United States Patent

Goudy

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[54] FOLDING CRANE BOOM

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[21] Appl. No.: **59,454**

[52] **U.S. Cl.** .....**212/46 A,** 212/59, 212/144

[51] **Int. Cl.** **B66c 23/62**

[58] **Field of Search**.....212/46, 46 A, 46 B, 59, 144

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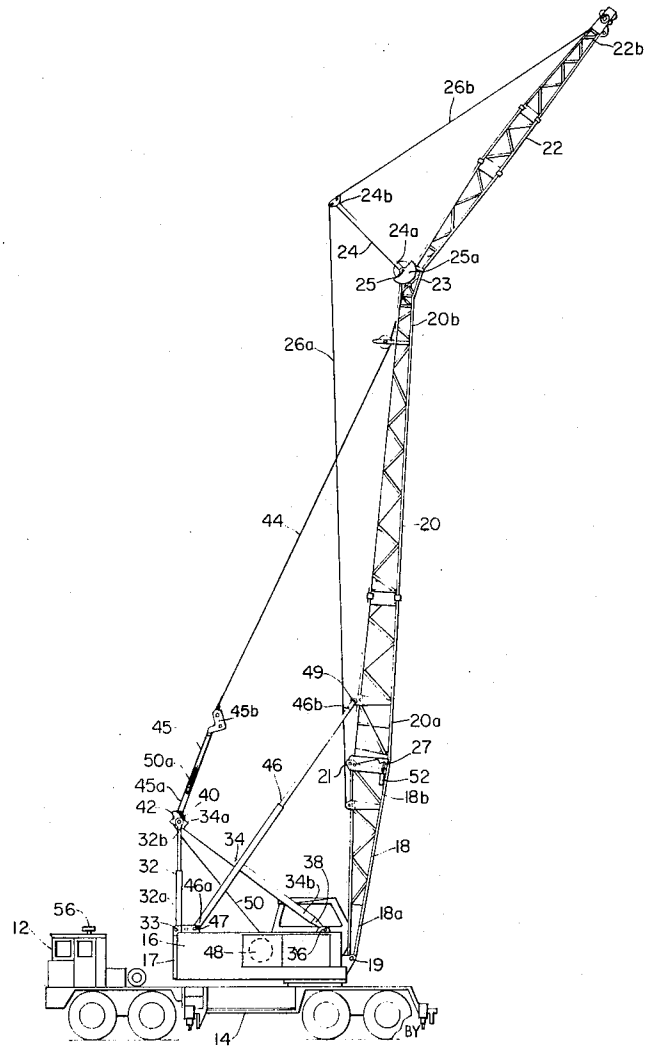
[57] **ABSTRACT**

A truck-mounted, fully collapsible boom for material handling and the like which carries at least 100 feet of boom and jib within reasonable highway limitations when in the traveling position, the overhang thereof when in the traveling position being substantially equally distributed between the front and the rear of the carrying vehicle to provide improved maneuverability and weight distribution on the axles of the carrying vehicle.

8 Claims, 11 Drawing Figures



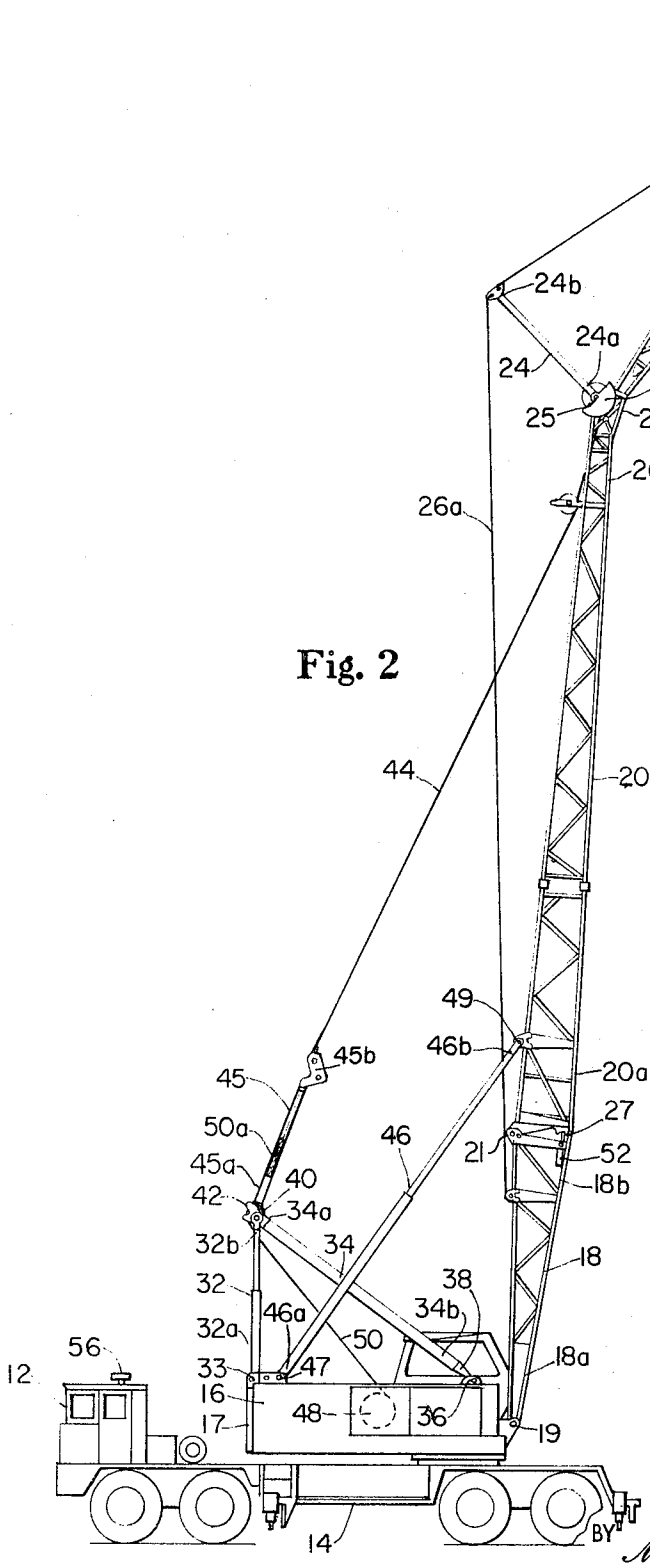


Fig. 2

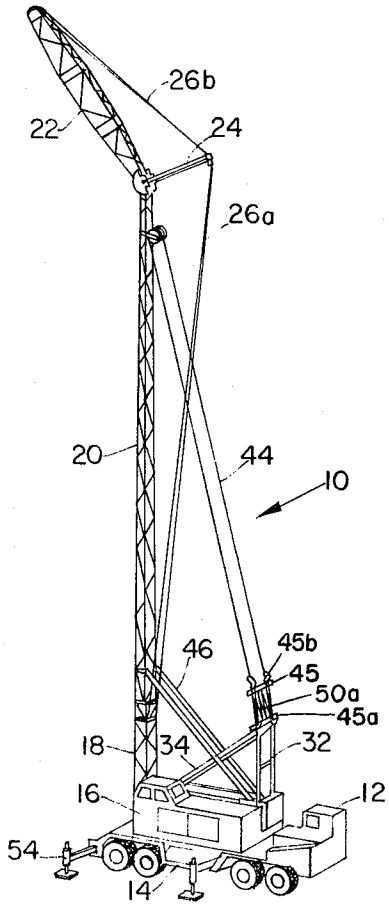


Fig. 1

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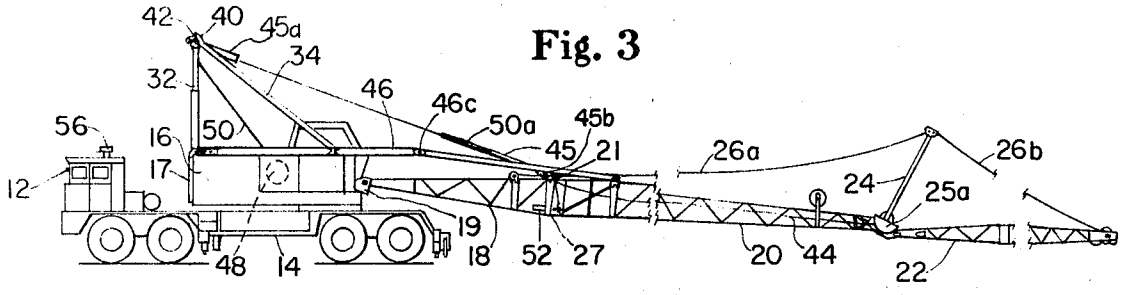

Fig. 3

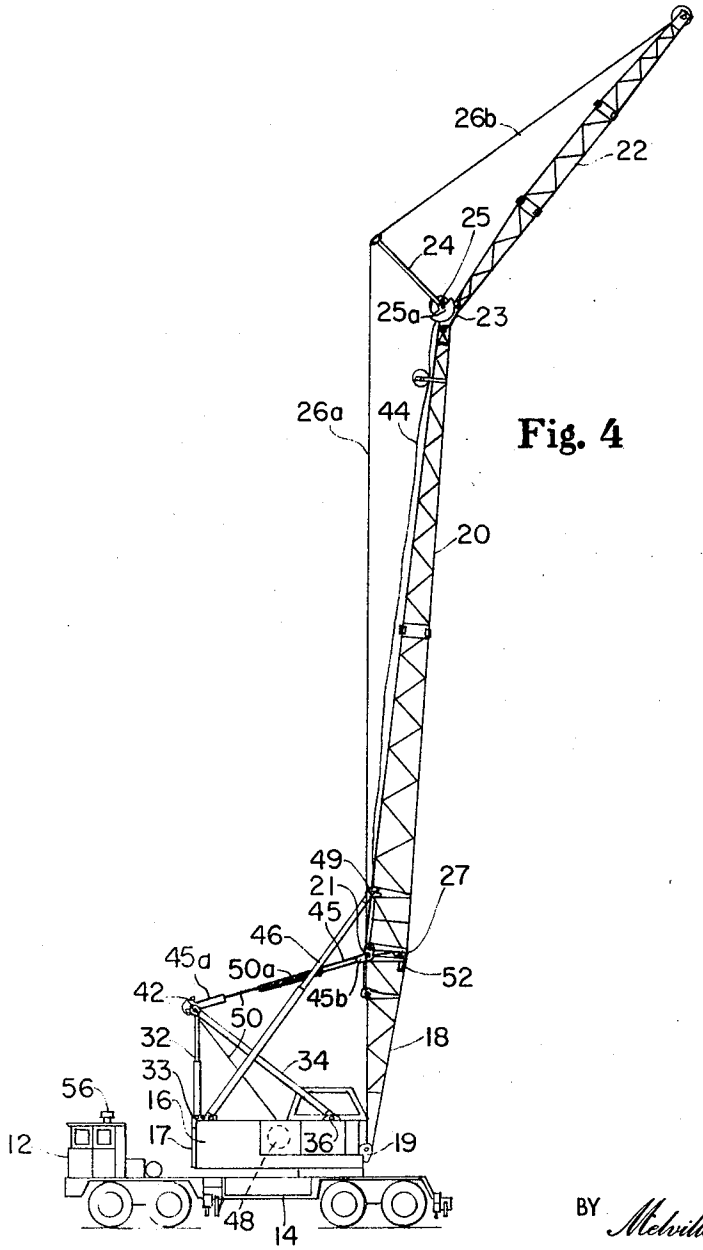

Fig. 4

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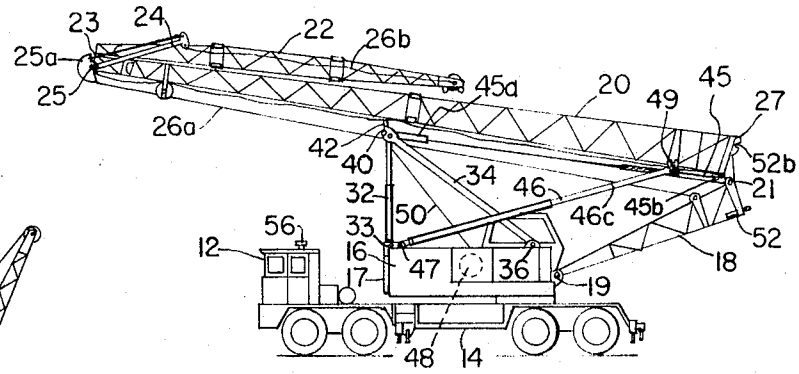

Fig. 6

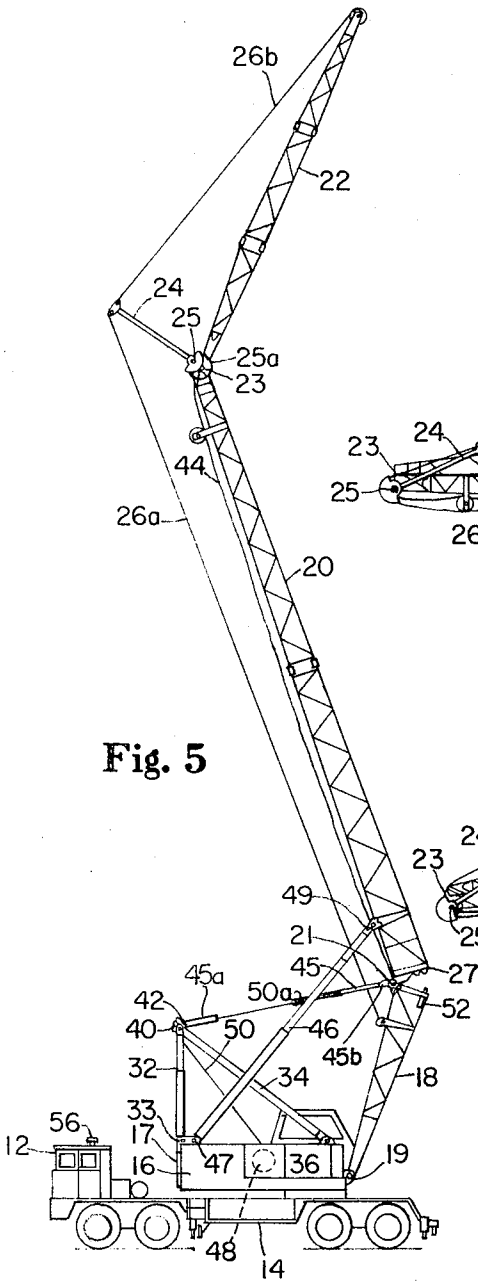

Fig. 5

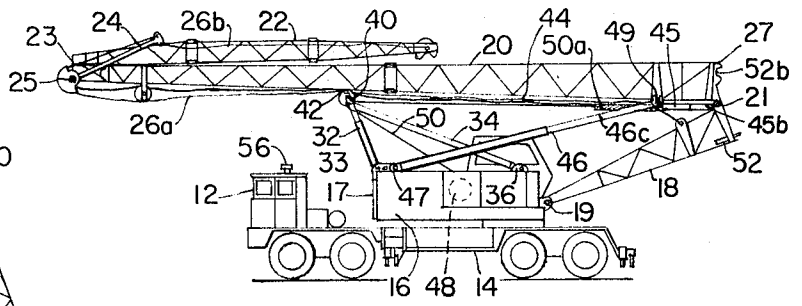

Fig. 7

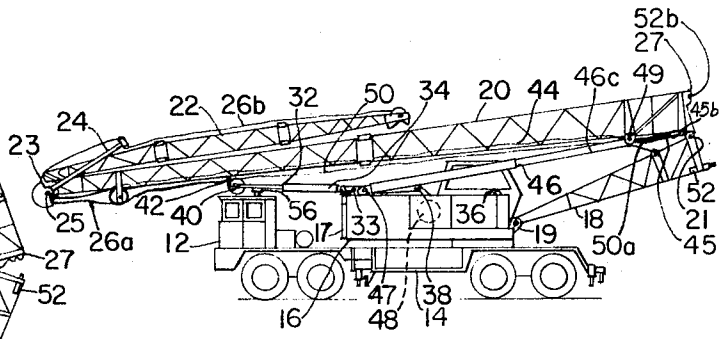

Fig. 8

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Fig. 9

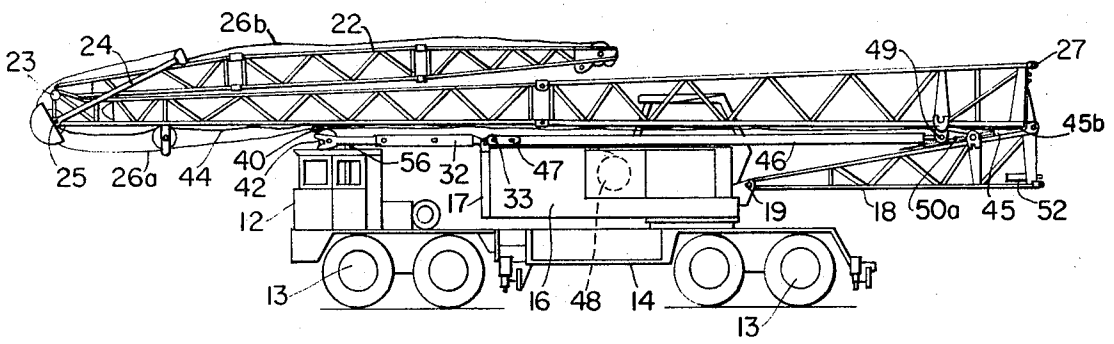


Fig. 10

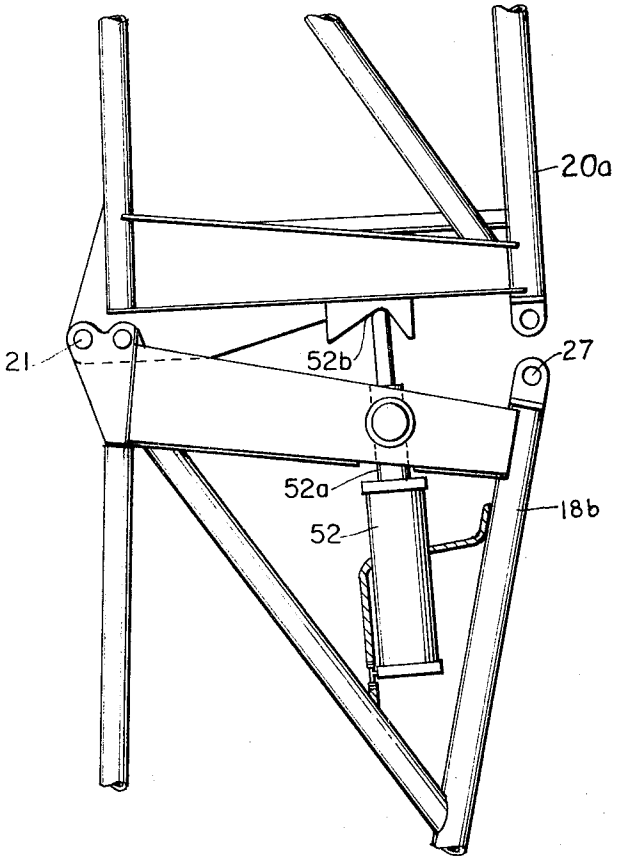
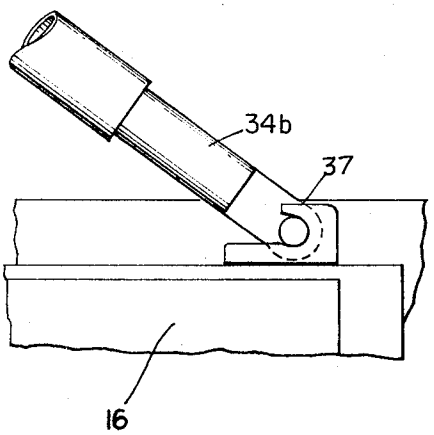


Fig. 11



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FOLDING CRANE BOOM

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to new and useful improvements in collapsible folding booms for material handling and the like, and more particularly to booms which are adapted to be folded for transporting on roads or highways.

2. Description of the Prior Art

The prior art has long been concerned with folding booms which are adapted to be mounted on a truck bed or similar platform having a rear wheel assembly and a front wheel assembly, because such booms provide an extremely acceptable manufacturer's rated lifting load over the side or rear of the truck before failure by elastic buckling in the lateral direction. Additionally, folding booms are much more inexpensive to manufacture than telescoping booms. However, the prior art has been unsuccessful in attempts to develop a folding boom capable of carrying 100 feet or more of boom and jib and which provides a maneuverable package while in the traveling position, for transportation over the road whereby the legal limits for highway travel in the various states is not exceeded, without sacrificing any lifting capacity. Additionally, such prior art folding booms have not been compatible with standard fixed boom sections so as to permit the boom to be extended to any desired length at the job site by inserting standard boom sections.

SUMMARY OF THE INVENTION

The present invention provides a new and improved truck-mounted, fully collapsible boom for material handling and the like which is capable of carrying at least 100 feet of boom and jib in a highly maneuverable package within reasonable highway limitations while in the traveling position without the sacrifice of lifting capacity in the working position. Briefly, when the folded boom is in the traveling position, the overhang thereof is split substantially equally fore and aft on the carrying vehicle and the upper works faces aft, putting the counterweight forward and giving a much better weight distribution on the axles of the carrying vehicle. In many instances such arrangement provides the difference between the truck-mounted boom in the traveling position being within legal highway regulations.

The folding sections of the boom are part of a standard boom system so that if the operator needs more boom for a given job he may add standard sections between the boom base section and the boom point section.

All power for raising and braking for lowering the folding boom may be supplied by the boom hoist drum and is well within its capacity.

At least one short stroke hydraulic cylinder is located between the boom base section and the boom point section near the lower chord line. Pressure is supplied to the cylinder during folding from the working position to the traveling position during the brakeover between the positions shown in FIG. 4 and that shown in FIG. 5. During erection from the traveling position to the working position, the hydraulic cylinder is not pressurized, but acts as a shock absorber or buffing cylinder during the brakeover between the position shown in FIG. 5 and that shown in FIG. 4.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view illustrating the truck-mounted, fully collapsible boom of the present invention in its working position for use in material handling and the like.

FIG. 2 is an elevational view illustrating the truck-mounted boom in its working or erected position.

FIGS. 3 through 8 are schematic views illustrating the folding crane boom of this invention starting from the work position of FIGS. 1 and 2 and illustrating the position of the various parts of the folding boom as the sections thereof are lowered to the traveling position of FIG. 9.

FIG. 9 is an elevational view illustrating the truck-mounted, fully collapsible boom of the present invention in its traveling position.

FIG. 10 is an enlarged elevational view showing the hydraulic cylinder near the lower chord line between the boom base section and the boom point section.

FIG. 11 is a partial elevational view showing a telescoping front gantry leg which is pivotally secured to the base.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning first to FIGS. 1 and 2, which show the truck-mounted boom 10 of the present invention in its working or fully erected position, it will be seen that the carrying vehicle or truck 12 includes a truck chassis 14 on which a base 16 provided with a counterweight 17 is mounted for pivotal movement about a vertical axis. The collapsible boom includes a base section 18, at least one point section 20, a jib 22 and a mast 24. It will, of course, be understood that the selection of the structural material as well as the design of the lattice members of the boom are well known in the art. Accordingly, reference will be made thereto only insofar as is necessary to explain the description of the preferred embodiment of the present invention.

The boom base section 18 is pivotally connected at one end 18*a* thereof to the base 16 at the connection point 19 for vertical swinging movement about a horizontal axis. In like manner, boom point section 20 is pivotally connected at the connection point 21 at one end 20*a* thereof to the end 18*b* of the base section 18 remote from the base 16 for vertical swinging movement about a horizontal axis. The jib 22 is also pivotally mounted at the connection point 23 for vertical swinging movement about a horizontal axis on the upper end 20*b* of the point section 20. The mast 24, which is provided with a half sheave 25*a* at the end 24*a* thereof, is pivotally mounted at the connection point 25 for vertical swinging movement about a horizontal axis on the upper end 20*b* of the point section 20.

Cable means, such as the jib backstay line 26*a* and the jib pendant 26*b*, connect the boom base section 18 well below the pivot point 21, the end 24*b* of the mast 24 remote from the base 16, and the end 22*b* of the jib 22 remote from the base 16.

Gantry means, including a pair of parallel telescoping rear legs 32 and at least one front leg 34, are pivotally secured to the base 16. As can be seen in FIGS. 1 and 2, the rear legs 32 are spaced from the boom base section 18, with the adjacent ends 32*a* thereof pivotally mounted at 33 on the base 16 for vertical swinging movement about a horizontal axis. If desired, the rear legs 32 may straddle the boom base section 18. One end 34*a* of the front leg 34 is pivotally connected to the other adjacent ends 32*b* of the rear gantry legs 32, and the other adjacent end 34*b* thereof is releasably and pivotally connected for vertical swinging movement about a horizontal axis in a socket 36 on the base 16 between the pivot connections on the base 16 for the boom base section 18 and the rear gantry legs 32. It should be noted that the lower end 34*b* of the front gantry leg is preferably provided with a clevis 38 which will pull out of the socket 36 during erection or folding. Additionally, rollers 40 are positioned on the gantry peak 42.

FIG. 11 discloses a variation of the front gantry leg 34 which is telescoping and which thus provides for the lengthening thereof during erection or folding. Accordingly, the lower end 34*b* may be pivotally secured on the base 16 as at 37 because it is unnecessary for the leg 34 to pull away from the base 16.

A boom harness 44, which is provided with a floating block 45, having linkage means 45*b*, and a stationary block 45*a*, joins the gantry peak 42 with either the upper end 20*b* of the boom point section 20 or with a point as close as possible to the pin connection point 21 joining the boom base section 18 and the boom point section 20.

A pair of parallel telescoping backstop members 46 are also provided. As can be seen, adjacent ends 46*a* of the backstops

46 are pivotally mounted at 47 on the base 16 adjacent the adjacent ends 32*a* of the rear gantry legs 32 for a vertical swinging movement about a horizontal axis. The other adjacent ends 46*b* are pivotally mounted near the lower end 20*a* of the boom point section at 49 for vertical swinging movement about a horizontal axis.

Means acting against the lower end 20*a* of the point section 20 and the upper end 18*b* of the base section 18 are also provided for extending and retracting the boom to a working position or to a traveling position, respectively. While such means may comprise any standard crane source, the truck-mounted boom 10 of the present invention preferably utilizes a boom hoist drum 48 and boom hoist line 50. The boom hoist drum 48 is mounted on the base 16 and the working or free end of the hoist line 50 is attached through the stationary block 45*a* and the reaving 50*a* to the floating block 45, which includes the linkage means 45*b*. As was previously explained, the floating block 45, through the linkage means 45*b*, is pinned into the boom base section 18 as close as possible to the connection point 21.

As best seen in FIG. 10, at least one short stroke hydraulic cylinder 52, which includes a plunger 52*a* and a striker plate 52*b*, is pivotally mounted between the boom base section 18 and the boom point section 20 near the lower chord line. The cylinder 52 may pivot through an angle of 4° to 5° so as to provide for the satisfactory mating of the plunger 52*a* and the striker plate 52*b* as the boom is extended or retracted. As will be more fully explained hereinafter, pressure is supplied to the cylinder 52 during folding from the working position to the traveling position during brakeover, and during erection from the traveling position to the working position, the cylinder is not pressurized, but acts as a shock absorber or buffing cylinder during brakeover.

Stabilizing feet 54 are also positioned outwardly from the chassis 14 of the truck 12 so as to stabilize the truck-mounted boom 10 for material handling and the like.

FIGS. 1 and 2 show the truck-mounted boom 10 in the standard working position. In order to fold the boom it is lowered to the ground in the position shown in FIG. 3. The floating block 45 of the boom harness 44, which is ordinarily tensionably connected to the end 20*b* of the point section 20 when the boom is in the working or errected position, is pinned into the boom base section 18 as close as possible to the pivot pin connection 21, and the boom pins at the connection point 27 are removed.

The boom is then raised to the position shown in FIG. 4 by taking up on the boom hoist line 50, at which time the telescoping backstop 46 becomes solid and acts as a compression member. Hydraulic pressure is then applied to the cylinder 52.

The operator then plays out on the boom hoist line 50. The plunger 52*a* of the cylinder 52 pushes against the striker plate 52*b* on the point section 20, causing the point section 20 to rotate in a counter-clockwise direction about the pivot pin connection 21 to the position shown in FIG. 5. In this position the center of gravity of the boom point section 20 and the jib 22 is well behind the pivot pin at the connection 21 so that as the operator continues to play out on the boom hoist line 50, the boom point section 20 continues to fold down until it rests on the rollers 40 at the gantry peak 42, as shown in FIG. 6. Since the jib backstay line 26*a* is attached to the boom base 18 at a point well below the pivot pin connection 21, as the boom point section 20 and the base section 18 fold about the pivot point connection 21, the jib 22 and the mast 24 are permitted to rotate in the clockwise direction about their pivot points 23 and 25, respectively, reaching the position shown in FIG. 6.

As the operator continues to play out the boom hoist line 50 from the position shown in FIG. 6, the telescoping rear gantry legs 32 retract to their low position as shown in FIG. 7, at which time the pin 46*c* is inserted into the backstop 46 so as to permit it to act as a tension member.

The operator continues to play out the boom hoist cable 50 from the position shown in FIG. 7, and the rear gantry legs 32 rotate in the counter-clockwise direction about the pivot points 33, whereupon, if the front gantry leg 34 is non-telescoping, the lower clevis 38 thereof pulls out of the socket 36 and slides to the rear, or if the front gantry leg 34 telescopes, as shown in FIG. 11, it lengthens and pivots, as at 37. This action continues until the truck-mounted boom 10 is in the position shown in FIG. 8, at which time the rear gantry legs 32 lay on the rest 56 on the truck body 12. The pin 46*c* is thereupon removed from the telescoping backstop 46 so as to permit the backstop to extend.

The operator continues to play out the boom hoist line 50 from the position shown in FIG. 8 and the boom base section 18 rotates in the clockwise direction about its connection 19 on the base 16 until the boom reaches the traveling position shown in FIG. 9.

The erection of the boom from the traveling position shown in FIG. 9 to the working position shown in FIGS. 1 and 2 is the exact reverse of the folding sequence with one exception. The hydraulic cylinder 52, which is mounted near the lower chord at the juncture between the boom base 18 and the point section 20, is not pressurized, but acts as a shock absorber or buffing cylinder during the brakeover between the position shown in FIG. 5 and that shown in FIG. 4.

The compactness of the boom fold of the truck-mounted boom 10 of the present invention is a combination of how the boom base section 18 and the boom point section 20 are proportioned plus the geometry of the four-bar linkage of the gantry means aided by a two-scissors system. As shown in the drawings, the four-bar linkage comprises the main base 16, the boom base section 18, a portion of the boom point section 20 and the back stops 46. The linkage pivot points are 19, 21, 49 and 47. The four-bar linkage is aided by a two-scissors system which at one point during extension or retraction of the boom comprises the stiff, pivotally fixed front leg member 34 of the gantry means and the telescoping parallel backstops 46, and at another point during extension or retraction of the boom comprises the rear legs 32 of the gantry means and the backstops 46. The common members of the four-bar linkage and the two-scissors system are the backstops 46, the backstops during retraction of the boom telescoping inwardly, becoming solid and starting to act as a compression members, then acting as tension members, and finally telescoping extensibly during the remainder of the retraction of the boom.

The unique construction of the truck-mounted boom 10 of the present invention enables the carrying of at least 100 feet of boom and jib in a highly maneuverable package within reasonable highway limitations while in the traveling position without the sacrifice of lifting capacity in the working position. As can be seen from FIG. 9, when the boom is in the traveling position the overhang thereof is split substantially equally fore and aft on the carrying vehicle, the crane counterweight 17 is forward, and the upper works, such as the jib 22 and the mast 24, faces aft, providing a much better weight distribution on the axles 13 of the carrying vehicle.

While certain preferred embodiments of the invention have been specifically illustrated and described, it is understood that the invention is not limited thereto, as many variations will be apparent to those skilled in the art, and the invention is to be given its broadest interpretation within the terms of the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A truck-mounted, fully collapsible boom for material handling and the like which carries at least 100 feet of boom within reasonable highway limitations when in the traveling position, the overhang thereof when in the traveling position being substantially equally distributed between the front and the rear of the carrying vehicle to provide improved maneuverability and weight distribution on the axles of the carrying vehicle, which comprises:

a. a truck chassis;

b. a base mounted on said chassis for pivotal movement about a vertical axis;

c. a boom base section pivotally connected at one end to said base for vertical swinging movement about a horizontal axis;

d. a boom point section pivotally connected at one end to the end of said base section remote from said base for vertical swinging movement about a horizontal axis;

e. gantry means including a pair of parallel telescoping rear legs adjacent ends of which are pivotally mounted on said base for vertical swinging movement about a horizontal axis, said rear legs being spaced from said boom base section, at least one front leg one end of which is pivotally connected to the other adjacent ends of said rear gantry legs and the other end of which is pivotally connected for vertical swinging movement about a horizontal axis on said base between the pivot connections on said base for said boom base section and said rear gantry legs adjacent said pivot connection on said base for said boom base section, the connection between said rear and front gantry legs forming a gantry peak;

f. a boom harness joining said gantry peak with the upper end of said boom point section, the end of said boom harness joining said gantry peak being attached to a floating block provided with linkage means, whereby when said boom is in the working position said boom harness is tensioned, and when said boom is in the traveling position said linkage means is connected to said boom point and base sections substantially at the pivot connection therebetween and said boom harness is in a relaxed position;

g. a pair of parallel telescoping backstops adjacent ends of which are pivotally mounted on said base adjacent said rear gantry legs for vertical swinging movement about a horizontal axis and the other adjacent ends of which are pivotally mounted near the lower end of said boom point section for vertical swinging movement about a horizontal axis; and

h. means joining said boom harness and acting with the lower end of said point section and the upper end of said base section for extending and retracting said boom to a working position and to a traveling position, respectively;

said base, boom base section, boom point section and backstops forming a four-bar linkage, said four-bar linkage being aided by a two-scissors system, which at one point during extension and retraction of said boom comprises the stiff, pivotally fixed front leg of said gantry means and said telescoping, parallel backstops, and at another point during extension and retraction of said boom comprises the rear legs of said gantry means and said telescoping, parallel backstops, the common members of said four-bar linkage and said two-scissors system being said backstops, said backstops during retraction of said boom telescoping inwardly, becoming solid and starting to act as compression members, then acting as tension members, and finally telescoping extensibly during the remainder of the retraction of said boom.

2. The truck-mounted collapsible boom according to claim 1, including:

a. a jib pivotally mounted for vertical swinging movement about a horizontal axis on the upper end of said point section;

b. a mast pivotally mounted for vertical swinging movement about a horizontal axis on the upper end of said point section; and

c. cable means connecting the end of said jib remote from said base, the end of said mast remote from said base, and said boom base section well below the pivot point between said base section and said point section.

3. The truck-mounted collapsible boom according to claim 2, wherein said means for extending and retracting said boom and jib comprises a boom hoist drum and boom hoist line, said boom hoist drum being mounted on said base and the free end of said boom hoist line being attached through a stationary block and reaving to said floating block.

4. The truck-mounted collapsible boom according to claim 3, wherein at least one single acting short stroke hydraulic cylinder is mounted substantially at the juncture between said boom base section and said boom point section, said hydraulic cylinder being pivotally fixed at one end and including a plunger and a mating striker plate, said striker plate being mounted on said point section, the pivotal mounting of said cylinder providing satisfactory mating of said plunger and said striker plate as said boom is extended or retracted, whereby pressure is supplied to said cylinger during retraction of said boom from the working position to the traveling position during brakeover, said plunger pushing against said striker plate and pushing said boom point section over-center, and during extension of said boom from the traveling position to the working position, said hydraulic cylinder is not pressurized, but acts as a shock absorber or buffing cylinder during brakeover.

5. The truck-mounted collapsible boom according to claim 4, wherein rollers are provided at said gantry peak against which said boom point section may rest during the erection and retraction of said boom and when said boom is in the traveling position.

6. The truck-mounted collapsible boom according to claim 5, wherein the other end of said front gantry leg is releasably and pivotally connected in a socket on said base, whereby said front gantry leg will pull out of said socket as desired during the erection and retraction of said boom.

7. The truck-mounted collapsible boom according to claim 5, wherein said front gantry leg is telescoping, whereby the length thereof will change as desired during the erection and retraction of said boom.

8. The truck-mounted collapsible boom according to claim 5, wherein said rear gantry legs straddle said boom base section.

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