26. Plates 54 span the outsides of the two lower corners of the tube in FIGS. 2 and 3. As is also evident in FIG. 3, plates 54 obscure (and thus overlap) lower plates 50 as such are viewed axially of the assembly.

Completing a description of boom 18, indicated generally at 56 is a hydraulic ram which is for extending and contracting tube 24 under power relative to tube 22. Ram 56 includes the usual elongated cylinder 56*a* and rod 56*b*. Ram 56 is disposed axially within the boom, with its rod end toward the inner end of the boom.

Referring particularly to FIGS. 2 and 4, the ram is mounted in place by means of two sets of pivot pins indicated at 58, 60. Pins 58, which are axially aligned, pivotally connect the right end of the cylinder in the ram to opposite sides of tube 24. Pins 60, which also are axially aligned, pivotally support opposite sides of a fluid connector unit 62 on opposite sides of tube 22. The fluid connector unit is suitably joined to the exposed end of rod 56*b*, and is a conventional unit which accommodates the coupling of fluid lines to passages extending through the unit and also through rod 56*b* to opposite ends of cylinder 56*a*. The previously mentioned inner end configurations of tubes 22, 24, 26 accommodate this mounting arrangement for the ram.

Such a mounting for ram 56 simplifies the connections of fluid lines thereto, and affords ample clearance inside the boom for allowing extension and contraction of the tubes.

Explaining now how the assembly described herein may be employed, when it is desired to use boom 18 in a fully contracted condition, tubes 22, 24, 26 may be suitably locked together, as by pinning, in the relative positions shown in FIG. 2.

To extend the boom, either partially or fully, the tubes are unlocked, and one or more of tubes 24, 26 are extended from the outer end of the assembly. The tubes may then be relocked in the positions desired. Extension of tube 26 from tube 24 is done manually, with plates 50, 52, 54 acting as bearings therebetween, and with engagement of plates 50, 54 limiting the maximum obtainable extension. Extension of tube 24 from tube 22 is done under power by extending ram 56. Bearing parts 32, 34, 36 and 42, 44, 46 permit such extension (or contraction) to be done even under conditions with the boom supporting a load. The maximum extension permitted between tubes 22, 24 is limited by engagement of plates 38, 48.

Should it become necessary to disassemble the boom for repair purposes, it will be apparent that once ram 56 is removed, the assembly can only be taken apart by removing or withdrawing the inner tubes from the inner end of the assembly. Conversely, reassembling of the parts can only be accomplished from such end. This feature, together with the incorporation of extension-limiting stops which are welded to the tubes, facilitate simple, fool-proof, safe assembling and disassembling operations.

It should be observed that yet another important function contributed by plates 50, 52, 54, which plates span corners in tubes 24, 26, is that these plates provide reinforcement for such corners.

Considering the various parts proposed herein which provide bearing surfaces between the tubes, it will be noted that for every condition of extension or contraction in the boom, the maximum axial spread is maintained between the bearing surfaces provided for each set of tubes. This minimizes bearing wear, and reduces stresses in the boom.

The proposed boom may, of course, be used to carry any desired sort of load-gripping or engaging device, with such device suitably attached, preferably to the outer end of tube **26.**

While a pair of modifications of the invention have been described herein, it is appreciated that variations and other modifications may be made without departing from the spirit of the invention.

I claim:

1. In an elongate telescopic boom assembly for a portable material-handling loader, said assembly having an inner, mounting end and an outer, load-handling end, and including a plurality of nested tubular boom sections disposed in the assembly with an annular clearance space between adjacent sections, each of said sections having an inner end and an outer end, with said inner and outer ends being oriented toward the inner and outer ends, respectively, of said assembly, means joined to the outermost of said sections adjacent its said inner end for mounting the assembly on a loader, means accommodating the attachment of a load-handling device to the innermost of said sections adjacent its outer end, and means powering the extension of one of said plurality of sections with respect to an adjacent one of the plurality,

means for limiting extension of one of a pair of boom sections with respect to an adjacent section, and for preventing withdrawal of the inner section of said pair from the outer end of the outer section of the pair, but permitting withdrawal from the latter's inner end, said means consisting of first projection means including a first projecting part joined integrally to the outer section of the pair adjacent its outer end and extending into the clearance space between the pair, and second projection means including a second projecting part joined integrally to the inner section intermediate its ends but nearer the inner end, and extending into said clearance space, with said first and second parts, viewed along a line paralleling the assembly's longitudinal axis, having portions which overlap, said first and second projection means further including bearing means for transmitting a force between adjacent boom sections in a direction which is at an angle to said longitudinal axis, said bearing means comprising a captured bearing part.

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