April 18, 1961 H. J. TROCHE ET AL 2,980,263

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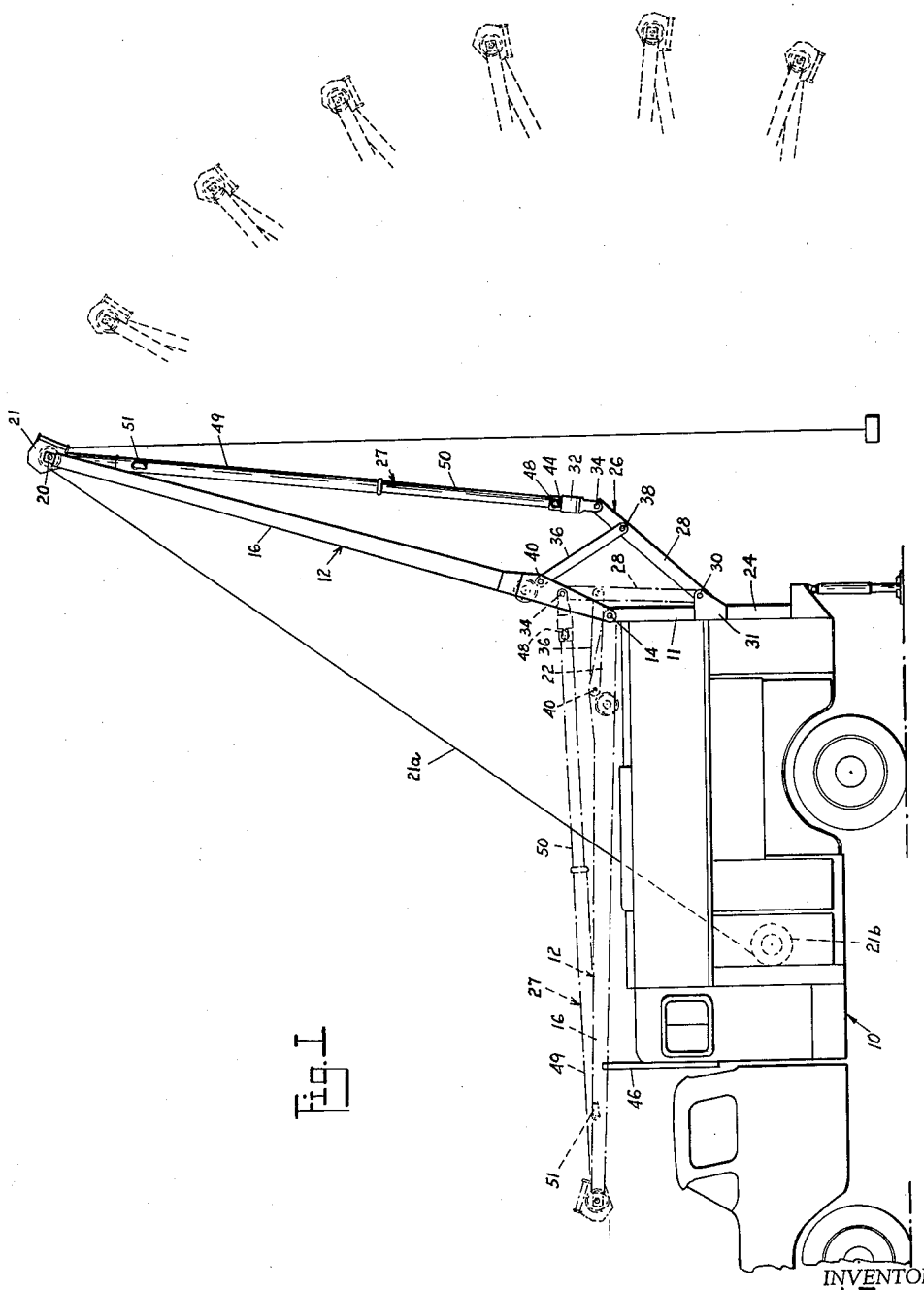


Fig. 1

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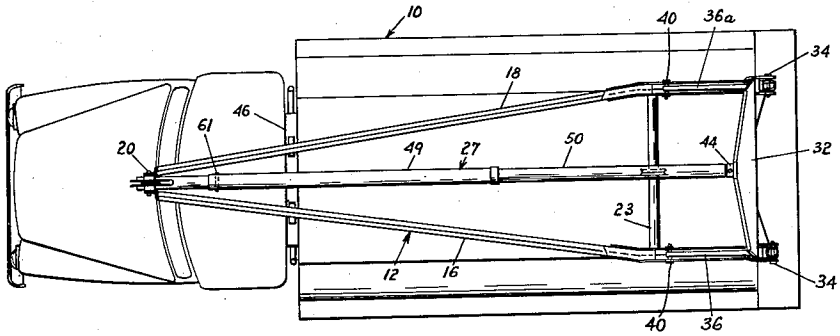


Fig. 2

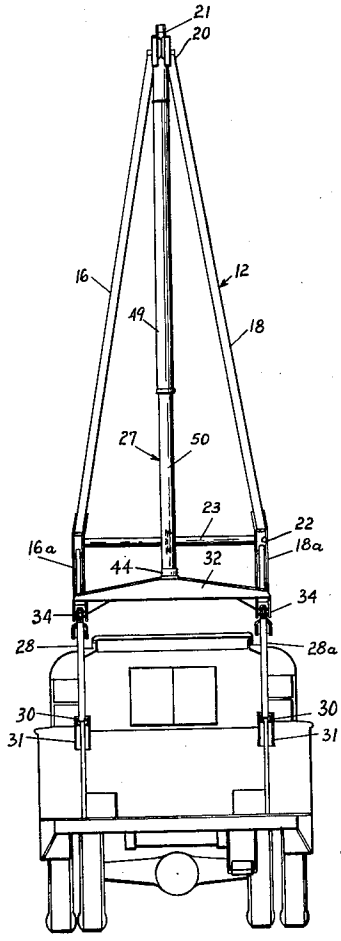


Fig. 3

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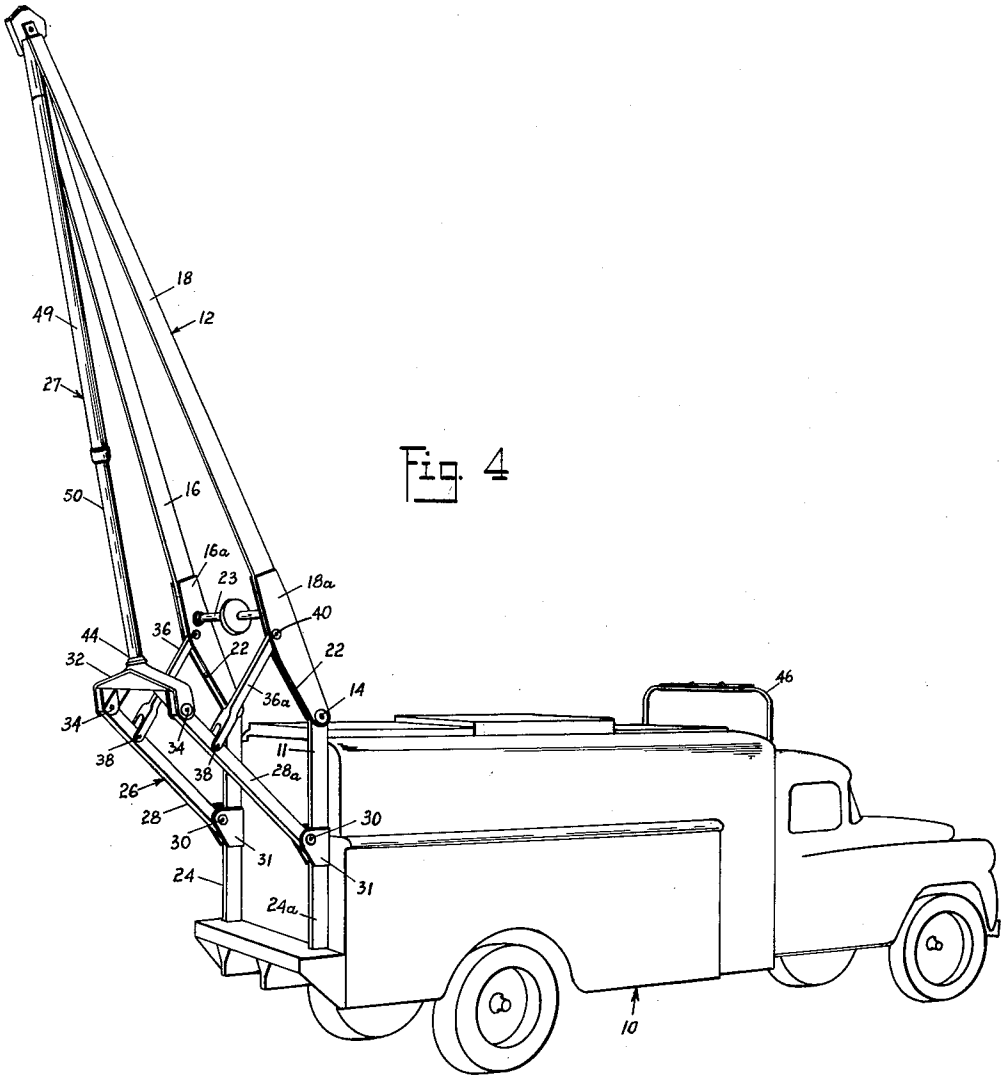


Fig. 4

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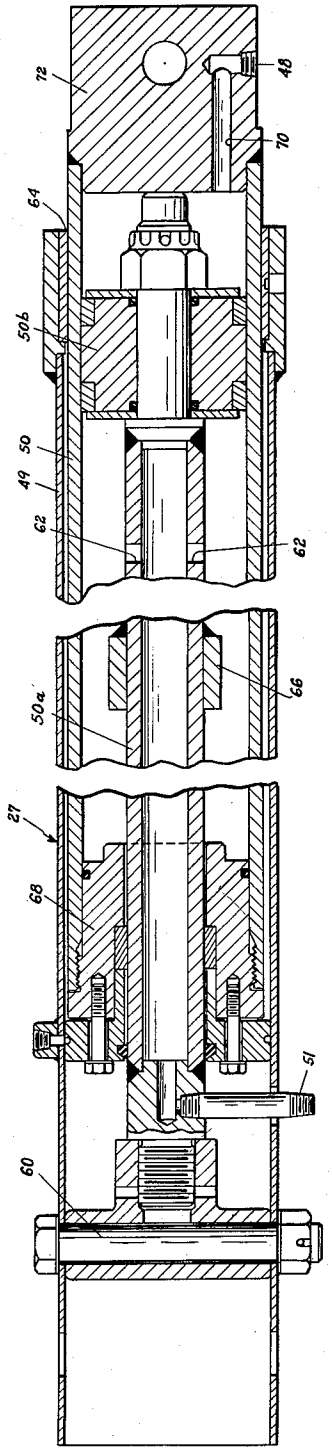


Fig. 5

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DERRICK

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12 Claims. (Cl. 212—8)

This invention relates in general to a power-operated, portable derrick or boom of the type that may be collapsed and stored on a vehicle body when not in use, and more particularly to an improved vehicle mounted derrick adapted to swing in a generally vertical plane from a carried or inactive position on the vehicle through an arc to various work or load carrying positions.

Power-operated portable booms are conventional equipment on many types of wheeled utility vehicles, and are adapted to handle various types of loads. This invention is concerned primarily with the type of portable boom or derrick that is an integral part of the wheeled vehicle, and may be collapsed on the vehicle body in overlying self-storing relation therewith when not in use, and which may be moved through an arc of movement in excess of 180 degrees, and which has optimum leverage characteristics during its full range of movement, and especially during the load carrying portion of the derrick's arc of movement.

Accordingly, it is an object of this invention to provide an improved power-operated derrick or boom particularly adapted for mounting on a vehicle.

Another object of the invention is to provide a derrick or boom of the latter type which is mounted for movement from an inactive carried position on the vehicle through an arc to various work positions, and wherein a single fluid powered ram is utilized to so actuate the derrick, and wherein a novel structural arrangement is provided to give optimum leverage characteristics of the ram force to the derrick and throughout the latter's full range of movement.

A still further object of the invention is to provide a derrick or boom of the latter mentioned type which is movable in a generally vertical plane through an arc in excess of 180°, and wherein the fluid powered ram pulls the derrick upwardly from its inactive or carried position and moves it to its various work positions.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a side elevational view of the derrick of the invention mounted on a utility-type of vehicle; in full lines an erected load carrying position of the derrick is illustrated, and in dot-dash lines the folded or inactive carried position of the derrick is shown, while in broken-dashed lines various other load carrying positions of the derrick are illustrated.

Fig. 2 is a top-plan view of the vehicle mounted derrick illustrated in Fig. 1, with the derrick being shown in its inactive or collapsed position.

Fig. 3 is a rear end, elevational view of the vehicle mounted derrick showing the same in an erected condition substantially corresponding to that illustrated in full lines in Fig. 1.

Fig. 4 is a perspective view of the vehicle mounted derrick arrangement illustrated in the above mentioned figures.

Fig. 5 is an enlarged broken sectional view of the reciprocal motor unit used to actuate the boom or derrick.

Referring now again to the drawings, there is shown a wheeled utility type vehicle **10** having a truck body forming a base **11** on which the portable derrick or boom **12** of the invention is hinged, as at **14**, for swinging movement in a generally vertical plane.

The derrick **12**, in the embodiment illustrated, is in the form of an A-frame having a pair of side legs **16** and **18** (Figs. 2 and 3), which converge at their upper ends toward a common apex **20**. A sheave **21** may be rotatably mounted at apex **20** for receiving winch line **21***a* operatively connected to preferably power operated winch mechanism **21***b* mounted on the vehicle and in a manner well known in the art. The legs **16** and **18** of the derrick, in their preferred form, are constructed of rectangular metal sections, to provide a light-weight derrick frame having high strength characteristics. The bottom or base portions **16***a* and **18***a* of the legs **16** and **18** are preferably recessed as at **22**, on their rearwardly facing ends, for a purpose to be hereinafter described. Cross member **23** extends transversely between the lower portions of legs **16** and **18**, and aids to rigidify the derrick frame.

The legs **16** and **18** are pivotally mounted, in the embodiment illustrated, on post structure **24**, **24***a* disposed at the rear end of the vehicle body **10**, and a linkage erecting or actuating arrangement **26** is provided, together with a double acting, reciprocal, fluid powered motor unit or ram **27**, for moving the derrick in a generally vertical plane and through an arc in excess of 180°.

The linkage erecting arrangement **26** takes the form of a pair of transversely spaced arms or links **28**, **28***a* pivotally mounted, as at **30**, to brackets **31** mounted on the respective post structure **24**, **24***a*, and well below and slightly rearwardly of the pivotal connections **14** of the derrick legs to the vehicle. Arms **28**, **28***a* are connected adjacent their outer ends by transverse cross-member **32** pivotally joined to legs **28**, **28***a* as at **34**. Secondary arms or links **36**, **36***a* are pivotally connected as at **38** to the respective arms **28**, **28***a*, and extend upwardly therefrom to be pivotally connected, as at **40**, to the respective leg **16** or **18** of the derrick frame. As can be best seen from Fig. 1, the aforementioned recesses **22** in the bottom portions **16***a* and **18***a* of the derrick legs receive links **36**, **36***a* therein in non-interfering relation in the collapsed position of the derrick.

The double-acting reciprocal fluid powered motor unit **27** is pivotally secured at one end adjacent apex **20** of the derrick frame and at its other end is secured as at **44** to the central portion of cross-member **32**.

Referring now to Fig. 1, the inactive or forwardly carried position of the derrick is shown in dot-dash lines in Fig. 1, with the derrick being disposed in a generally horizontal position overlying the vehicle. Support or rest structure **46** is provided, extending upwardly from the vehicle for supporting the free end of the derrick thereon in the carried position thereof. It will be noted that in the carried position, the motor unit **27** extends rearwardly from the free end of the derrick and along the derrick generally intermediate the legs **16** and **18** thereof, and preferably slightly diagonally upwardly therefrom. When it is desired to erect the derrick to a work position, pressurized fluid is fed for instance via distributing line **51** to the outer end of outer sleeve **49** of the extensible motor unit **27**, to thereby drive or move the sleeve **49** (Fig. 5) of the motor unit axially over the cylinder portion **50**, to thus pull the derrick upwardly and rearwardly about its pivotal connections **14** to the vehicle. The motor unit **27** will hereinafter be described in detail.

In Fig. 1, there is shown various work or load carrying positions of the derrick, and it will be clearly seen that

the arc of movement thereof is in excess of 180° from the derrick's inactive or carried position, to its maximum rearwardly swung work position, to thereby provide a derrick arrangement having great usability under varied operating conditions.

An important feature of the invention, is that with the arms 28, 28*a* of the erecting linkage 26 being disposed rearwardly of the pivotal connections 14 of the derrick to the vehicle, and with the extensible motor unit 27 disposed generally rearwardly of the derrick arms 16 and 18 during the load supporting portion of the arc of movement of the derrick, such load supporting portion being substantially that illustrated in Fig. 1 of the drawings in full lines and in broken dashed lines, the pivotal connections 34 of the ram 27 to the erecting linkage 26 are disposed at all times as great a distance as possible from the pivotal connections 14 of the derrick to the vehicle, and with such distance from the pivots 14 to the pivots 34 increasing as the boom or derrick is swung rearwardly through its arc to its various work positions. Such an arrangement provides for optimum application of effective force by the extensible motor unit 27 to the derrick to move the latter and especially during the load supporting portion of the derrick's arc of movement, and yet provides for the convenient storage of the derrick in overlying relation over the vehicle and out of interfering or rearwardly projecting relation with respect to the vehicle and as can be most clearly seen from Fig. 2 of the drawings. It will be seen that links 36, 36*a* coacting between derrick legs 16 and 18 and links 28, 28*a* cause rearward pivotal movement of links 28, 28*a* about their pivotal connections 30 to the vehicle, and thus movement of connections 34 away from derrick pivots 14 to thereby increase the effective force applied to the derrick by motor unit 27 during rearward swinging movement of the derrick from its carried position to load carrying position, and throughout the operating range of the derrick. Furthermore, it will be seen that the distance between pivots 34 and 14 is greatest when the boom 12 is in its rearwardmost and lowermost positions, thus providing optimum effective force from the motor unit 27 for actuating the derrick when the latter's power needs are the greatest.

To collapse the derrick and return it to its carried position, or to swing it forwardly about the pivots 14 to change its work position in its load supporting portion of its arc of movement, pressurized fluid is fed as for instance via distributing line 48 to the inner end of the cylinder 50 of extensible motor unit 27 to cause outward movement of the piston rod 50*a* (Fig. 5) with respect to the cylinder 50 to thereby cause outward axial movement of sleeve 49 with respect to cylinder portion 50 and pivot the derrick arms 16 and 18 about their pivotal connections 14 to the vehicle, while arms 28, 28*a* are swung counterclockwise, as viewed in Fig. 1, by the link arms 36, 36*a*, to thereby move the arms 28, 28*a* to their generally vertically extending non-rearwardly projecting storage position when the derrick arrives at its generally horizontal carried or storage position on the vehicle.

Referring now to Fig. 5, which shows a lengthwise cross section of the reciprocal motor unit 27, it will be seen that the piston rod 50*a* and associated piston head portion 50*b*, are secured as at 60 to the outer sleeve 49 of the motor unit, such outer sleeve being adapted to telescope over cylinder portion 50. In the embodiment illustrated sheave head 21 is connected to the sleeve portion 49 of the motor unit, as by means of pin 61 (Fig. 2).

Fluid pressure is fed via line 51 into the hollow piston rod 50*a* and passes from the piston rod via ports 62 into actuating contact with the piston 50*b*, to thus slide outer sleeve 49 telescopically over cylinder 50, to thereby cause shortening of the motor unit and erection of the derrick. Bearing portion 64 is provided on sleeve 49 to facilitate axial movement thereof with respect to cylinder 50, and stop 66 is provided on the piston rod 50*a* for engagement with head portion 68 of cylinder 50, to positively limit the extension of the motor unit. Extension of the motor unit is accomplished, as aforementioned, by feeding pressurized fluid via feed line 48, where it passes through passage 70 in end plug 72 into actuating contact with piston head 50*b*, to thereby move sleeve 49 axially outwardly with respect to cylinder 50, while draining fluid from cylinder 50 via line 51.

The motor unit 27 may be supplied with pressurized fluid from a pump and reservoir mounted on the vehicle body and driven as by means of a separate power unit, or operatively coupled to the engine of the vehicle, in a manner well known to those skilled in the art. Conventional valving means may be provided to selectively control the flow of pressurized fluid from the pump to the motor unit 27 in the conventional well known manner.

From the foregoing description and accompanying drawings it will be seen that the invention provides an improved portable-type derrick or boom operated by means of a single extensible motor unit and wherein the derrick or boom is movable in a generally vertical plane from a collapsed or carried position on the vehicle to load supporting positions and vice versa, and with the arc of derrick movement being in excess of 180°, and with the derrick or boom erecting arrangement providing for optimum application of leverage force by the motor unit to actuate the derrick throughout its range of movement and especially during the load supporting portion of the derrick's arc of movement.

The terms and expressions which have been used are used as terms of description and not of limitation and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

We claim:

1. In a portable boom pivotally mounted at one end on a support for swinging movement in a generally vertical plane from forward storage position to rearward load supporting position, fluid powered reciprocal means pivotally connected adjacent one end thereof to the boom outwardly therealong from the pivotal connection of the boom to the support, linkage means pivotally connected to the support and downwardly from the pivotal connection of said boom to the support, said linkage means being disposed generally rearwardly of said pivotal connection of said boom to the support, the other end of said reciprocal means being pivotally connected to said linkage means outwardly therealong from the pivotal connection of said linkage means to said support, and other linkage means extending between said first linkage means and said boom and being pivotally connected thereto, the axis of the pivotal connection of said other linkage means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said other linkage means to said first linkage means, throughout the range of movement of said boom, said other linkage means operating to pivot said first linkage means and said reciprocal means outwardly and rearwardly away from the pivotal connection of said boom to said support, upon actuation of said reciprocal means to move said boom from its storage position to load supporting position.

2. A portable boom in accordance with claim 1 wherein the pivotal connection between said other linkage means and said first linkage means is disposed intermediate the pivotal connection of said first linkage means to said support and the pivotal connection of said reciprocal means to said first linkage means.

3. A portable boom in accordance with claim 1 wherein the distance between the pivotal connection of said first linkage means to said support and the pivotal connection of said reciprocal means to said first linkage means is greater than the difference in elevation be-

tween the pivotal connection of said first linkage means to said support and the pivotal connection of said boom to the support.

4. In a portable boom pivotally mounted at one end on a support for swinging movement in a generally vertical plane and adapted to extend generally horizontally over the support when in a storage position thereon and being adapted to be swung rearwardly with respect to such storage position to various load carrying positions, reciprocal double acting fluid powered motor means pivotally coupled at one end to said boom and extending rearwardly therealong in generally diverging relation therewith to a point disposed rearwardly of the pivotal connection of said boom to the support when said boom is in said storage position, linkage means extending between the rearward end of said motor means and a pivotal connection on said support and being pivotally connected thereto, said last mentioned pivotal connection on said support being disposed below the elevation of the pivotal connection of said boom to said support, and connecting means extending between said linkage means and said boom and being pivotally connected thereto, the axis of the pivotal connection of said connecting means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said connecting means to said linkage means, throughout the range of movement of said boom, said connecting means operating to pivot said linkage means rearwardly away from the pivotal connection of said boom to said support upon actuation of said motor means to move said boom from its storage position to load supporting position, and pivoting said motor means outwardly about its pivotal connection to said boom and away from the pivotal connection of said boom to the support.

5. In a portable boom mounted at one end on a support for swinging movement in a generally vertical plane from a generally horizontal storage position overlying the support to a load supporting position wherein the boom projects rearwardly of the support, reciprocable fluid powered motor means pivotally connected at one end to said boom adjacent the free end thereof, linkage means pivotally connected adjacent one end thereof to the support, said last mentioned pivotal connection being disposed downwardly from the pivotal connection of said boom to said support, said linkage means being disposed generally rearwardly of the pivotal connection of said boom to the support, the other end of said linkage means being pivotally coupled to the other end of said motor means, and other linkage means extending between said first linkage means and said boom and being pivotally connected thereto, the axis of the pivotal connection of said other linkage means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said other linkage means to said first linkage means, throughout the range of movement of said boom, said other linkage means operating to pivot said first linkage means and said motor means outwardly and rearwardly away from the pivotal connection of said boom to said support, upon actuation of said motor means to swing said boom rearwardly about its pivotal connection to the support.

6. In a portable boom having two converging legs connected at one end thereof for operatively supporting a sheave, each of said legs being pivotally mounted at its other end on a support for swinging movement of the boom in a generally vertical plane from forward storage position to rearward load supporting position, a double acting reciprocal hydraulic motor unit pivotally connected adjacent one end to said boom adjacent the free end thereof and extending generally centrally along said boom toward the anchored end thereof, a pair of spaced links pivotally connected to said support downwardly from the pivotal connections of said legs to said

support, each of said links being associated with a respective one of said legs and being adapted for swinging movement in a plane parallel to the first mentioned plane, said links being disposed generally rearwardly of the pivotal connections of said legs to the support, means pivotally connecting the other end of said motor unit to said links outwardly therealong from the pivotal connections of said links to the support, and other connecting means extending between a respective leg and link and being pivotally connected to the latter, the axis of the pivotal connection of said other connecting means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said other connecting means to the respective link, throughout the range of movement of said boom, said other connecting means operating to pivot said links and said motor unit outwardly and rearwardly away from the pivotal connections of said legs to said support, upon actuation of said motor unit to move said boom from storage position to load supporting position.

7. A portable boom in accordance with claim 6 wherein each of said legs has a recess in the rearwardly facing side thereof, said other connecting means being adapted for receipt in the recess in the respective leg when said boom is in storage position.

8. In a portable boom pivotally mounted at one end on a support for swinging movement in a generally vertical plane and being adapted to extend generally horizontally over the support when in a storage position and being adapted to be swung rearwardly with respect to such storage position to various load carrying positions, reciprocal hydraulic motor means pivotally connected at one end to said boom and extending rearwardly therealong and diagonally upwardly therefrom when said boom is in said storage position, linkage means pivotally connected to said support and extending outwardly therefrom, said last mentioned pivotal connection being disposed below the pivotal connection of said boom to the support, said linkage means being disposed generally rearwardly of the pivotal connection of said boom to said support and extending above said last mentioned pivotal connection in said storage position of said boom, the other end of said motor means being pivotally connected to said linkage means outwardly therealong from the pivotal connection of said linkage means to said support, said pivotal connection of said motor means to said linkage means being disposed above the pivotal connection of said boom to said support when said boom is in said storage position, and connecting means extending between said boom and said linkage means and being pivotally connected thereto, the pivotal connection of said connecting means to said linkage means being disposed intermediate the pivotal connection of said motor means to said linkage means and the pivotal connection of said linkage means to said support, the axis of the pivotal connection of said connecting means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said connecting means to said linkage means, throughout the range of movement of said boom, said connecting means operating to pivot said linkage means rearwardly away from the pivotal connection of said boom to said support upon actuation of said motor means to move said boom from said storage position to a load carrying position and pivoting said motor means outwardly about its pivotal connection to said boom and away from the pivotal connection of said boom to the support.

9. A portable boom in accordance with claim 8 wherein the pivotal connection of said linkage means to the support is disposed rearwardly of the pivotal connection of said boom to the support.

10. A portable boom in accordance with claim 8 wherein the distance between the pivotal connection of

said linkage means to said support and the pivotal connection of said connecting means to said linkage means is substantially the same as the distance between the pivotal connections of said connecting means to said boom and to said linkage means.

11. In a portable boom having two converging legs connected at one end thereof for operatively supporting a sheave, each of said legs being pivotally mounted at its other end on a generally horizontal axis on a support for swinging movement in a generally vertical plane and being adapted to extend generally horizontally over the support when in a storage position thereon and being adapted to be swung rearwardly with respect to such storage position to various load carrying positions, a double acting reciprocal hydraulic motor unit pivotally connected at one end thereof to said boom adjacent the convergence of said legs and extending rearwardly therealong and diagonally upwardly therefrom when said boom is in said storage position, a pair of spaced links pivotally connected to said support in downwardly spaced relation to the pivotal connections of said legs to the support, each of said links being associated with a respective one of said legs and being adapted for swinging movement in a plane parallel to the plane of movement of the respective leg, said links being disposed generally rearwardly of the pivotal connections of said legs to said support, means pivotally connecting the other end of said motor unit to both of said links outwardly therealong from the pivotal connections of said links to the support, the pivotal connection of said motor unit to said links being disposed above the pivotal connections of said legs to said support when said boom is in said storage position, and connecting means extending between a respective leg and link and being pivotally conected thereto, the pivotal connection of said connecting means to the respective link being disposed intermediate the pivotal connection of said motor unit to such link and the pivotal connection of the latter to said support, the axes of the pivotal connections of said connecting means to said boom being disposed above a horizontal plane passing through the axes of the pivotal connections of said connecting means to the respective of said links, throughout the range of movement of said boom, said connecting means operating to pivot said links rearwardly away from the pivotal connections of said legs to said support upon actuation of said motor unit to move said boom from its storage position to load supporting position and pivoting said motor unit outwardly about its pivotal connection to said boom and rearwardly away from the pivotal connections of said boom to the support.

12. The combination comprising a wheeled vehicle, a boom pivotally mounted at one end thereof on one end of the vehicle for rearward swinging movement in a generally vertical plane from a generally horizontal storage position wherein the boom overlies the vehicle to various load supporting positions wherein said boom projects generally outwardly from said one end of said vehicle, a double acting fluid powered motor unit pivotally connected at one end thereof to said boom outwardly therealong from the pivotal connection of said boom to said vehicle, linkage means pivotally connected to said one end of said vehicle and substantially vertically downwardly from the pivotal connection of said boom to said vehicle, said linkage means being disposed generally rearwardly of said pivotal connection of said boom to said vehicle and extending generally vertically upwardly from its pivotal connection with the vehicle to a point above the pivotal connection of said boom to said vehicle when said boom is in said storage position, the other end of said motor unit being pivotally connected to said linkage means above the pivotal connection of said boom to the vehicle, and other linkage means extending between said first linkage means and said boom and being pivotally connected thereto, the pivotal connection of said other linkage means to said first linkage means being disposed intermediate the pivotal connection of said motor unit to said first linkage means and the pivotal connection of the latter to said vehicle, and the pivotal connection of said other linkage means to said boom being disposed outwardly therealong from the pivotal connection of said boom to said vehicle, the axis of the pivotal connection of said other linkage means to said boom being disposed above a horizontal plane passing through the axis of the pivotal connection of said other linkage means to said first linkage means, throughout the range of movement of said boom, said other linkage means operating to pivot said first linkage means rearwardly away from the pivotal connection of said boom to said vehicle upon actuation of said motor unit to move said boom from its storage position to load supporting position, and pivoting said motor unit outwardly about its pivotal connection to said boom and rearwardly away from the pivotal connection of said boom to the vehicle.

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