

July 29, 1952

L. T. GRAVES
MOBILE CRANE

2,605,002

Filed March 1, 1948

3 Sheets-Sheet 1

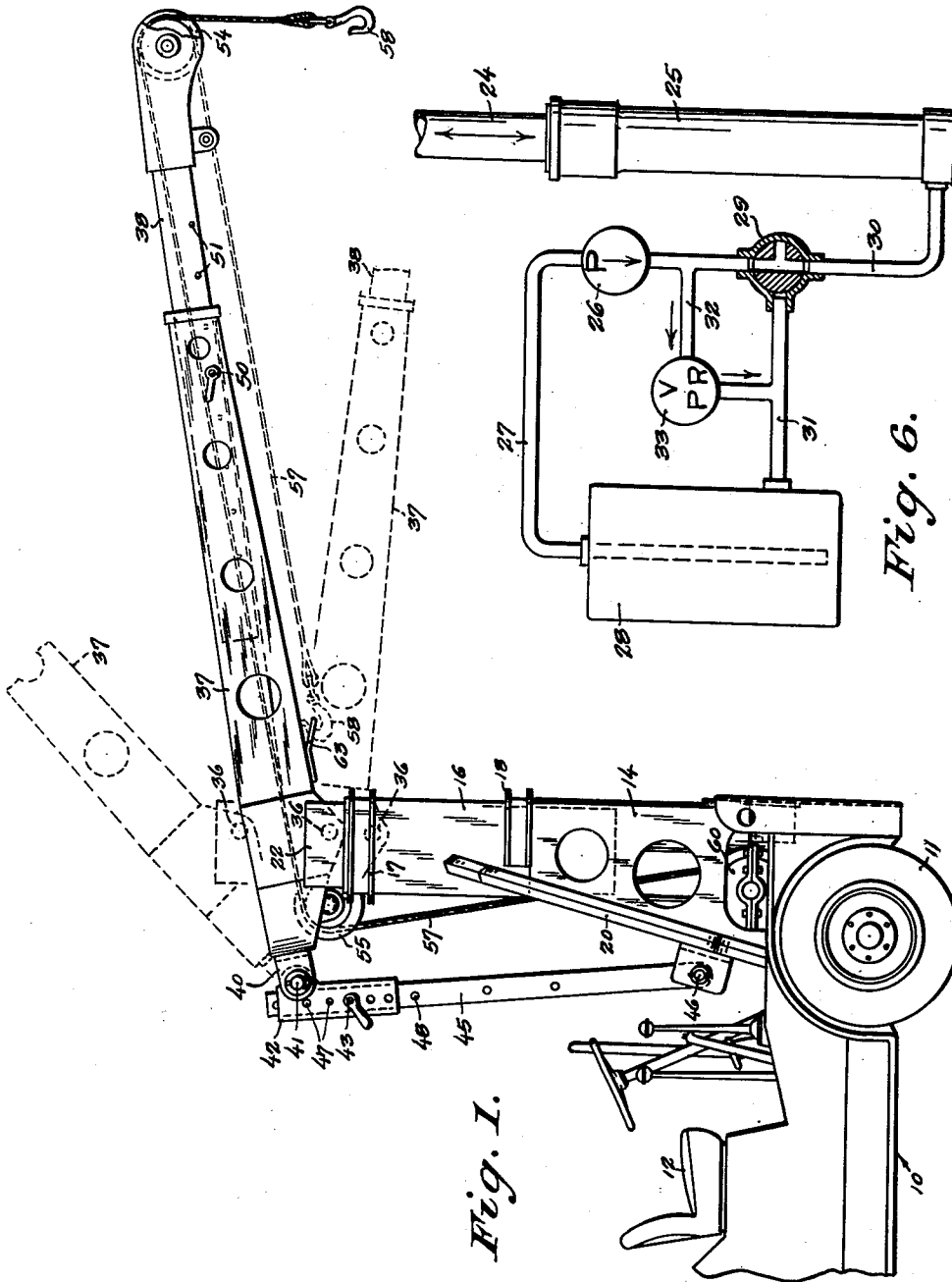


Fig. 6.

Fig. 1.

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3 Sheets-Sheet 2

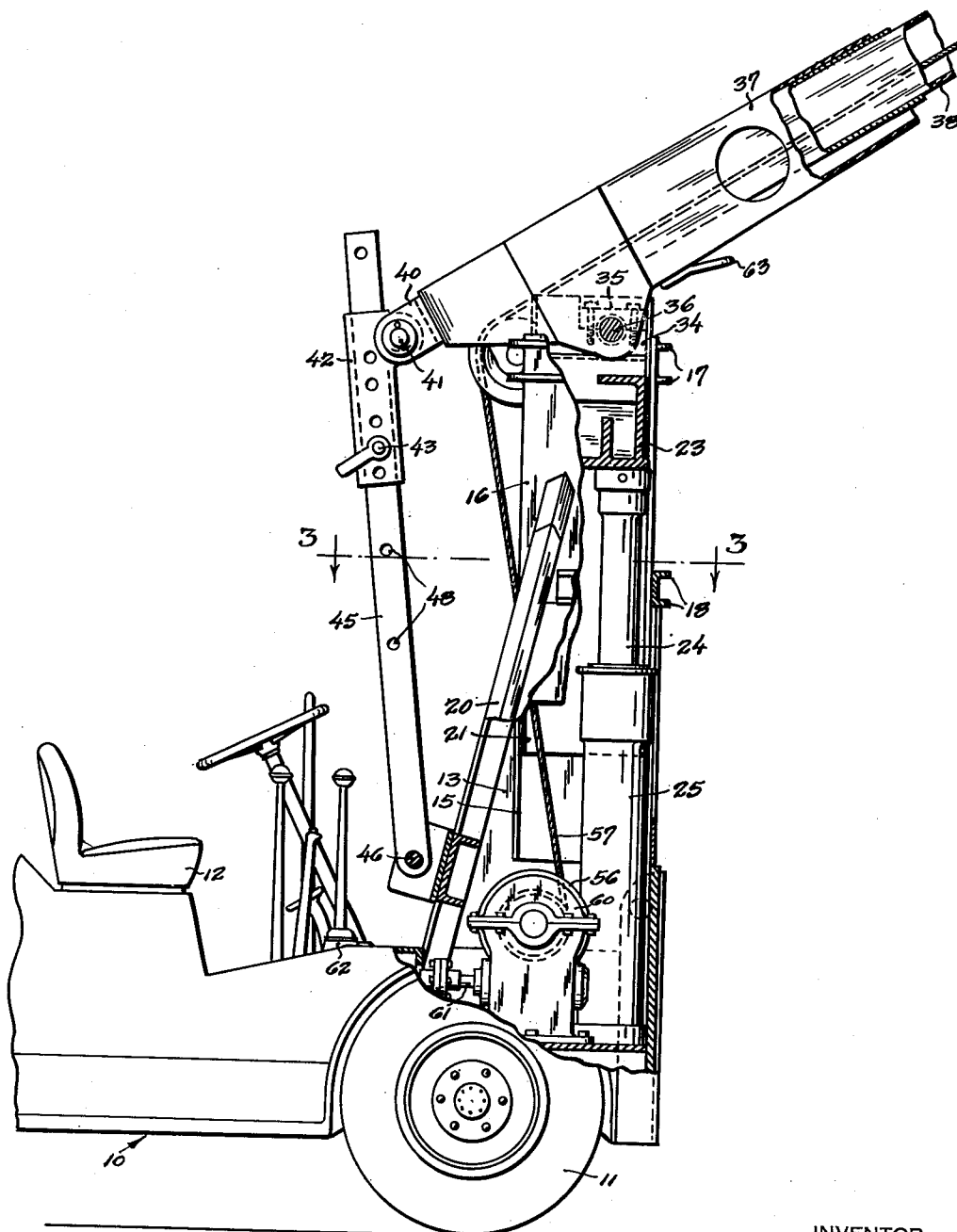


Fig. 2.

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3 Sheets-Sheet 3

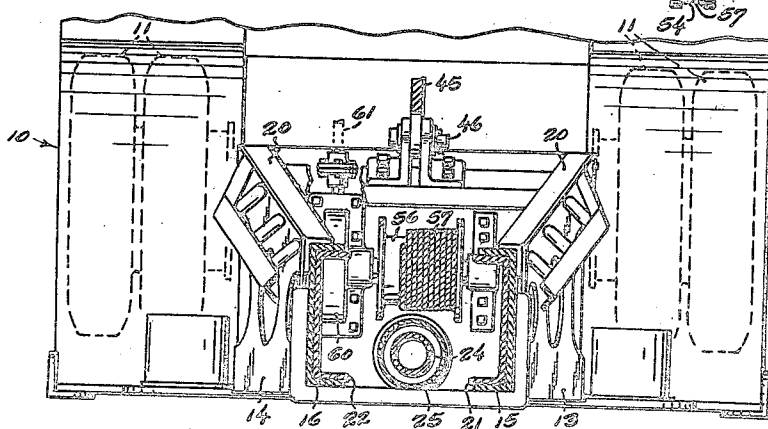
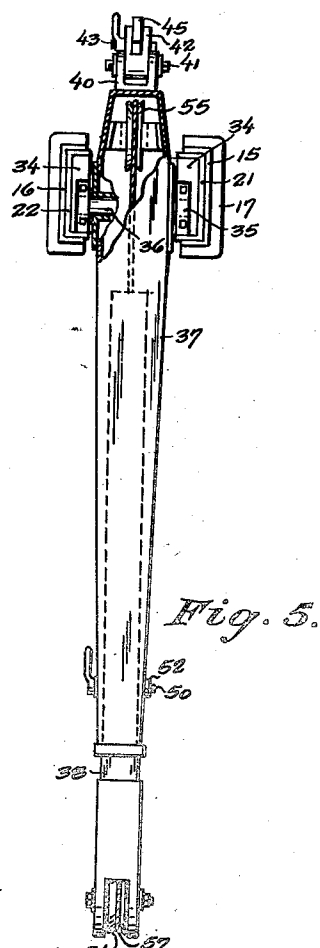
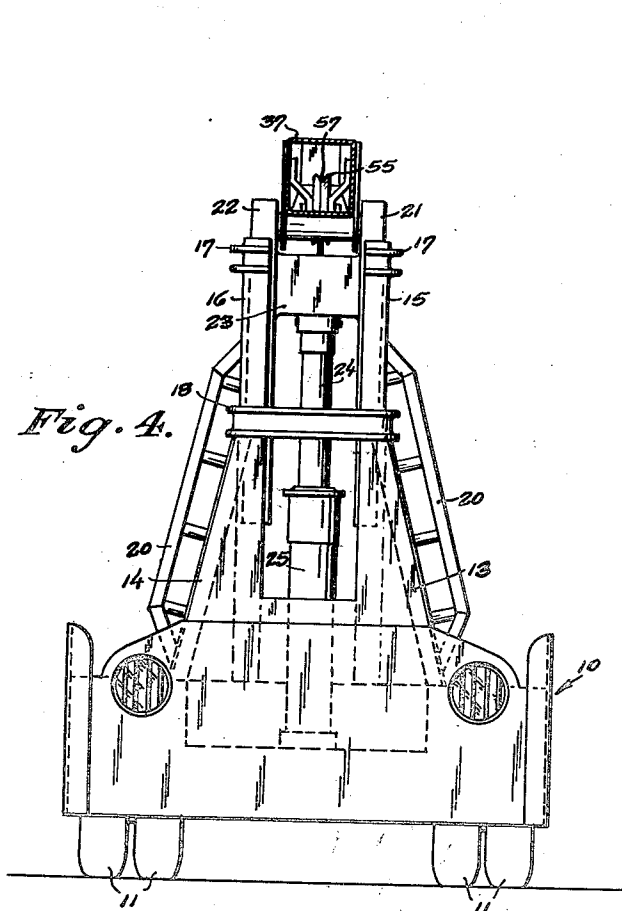


Fig. 3.

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UNITED STATES PATENT OFFICE

2,605,002

MOBILE CRANE

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Application March 1, 1948, Serial No. 12,262

9 Claims. (Cl. 212-8)

1

This invention relates to improvements in mobile cranes, and for its general object aims to provide a load-handling machine of this character assuring exceptional maneuverability, simplicity of control, and applicability to a wide range of work requirements.

More particularly stated, it is one object of the present invention to devise a mobile crane employing a cantilever arm for its boom and having the fulcrum and power points so located as to give to the boom the substantial working characteristics of a lever of the third order.

As a further object still, the invention aims to provide a mobile crane peculiarized in that the point to which power is applied for raising or lowering the working end of the boom is guidably held to movement along a perpendicular axis fixed in relation to the vehicular support, and in which the fulcrum, in compensation of the power point's rectilinear movement, is linked to the vehicular support in a manner permitting the fulcrum to float within a localized swing arc.

The invention has the yet further aim, and which is ancillary to the afore-mentioned object, of devising a mobile crane utilizing hydraulic energy as the force responsible for swinging the boom, and having, as the functioning instrumentality therefor, a piston-and-cylinder assembly characterized in that the cylinder is made rigid with the frame of the supporting vehicle.

It is a yet further object to provide a mobile crane in which the arm which links the fulcrum to the vehicular support is adjustable for length.

The invention has the further and important object of providing a boom comprised of telescoping sections and which, in its permitted adjustment of the length or reach of the boom, works in complement with the vertical adjustment of the fulcrum point to most easily adapt the crane to varying requirements of different load-handling operations.

Other still more particular objects and advantages will, with the foregoing, appear and be understood in the course of the following description and claims, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Figure 1 is a fragmentary side elevational view portraying a mobile crane constructed to embody the preferred teachings of the present invention.

Fig. 2 is a somewhat similar view taken to an enlarged scale with parts broken away and shown in section, and also illustrating the fulcrum as

2

having been adjusted to occupy a lower level than that in which it is portrayed in Fig. 1.

Fig. 3 is a horizontal sectional view on line 3-3 of Fig. 2.

Fig. 4 is a front elevational view of the vehicle and its boom-carrying tower, and showing the boom in transverse vertical section.

Fig. 5 is a top plan view portraying the boom and the head end of the tower, and with the boom broken away and shown partly in section; and

Fig. 6 is a view diagramming the hydraulic circuit.

Referring to said drawings, the self-propelled wheeled vehicle which gives mobility to the crane is designated generally by the numeral 10, said vehicle having its engine located at the rear end and being steerable through the rear wheels. In order to simplify the drawings and insofar as the vehicle is concerned, I have confined the illustration to a portrayal of only the front wheels 11 together with so much of the chassis as permits a showing of the driver's seat 12 and the various controls for the operation of both the vehicle and the crane.

According to the present invention there is placed at the front end of the vehicle and integrated with the frame thereof a tower comprised of a pair of opposingly placed uprights 13 and 14 lying one at one side and the other at the other side of the vehicle's longitudinal median line and having a respective channel member, as 15 and 16, welded or otherwise rigidly secured thereto to extend upwardly as a perpendicular prolongation of the upright. These channel members are disposed to locate their gutters in facing relation. For reinforcing the channels horizontal sets of ribs 17 and 18 are applied externally thereof at spaced intervals of the height, and the tower members are braced from the frame by diagonal struts 20. The lower said set of ribs spans the tower to produce a rigid tie between the channel members.

Associated with said rigid channel members is an inner sliding framework similarly composed of a pair of transversely spaced channel members designated 21 and 22 and which, likewise, are placed with the gutters in facing relation, and made integral with these sliding channels and placed adjacent the head end thereof is a reinforced cross-tie 23. Employed to elevate said inner frame-work is a hydraulic ram 24 finding rigid connection by its head end against the underside of the cross-tie, and as the complement of this ram there is provided a cylinder 25 which

3

feet upon and is made rigid with the frame of the vehicle. The fluid circuit for the ram is or may be conventional and is shown schematically in Fig. 6, comprising a continuously driven pump 26 drawing oil through a pipe 27 from a reservoir 28 and operating by means of a control valve 29 to force this oil through either of two pipes 30 or 31 into the cylinder or back to the reservoir, selectively, the valve being of a three-way character to also allow pressure oil within the cylinder to be bled back to the reservoir. Incorporated in the circuit is a by-pass pipe 32 fitted with a pressure-release valve 33 and leading from the output side of the pump to the return pipe 30.

Reverting to the movable inner element of the telescoping tower, there is welded within the gutters of each of the channel members 21 and 22 to lie at the head ends thereof and above the cross-tie 23 a respective block 34 which acts in complement with a cap 35 to form bearings for a transverse pivot pin 36, and receiving a journal mounting from this pin is a hollow boom comprised of a root section 37 and a reach section 38, the reach section, in order to admit of telescoping action in respect of the root section, receiving a slide journal within the latter. The point at which said root section is journaled upon the pivot pin is proximate to but forwardly removed from the rear extremity of the root section, and attached by a transverse pivot pin 41 to the rearwardly projecting heel 40 is a muff 42 serving as a floating fulcrum for the boom. This muff sleeves upon and is attached by a pin 43 to the head end of a vertical stay-link 45, and the bottom end of said stay-link connects with the frame of the vehicle by an anchor pin 46. For adjusting the swing radius of the fulcrum pin 41 the muff and the link each provide a series of alternatively employed holes, as 47 and 48, arranged to be brought into selective registration for reception of the pin 43. A similar instrumentality is used for setting the boom arm to adjusted lengths, and namely a pin 50 insertable through the root section 37 into a selected one of several holes 51 piercing opposite side walls of the reach section at spaced intervals of the latter's length. In the instance of both pins, the same present threads upon one end which work in the threads of a nut or nuts 52 welded upon the back face of the root section 37 or the muff 42, as the case may be, and to facilitate application of these pins the same are provided upon the other end with a handle.

There is journal-mounted at both the front and rear ends of the boom a respective sheave, as 54 and 55, and passing from a power drum 56 located at the base of the tower over the rear sheave 55 and thence through the hollow center of the boom along the length of the latter to and over the sheave 54 is a cable 57 fitted upon its free end with a hook 58. Powering the drum through worm and worm-wheel gearing carried in a case 60 which also serves as one of the cheek bearings for the drum is a shaft 61 driven from the engine of the vehicle and controlled by a forward-and-reverse transmission 62.

The root section of the boom has provided upon its underside a fitting 63 which is placed, by preference, immediately forward of the tower, and this fitting, as indicated by dotted lines in Fig. 1, accommodates the attachment of the hook. When so attached, and subject only to a lowering of the boom such that its outer end lies below the pivot pin 36, the operator may, by removing the pin 50, lengthen or shorten the boom by either slacking off or taking up on the cable. The

4

greased guide-way in which the reach section is slidably journaled allows the reach section to move freely, wherefor force of gravity serves to lengthen the boom while a pull force exerted by the bight of the cable to the sheave 54 shortens the boom. For adjusting the length of the link, the operator need only hook the end of the cable in the fitting 63, withdraw the pin 43, and then take up or slacken off on the cable, the boom then swinging about the pivot pin 36 as a fulcrum, the pin 43 being replaced when the desired holes of the muff and link are brought into registration.

As will, it is believed, be clear, the boom operates as a lever of the third order in that the same is fulcrumed at the rear extremity and has its power applied at a point intermediate the ends. This feature is important in point of its desirable load distribution. However, while eminently to be preferred over an arrangement in which, say, the fulcrum would be located forward rather than to the rear of the lower point, the latter arrangement is deemed to be within the teachings of the invention to the end that it would still permit the employment of a floating fulcrum and hence allow the applied power, albeit working in a counter direction, to be passed into the boom along a fixed perpendicular axis.

The invention and the manner of its operation is thought to be apparent from the foregoing detailed description of my now-preferred embodiment. I am cognizant that a re-location of parts such as I have referred to above, as well as minor changes in the details of construction, may be resorted to without departing from the spirit of the invention and I therefore intend that the hereto annexed claims be read with the broadest interpretation to which the employed language fairly admits.

What I claim, is:

1. A load-handling vehicle comprising, in combination with the vehicle frame, a tower structure rigid with said vehicle frame, a lift member carried by the tower for vertical sliding movements in relation thereto, means for raising and lowering the lift member, an extensible boom comprising a root section and a reach section receiving a slide journal from the root section, said root section being fulcrumed to the frame of the vehicle and being pivotally connected with the lift member at a point longitudinally offset from the fulcrum, respective sheaves carried by the boom sections at the forward and rear ends of the boom, a power-driven drum carried by the vehicle frame, a cable presenting a hook upon its free end and running from the drum over the rearwardly placed sheave and therefrom to and over the forwardly placed sheave, a fitting upon the root section of the boom arranged to be engaged by the hook and operating by the act of lowering the boom and coincidentally taking up or slacking off on the cable to adjustably slide the reach section in relation to the root section and thereby either shorten or lengthen the boom, and means for securing the two sections in selected adjusted positions.

2. A load-handling vehicle comprising, in combination with the vehicle frame, a tower structure rigid with said frame, a lift member carried by the tower for vertical sliding movements in relation thereto, means for raising and lowering the lift member, an upright link located to the rear of the tower and having an anchoring pivot at its lower end, a muff sleeved for endwise movement upon the link and having means for securing the same in selected adjusted positions thereon, and a boom fulcrumed by its rear extremity

5

to the muff and receiving a pivot mounting from the lift member at a point forwardly removed from the fulcrum.

3. The load-handling vehicle of claim 2 in which the means for securing the muff and link in adjusted positions comprises a series of holes piercing the link at spaced intervals of the length and a second series of holes provided by the muff and arranged to be brought selectively into register with a selected one of the first said series, and a locking pin arranged to be passed through said registering holes of the two series.

4. In a load-handling vehicle, and in combination with the vehicle frame, a tower structure made rigid with the vehicle frame and providing a pair of channel members placed one in facing relation to the other at opposite sides of the longitudinal median line of the vehicle, a unitary movable frame-work providing paired channel members receiving a slide journal within the gutters of the rigid channel members, a hydraulic cylinder rigidly supported by the vehicle frame to occupy a position below the movable frame-work, a ram working in the cylinder and connected by its head end with the movable frame-work, a pressure source of hydraulic fluid for the cylinder-and-ram assembly, an upright link located to the rear of the tower and having an anchoring pivot at its lower end, and a boom fulcrumed by its rear extremity to the upper end of said link and pivotally connected to the movable frame-work at a point forwardly removed from the fulcrum.

5. In a load-handling vehicle, and in combination with the vehicle frame, a tower structure made rigid with the vehicle frame and providing a pair of channel members placed one in facing relation to the other at opposite sides of the longitudinal median line of the vehicle, a unitary movable frame-work providing paired channel members receiving a slide journal within the gutters of the rigid channel members, a hydraulic hoist contained within the tower structure and providing a cylinder footing upon the frame of the vehicle and a ram working in the cylinder and exerting its lift thrust upon the movable frame-work, a source of hydraulic pressure for said hydraulic hoist, a link disposed to the rear of the tower and pivotally anchored to the frame of the vehicle for longitudinal swinging movement about a transverse axis, a hollow boom fulcrumed by its rear end to the free end of said link and pivoted to the movable frame-work at a point forwardly removed from said fulcrum, sheaves carried by the boom at the front and rear ends thereof, a power-driven drum located at the foot of the tower structure, and a cable running from the drum to the rearwardly placed sheave and passing therefrom through the hollow center of the boom to and over the forwardly placed sheave.

6. In a load-handling vehicle, and in combination with the vehicle frame, a tower structure made rigid with the vehicle frame, said tower structure comprising a pair of channel members placed one in facing relation to the other at opposite sides of the longitudinal median line of the vehicle and having said members connected by a yoke and each reinforced at the back sides by a diagonal strut, a unitary movable frame-work providing paired channel members receiving a slide journal within the gutters of the rigid channel members, power means operatively connected with said movable frame-work and supported by the vehicle frame for raising and lowering said movable frame-work, and a boom fulcrumed to

6

the frame of the vehicle and having a pivotal connection with the head end of the movable frame-work at a point longitudinally offset from said fulcrum.

7. The load-handling structure of claim 6 in which the boom is extensible and is comprised of telescoping root and reach sections with the root section being a double-walled structure of which the inner wall defines a sleeve closely fitting the reach section and guiding the latter in its endwise movement relative to the root section.

8. A load-handling vehicle comprising, in combination with the vehicle frame, a tower structure rigid with said vehicle frame, a lift member carried by the tower for vertical sliding movements in relation thereto, means for raising and lowering the lift member, and an extensible boom comprised of telescoping root and reach sections of which the root section is fulcrumed to the frame of the vehicle and pivotally connected with the lift member at a point longitudinally offset from the fulcrum, said reach section having a substantially uniform cross-sectional size from the inner end thereof throughout very nearly its entire length, said root section being a double-walled structure of which the outer wall flares outwardly from the outer toward the inner end of such section and of which the inner wall defines a sleeve closely fitting the reach section and guiding the latter in its endwise movement relative to the root section.

9. A load-handling vehicle comprising, in combination with the vehicle frame, a tower structure rigid with said vehicle frame, a lift member carried by the tower for vertical sliding movements in relation thereto, means for raising and lowering the lift member, an extensible boom comprising a root section and a reach section receiving a slide journal from the root section, said root section being fulcrumed to the frame of the vehicle and being pivotally connected with the lift member at a point longitudinally offset from the fulcrum, respective sheaves carried by the boom sections at the forward and rear ends of the boom, a power-driven drum carried by the vehicle frame, a cable presenting a hook upon its free end and running from the drum over the rearwardly placed sheave and therefrom to and over the forwardly placed sheave, a fitting occupying a position in proximity of and localized with respect to the root section's axis arranged to be engaged by the hook and operating by the act of lowering the boom and coincidentally taking up or slacking off on the cable to adjustably slide the reach section in relation to the root section and thereby either shorten or lengthen the boom, and means for securing the two sections in selected adjusted positions.

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