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T. R. BILL

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CRANE EXTENSION AND RESULTING CRANE ASSEMBLY

Filed June 1, 1965

2 Sheets-Sheet 1

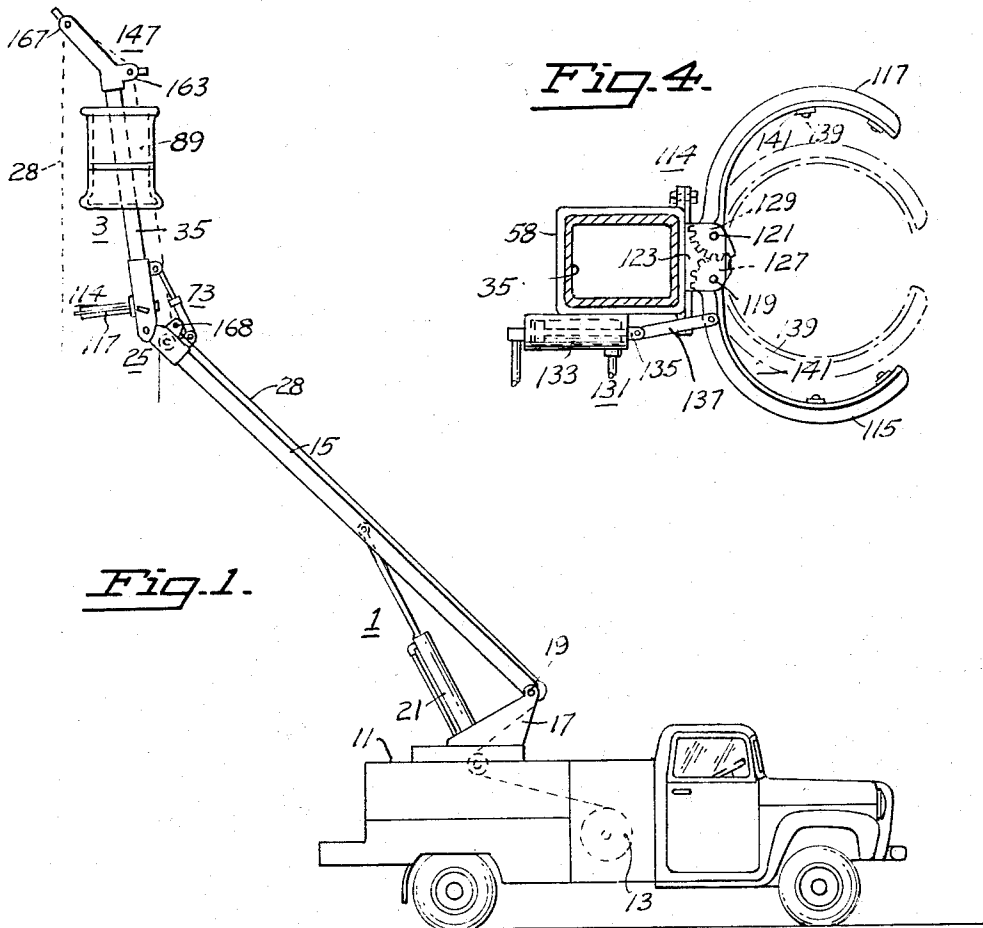


Fig. 5.

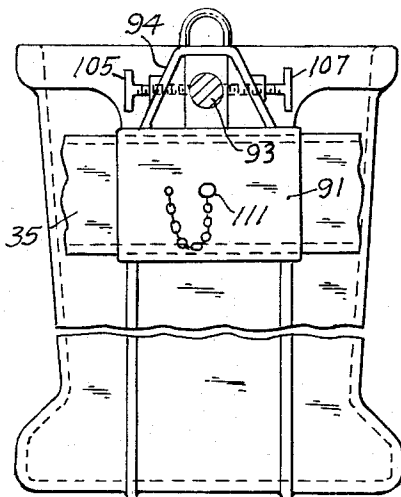
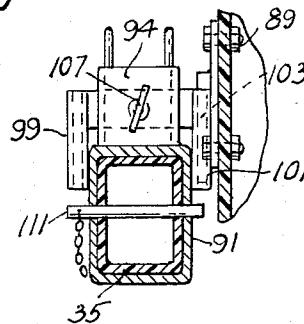


Fig. 6.



INVENTOR
THEODORE R. BILL
BY
WARREN, BROSLER, CYPHER & ANGLIM

ATTORNEYS

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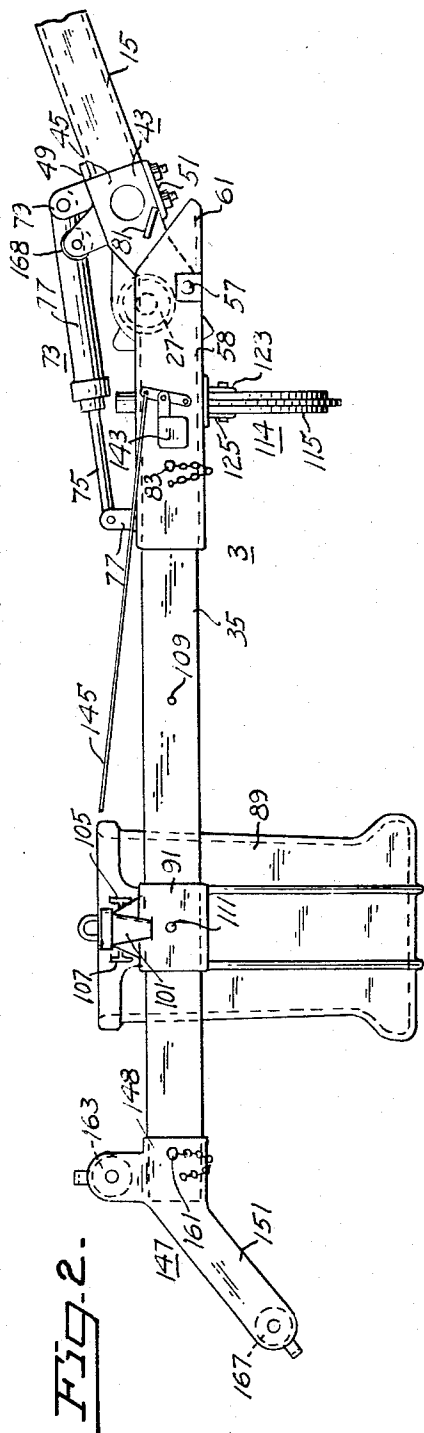
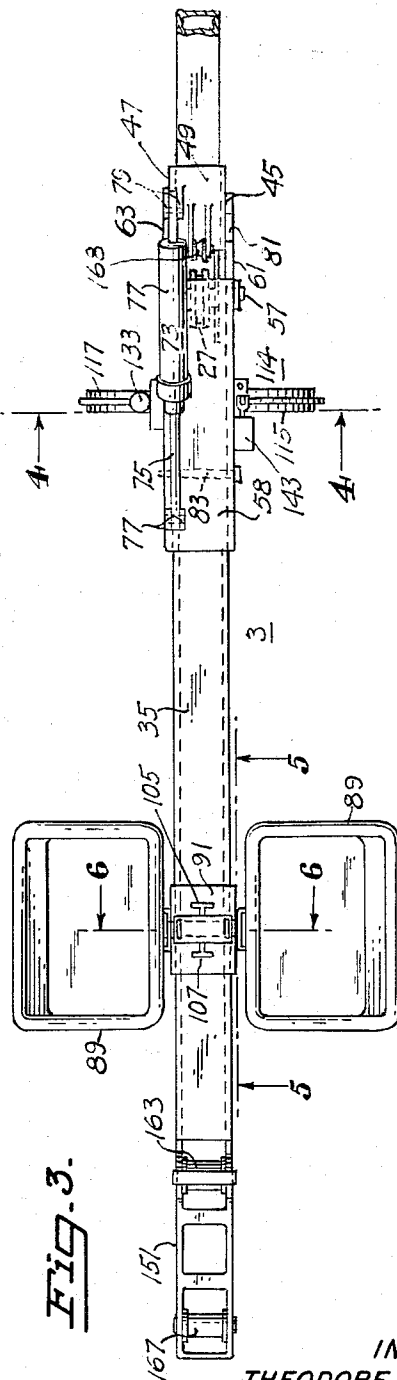


Fig. 3.

INVENTOR
THEODORE R. BILL
BY
WARREN, BROSLER, CYPHER & ANGLIM
ATTORNEYS

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CRANE EXTENSION AND RESULTING CRANE ASSEMBLY

Theodore R. Bill, San Leandro, Calif., assignor to Standard Trailer Company, a corporation of California
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The invention relates to cranes, and more particularly to a boom extension adapted for use with mobile or portable cranes having a boom capable of being elevated through an arc of movement relative to the horizontal.

Specifically the invention comprises an attachment and extension for truck mounted boom cranes, whereby the crane functions are amplified and increased, and the capability of the mobile crane expanded.

The conventional and existing boom crane as attached to a truck bed or other platform, but particularly those platforms which are mobile, terminates in a sheave assembly, whereby the crane is generally limited to its functions as a hoisting or lifting means.

The present invention is designed for affixing to the free outer end of the crane boom which, as has been indicated, normally terminates in a sheave assembly, and it is an important feature of the present invention that its attachment to and functional inclusion with the crane boom does not interfere with or impair in any way the utility of the normal crane sheave assembly, and hoisting and lifting in connection therewith.

The importance of this feature will be apparent when it is understood that the capacity of any crane is a function of both the angularity of the boom, relative to the horizontal, and the distance up the boom to the point of load suspension. With an extension provided, the original boom sheave, therefore, will be able to continue to function as a heavy-duty hoisting means, while the extension will permit of handling lighter loads at greater distances and elevations.

The crane extension of the present invention, as mounted at the original terminus of the crane boom, increases the capability and flexibility of the crane by providing additional functions through the provision of specialized attachments, a prominent feature of which is the provision in the invention of a variable angularity relative to the crane main boom, whereby, for example, the extension may be positioned parallel to a vertical surface while the crane boom maintains an angular relationship to the vertical.

An additional feature of the present invention is the provision of an operator's station on the extended crane boom, adapted to position the operator for both increased access and control of the life, as well as for continued supervision of and access to work being handled.

An important function of the present invention is to adapt a basic crane assembly to efficient work with telephone poles, light standards and the like, where such are being positioned or work is being performed thereon, by providing pole guiding and gripping means whereby a relationship between the pole or standard and the crane boom may be established and stabilized, thereby permitting continued and discreet operations.

An additional and featured provision of the present invention is the affording of an additional hoisting point outwardly of the pole positioning means so that supplemental lifting operations may take place, or when the pole gripping means is in operation, the two may cooperate enabling a single crane unit to undertake operations which would normally require two or more independent crane units.

Accordingly, among the objects of the invention are:

(1) To provide a novel and improved crane assembly;

(2) To provide a novel and improved crane boom extension or the like for a crane assembly;

(3) To provide a novel and improved crane boom extension which shall be capable of independent angular movement relative to the boom, and capable of substantially vertical conformity while the boom remains in an angular relationship;

(4) To provide a novel and improved boom extension or the like adapted particularly for use on portable, movable or mobile cranes normally having a boom adapted to be elevated through an arc of movement relative to the horizontal, but also usable on cranes having a boom of fixed angularity relative to the horizontal;

(5) To provide a novel and improved boom extension which will include pole or standard gripping, guiding and positioning means in combination therewith, and particularly such means which may be controllable for engagement, guiding or gripping independently of the angular elevation of the crane boom proper;

(6) To provide a novel and improved boom extension which shall provide one or more operator work stations, which may take the form of buckets, capable of elevation by the main crane boom, and capable of additional and independent angular elevation relative to the main boom;

(7) To provide a novel and improved boom extension and operator's work platform, which may be maneuvered for maximum control and operator access to a load during and subsequent to the lifting operation;

(8) To provide a novel and improved boom extension which will afford an additional lifting point while not interfering with free or simultaneous use of the original crane lifting means;

(9) To provide a novel and improved crane boom extension which shall be so designed and constructed as to afford a high degree of safety to the crane mechanism and operators, against accidental contact with electrical circuits carrying a high electrical potential;

(10) To provide a novel and improved crane boom extension which shall be formed of a number of parts adapted for ready assembly and disassembly, separation of functions, and which lend themselves to both economical and durable fabrication as well as easy replacement and repair.

Additional objects of my invention will be brought out in the following description of the preferred embodiment of the same, taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a side elevation view showing a representative crane and mobile mounting unit embodying the present invention;

FIGURE 2 is an enlarged view in side elevation depicting the boom extension illustrated in FIGURE 1, but disposed in a horizontal position;

FIGURE 3 is a top plan view of the boom extension shown in FIGURE 2;

FIGURE 4 is a transverse view partially in section, taken along the line 4—4 of FIGURE 3;

FIGURE 5 is a partial longitudinal section taken along the line 5—5 of FIGURE 3; and

FIGURE 6 is a transverse sectional view of a portion of the invention taken along the line 6—6 of FIGURE 3.

A representative embodiment of the invention would be constituted by any conventional type of mobile, movable boom crane 1 in combination with the boom extension 3, on the outboard end thereof.

The specific mobile crane illustrated comprises a platform 11 affixed to a mobile prime mover 13. The platform 11 may be rotatable about a vertical axis, or may be affixed in permanent alignment with the truck frame and body. Platform 11, as shown, carries a boom 15, hingedly mounted through supports 17 and hinge means 19 for limited rotation through a vertical arc.

In the embodiment shown, the means for selective ele-

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vation of the boom comprises a hydraulic piston cylinder assembly 21 connected between the platform 11 and the boom 15 and providing a selectively extensible leg for angular positioning of the boom relative to the horizontal. It will be apparent that the function of boom elevation may be achieved by any suitable means, including supporting guys and tension cables running to a truck mounted hoisting drum, and yet be within the purview of the present invention.

The outboard end of the boom 15 is provided with a sheave assembly 25, and as shown in FIGURES 1 and 2, the sheave assembly includes a pulley wheel 27 journaled for rotation on the boom, as shown in dotted lines, and capable of guiding a hoist cable 28 in a conventional manner.

The boom extension 3 of the present invention, comprises an assembly including a beam 35 hingedly secured to the main boom 15 by hinge means 37. The hinge means 37 as shown comprises a saddle 43 including forwardly extended side plates 45 and 47 and a top plate 49, with a removable bottom plate 51 permitting ready installation by positioning of the saddle over the crane boom tip and removable affixing it thereto by bolting the bottom plate into position.

It will be obvious that the hinge means as shown, is adapted for use with a crane boom of a square or rectangular cross section, and that the exact section of the hinge means utilized must be suited to the type and cross section of the crane boom to which it is intended to be affixed.

Journalled on the extended side plates 45 and 47 of the hinge means is a hinge shaft 57, providing a journal for a boom extension socket 58 constituting part of the hinge means. The boom extension socket, as shown, comprises a substantially box section body having rearwardly extended cheek pieces 61 and 63 as extensions of the sides thereof, and spaced sufficiently to permit the extension socket 58 to straddle the extended side plates in a fork and blade arrangement, and affording rotation of the socket about the journal. It should be noted that the hinge means as thus described permits normal use of the sheave assembly, irrespective of the angular position of the socket relative to the crane boom.

As a means of adjusting and maintaining the relative angularity of the boom extension relative to the parent boom, I provide a hydraulic ram 73 bridging the hinge means by connecting between the socket at one end and the saddle at the other. The hydraulic ram includes a piston rod 75 journaled in mounting lugs 77 provided on the top wall of the socket, and a cylinder 77 journaled in mounting lugs 79 provided on the top wall 49 of the saddle attached to the parent boom, the mounting lugs being adjacent the edge of their respective supporting components to place the ram in offset relationship to the longitudinal axis of the main boom and boom extension.

The choice of type of actuating means for determining and maintaining the relative angular alignment between the boom extension and the parent crane boom is optional, depending upon the type and kind of power source available. An alternative means to that shown, such as an extension screw mechanically actuated, is within the scope of the invention.

It is desirable to provide a lower limitation on the rotation of the boom extension 3 about the hinge shaft 57, and as shown in FIGURE 2, such limitation includes a stop 81 affixed to the sidewall 45 of the saddle 43 and cooperating with the extended cheek 61 of the boom extension socket, to define a lower limit stop or rest position when the boom extension is lowered to a position in substantially longitudinal alignment with the crane boom. A similar stop to function in a similar manner may be provided on the opposite wall of the saddle also.

Installed with one end in the socket 58 is the beam 35, and as shown, such comprises substantially a box section beam which is preferably formed of a material such as fiberglass reinforced plastic having high insulation char-

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acteristics, to protect an operator or workman from the hazards of operating in the vicinity of high tension lines or equipment.

This beam is removably held in the socket by means of a pin 83 fitted through registered openings in these components. It will be clear that in the form of the invention shown wherein the boom extension beam 35 is a separable member from the socket, the beam may be provided in varied lengths depending upon the particular operations to be undertaken, and such varied length beams may be conveniently stocked by the crane operator. However, it will be apparent that the socket may be permanently attached to and fabricated as an integral part of the beam 35, where the feature of separability is not desired.

An operator's platform is provided for on the boom extension 3 as an important feature of the invention, and as shown, such operator's work platform may comprise either a single or a pair of removable buckets 89 arranged to be carried by the extension beam at any one of a number of selectable positions therealong.

These buckets are gimbaled for normally free pivotal suspension in a perpendicular position, insuring operator occupancy irrespective of the angular positioning of the boom extension relative to the horizontal.

Such suspension means includes a box section carrier 91 of a size and shape to slidably surround the beam 35 for longitudinal positioning. A gimbal shaft 93 journaled in a shaft housing 94, mounted transversely of the carrier, terminates at the free ends thereof in bucket sockets 99 and 101 which are rigidly attached to shaft 93 for movement therewith.

The buckets are each provided at the beam side thereof, with a hook 103 adapted for insertion in one of the sockets to be removably carried thereby. When either one or both of the removable buckets 89 are thus supported, the weight thereof will be sufficient to rotate the gimbal shaft to maintain the bucket or buckets in a substantially vertical position.

In order, however, to lock the gimbal shaft against permissive angular movement and thereby stabilize the buckets, after the boom extension has been positioned at the desired angularity, locking means are provided, and such means comprise a pair of manually rotatable screws 105 and 107, threaded through opposite walls of the housing for manual tightening against the gimbal shaft.

Selectable bucket stations are provided along the boom extension, such stations being determined by locking pin holes 109 along the beam 35, which are adapted to receive a locking pin 111 through an alignable hole in the carrier.

To adapt the crane for work involving telephone poles, light standards and the like, where it is desired to either guide the pole or standard into position, or guide or stabilize the boom and operator platform relative to a pole or standard on which work is to be performed, I provide on the boom extension, pole guiding and gripping means 114.

Such means comprise a pair of arcuate opposable arms 115 and 117, affixed to the underside of the boom extension socket, and in a plane substantially transverse thereto.

Arms 115 and 117 are journaled on shafts 119 and 121 respectively extending between parallel bracket plates 123, for synchronous movement toward and away from each other, to provide pole encircling, gripping and guiding means. To assure such synchronous movement, arm 115 is provided with a terminal gear sector 127 axially of the shaft 119 while arm 117 is provided with a meshing terminal gear sector 129 axially of its shaft 121, to provide for simultaneous movement of the arms 115 and 117 about their respective journals and in opposite directions.

Motivation for the arm movement is provided by a hydraulic ram assembly 131, comprising a hydraulic cylinder 133 affixed to a side wall of the boom extension socket, and a movable piston rod 135 operatively joined to arm 115 through a link 137 for actuation of said arm.

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The degree of encirclement of the pole by the arms 115 and 117 to effect the type of engagement and degree of contact desired is controlled by the extent to which the hydraulic ram assembly 131 is controlled to close or open the interengaged arms. In order to permit and expedite relative longitudinal movement between the pole and the encircling arms, when desired, a plurality of low friction pole contacts are provided in spaced relation along the inner periphery of the arms. Such low friction contact points, as shown, may comprise a plurality of spherical rollers 139 mounted for free universal movement in sockets 141.

It is a feature of the present invention that operator control of the pole gripping arms is afforded to an operator positioned in a bucket 89, and such control means includes a suitable valve 143 positioned on a convenient wall of the boom extension socket 58, where it could be made accessible to an operator or workman through a control cable 145.

Valve 143 may be of any suitable type capable of being coupled in a hydraulic line to the hydraulic cylinder 133, to control flow to said cylinder both in magnitude and direction. Optionally, the cable may be placed in the hands of an operator located other than in one of the buckets, and the valve thus controlled from other vantage points.

As a means of increasing the utility and versatility of the boom extension, there is provided an additional sheave assembly 147, removably affixed to the outer free end of boom extension beam 35. As shown in Figures 2 and 3, such sheave assembly 147 comprises a socket 148 and an angularly offset extension 151, the socket being adapted to slip over the free end of the beam 35 and be removably pinned thereto by a locking pin 161.

A guide pulley 163 supported just above the socket 148 will guide a lift cable to a load sheave 167 mounted at the free end of the angular offset extension 151.

When utilization of the sheave assembly 147 is desired, the main cable 28 may be unthreaded from the main sheave assembly 25, run under a guide pulley 163 just above the main sheave assembly, and then carried over the guide pulley 163 to the load sheave 167.

A study of FIGURE 1 will indicate the important relationship of the load sheave 167 relative to buckets 89 and pole gripping arms 115 and 117, wherein it will be seen that the sheave assembly 147 provides a hoisting point above and substantially in vertical alignment with the pole encircling and gripping arms 115 and 117 when the beam 35 is substantially vertically oriented. When so disposed, a bucket carrying an individual, will place him in position to both guide the lift and subsequently to perform work from a convenient vantage point in relationship to a suspended or positioned load.

Important to the economical design and successful functioning of the present invention, is the fact that the ram assembly 131 is installed in offset relationship to the longitudinal axis of the parent boom and boom extension, thus leaving open and unobstructed, the normal and conventional routes for hoist cables, and enabling the installation of all sheaves and idlers along the conventional lines. Otherwise, radical departures from customary practice in the design and construction of cranes would have to be indulged in, all of which has been avoided in the present invention.

The hinge action provided between the main boom and boom extension enhances the flexibility of this type of apparatus, for in addition to the area of reach afforded by a rigid boom, the hinged boom extension adds the area within reach of its angle of swing, which in turn permits access to work regions not otherwise accessible through the use of a rigid boom alone.

While I have illustrated and described my invention in its preferred form and in substantial detail, the same is subject to alteration and modification without departing from the underlying principles involved, and I accord-

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ingly, do not desire to be limited in my protection to the details set forth except as may be necessitated by the appended claims.

I claim:

1. A crane comprising a boom

a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in means for attaching one end of a beam thereto, a beam attached at one end to said hinge means, and means for raising said boom extension about the end of said boom and through a range approaching a substantially vertical position, a carrier assembly adjustable along said beam, and means for locking said carrier assembly to said beam at a selectable position thereon, and a workman supporting means carried by said carrier assembly.

2. A crane comprising a boom

a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in means for attaching one end of a beam thereto, a beam attached at one end to said hinge means, and means for raising said boom extension about the end of said boom and through a range approaching a substantially vertical position, a carrier assembly adjustable along said beam, and means for locking said carrier assembly to said beam at a selectable position thereon, workman supporting means carried by said carrier assembly, and pole encircling and gripping means mounted on said boom extension below said carrier assembly.

3. A crane comprising a boom

a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom at its other end terminating in means for attaching one end of a beam thereto, a beam of insulation material attached at one end to said hinge means, a sheave assembly mounted on the free end of said beam, and means for raising and lowering said boom extension, a carrier assembly slidably mounted on said beam, said carrier assembly including means for locking said carrier assembly to said beam at a selectable position thereon, workman supporting means carried by said carrier assembly, and pole encircling and gripping means mounted on said boom extension in substantially vertical alignment with said sheave assembly when said boom extension is substantially vertically oriented.

4. A crane comprising a boom

a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in a socket for attaching one end of a beam thereto, a beam of insulation material attached at one end to said socket, and means for raising and lowering said boom extension about the end of said boom, a bucket carrier assembly adjustable along said beam, said carrier assembly including means for pivotally suspending a bucket therefrom, and means for locking said carrier assembly to said beam at a selectable position thereon, and a bucket suspendable from said carrier assembly.

5. A crane comprising a boom

a boom extension hingedly secured to the end of said

- boom and occupying a common plane with said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in means in the form of a socket for attaching one end of a beam thereto, a beam of insulation material extending from said socket, a sheave assembly mounted on the free end of said beam, and means for raising said boom extension about the upper end of said boom, said means including a hydraulic ram assembly bridging said hinge means and lying in a plane offset with respect to the longitudinal axis of said boom and boom extension.
6. A crane comprising
a boom
a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in means in the form of a socket for attaching one end of a beam thereto, a beam of insulation material extending from said socket, a sheave assembly mounted on the free end of said beam, and means for raising and lowering said boom extension, said means including a hydraulic ram assembly bridging said hinge means and lying in a plane offset with respect to the longitudinal axis of said boom and boom extension,
and pole encircling and gripping means mounted on said boom extension in substantially vertical alignment with said sheave assembly when said boom extension is substantially vertically oriented.
7. A crane comprising
a boom
a boom extension hingedly secured to the end of said boom, said boom extension comprising hinge means anchored at one end to said boom and at its other end terminating in means in the form of a socket for attaching one end of a beam thereto, a beam of insulation material extending from said socket, a sheave assembly mounted on the free end of said beam, and means for raising and lowering said boom extension, said means including a hydraulic ram assembly bridging said hinge means and lying in a plane offset with respect to the longitudinal axis of said boom and boom extension,
a bucket carrier assembly slidably mounted on said beam, said carrier assembly including means for pivotally suspending a bucket therefrom and comprising a gimbal shaft extending transversely thereof, a bucket carrying pocket affixed to each end of said shaft, means for locking said carrier assembly to said beam at a selectable position thereon, and manually operated means for locking said pivotal suspension means,
a bucket suspendable from said carrier assembly, including a hook adapted to enter said pocket and support said bucket therefrom, whereby such bucket, in the absence of pivotal suspension locking means, will permit such bucket to maintain vertical suspension while said boom extension is being raised and lowered,
and pole encircling and gripping means mounted on said boom extension in substantially vertical alignment with said sheave assembly when said boom extension is substantially vertically oriented.
8. A boom extension for hinge connection to the end of a crane boom, said boom extension comprising hinge means lying in a common plane and anchorable at one end to such boom and at its other end terminating in means for attaching one end of a beam thereto,
a beam attached at one end to said hinge means, means for spreading said hinge means to effect a raising of said boom extension when mounted on the end of a boom,
a carrier assembly adjustable along said beam, and

- means for locking said carrier assembly to said beam at a selectable position thereon,
and a workman supporting means carried by said carrier assembly.
9. A boom extension for hinge connection to the end of a crane boom, said boom extension comprising hinge means anchorable at one end to such boom and at its other end terminating in means for attaching one end of a beam thereto, both ends of said hinge means occupying a common plane,
a beam attached at one end to said hinge means, a sheave assembly mounted on the free end of said beam,
means for raising said boom extension, said means lying in a plane offset with respect to the said common plane,
a bucket carrier assembly adjustable along said beam, said carrier assembly including means for pivotally suspending a bucket therefrom, and means for locking said carrier assembly to said beam at a selectable position thereon,
and a bucket suspendable from said carrier assembly.
10. A boom extension for hinge connection to the end of a crane boom, said boom extension comprising hinge means anchorable at one end to such boom and at its other end terminating in means for attaching one end of the beam thereto, both ends of said hinge means occupying a common plane,
a beam attached at one end to said hinge means, means for raising said boom extension,
a bucket carrier assembly mounted on said beam, said carrier assembly including means for pivotally suspending a bucket therefrom, and manually operated means for locking said pivotal suspension means, and a bucket suspendable from said carrier assembly.
11. A boom extension for hinge connection to the end of a crane boom, said boom extension comprising hinge means anchorable at one end to such boom and at its other end terminating in a socket for attaching one end of the beam thereto,
a beam of insulation material attached at one end to said socket,
a sheave assembly mounted on the free end of said beam,
means for raising and lowering said boom extension, said means including a hydraulic ram assembly bridging said hinge means and lying in a plane offset with respect to the longitudinal axis of said boom extension,
and pole encircling and gripping means mounted on said boom extension in substantially vertical alignment with said sheave assembly when said boom extension is substantially vertically oriented.
12. A boom extension for hinge connection to the end of a crane boom, said boom extension comprising hinge means anchorable at one end to such boom and at its other end terminating in a socket for attaching one end of the beam thereto,
a beam of insulation material attached at one end to said socket,
a sheave assembly mounted on the free end of said beam,
means for raising and lowering said boom extension, said means including a hydraulic ram assembly bridging said hinge means and lying in a plane offset with respect to the longitudinal axis of said boom extension,
a bucket carrier assembly slidably mounted on said beam, said carrier assembly including means for pivotally suspending a bucket therefrom and comprising a gimbal shaft extending transversely thereof, a bucket carrying pocket affixed to each end of said shaft, means for locking said carrier assembly to said beam at a selectable position thereon, and manually

operated means for locking said pivotal suspension means,

- a bucket suspendable from said carrier assembly, said bucket including a hook adapted to enter said pocket and support said bucket therefrom, whereby such bucket, in the absence of pivotal suspension locking means, will permit such bucket to maintain vertical suspension while said boom extension is being raised and lowered, 5
- and pole encircling and gripping means mounted on said boom extension in substantially vertical alignment with said sheave assembly when said boom extension is substantially vertically oriented. 10

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HUGO O. SCHULZ, *Primary Examiner.*