United States Patent [19]

Holland, Sr.

[11] **3,848,751**

[45] **Nov. 19, 1974**

[54] **SIDE BOOM PIPE LAYING MACHINE**

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[22] Filed: **Jan. 16, 1973**

[21] Appl. No.: **324,194**

[52] **U.S. Cl.** ..... **212/145,** 212/56, 214/75 H

[51] **Int. Cl.** **B66c 23/78**

[58] **Field of Search** ..... 212/56, 59 R, 63, 145; 214/75 H

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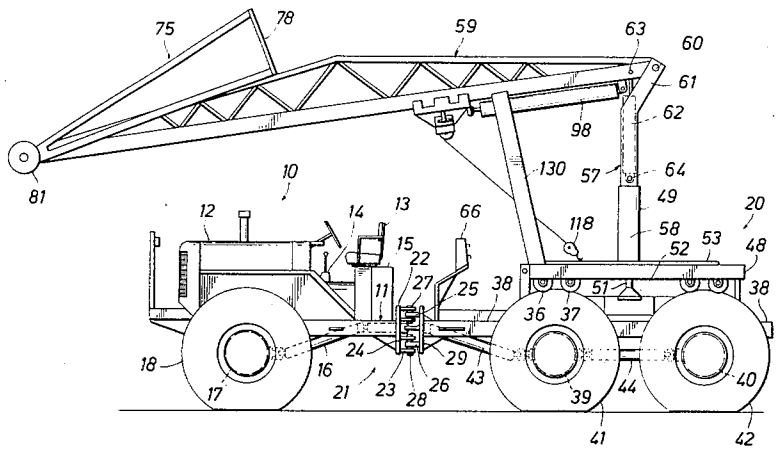
[57] **ABSTRACT**

In accordance with an illustrative embodiment of the present invention, a mobile article handling vehicle adapted for off-the-road operations such as pipe laying in the most rugged types of terrain includes a light weight vehicle unit with ground engaging tires of great ground bearing area, a rotatable, upright mast on the unit, a tiltable boom with its inner end pivoted to the upper end of the mast, a hoist structure movable longitudinally along the boom between selected stations, and a supporting leg pivoted to the outer end of the boom and rotatable between a supporting position where the lower end thereof engages the ground to provide vertical support, and a traveling position substantially parallel to and above the boom.

11 Claims, 7 Drawing Figures



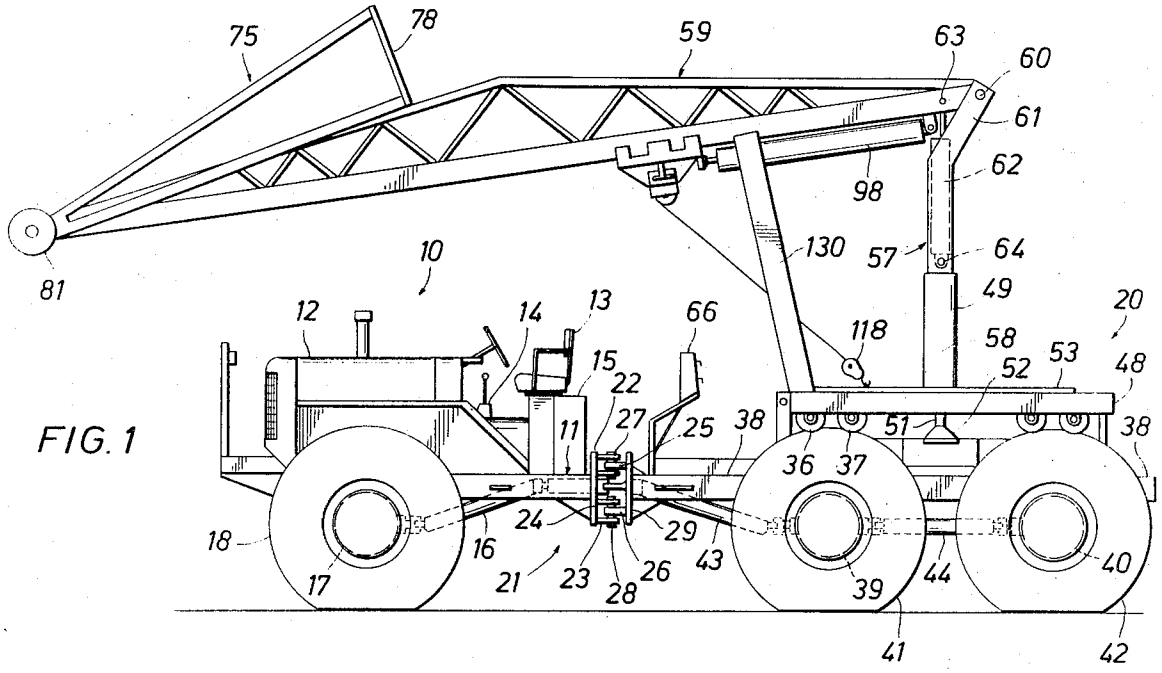

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FIG. 1

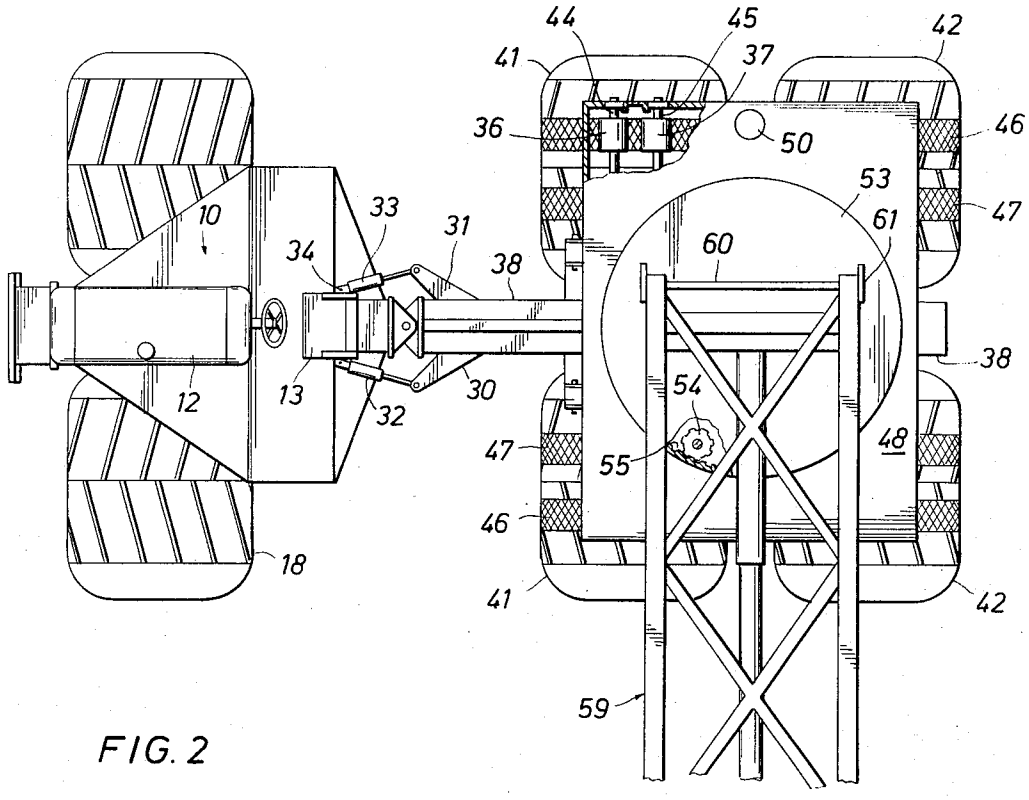
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FIG. 2

FIG. 3

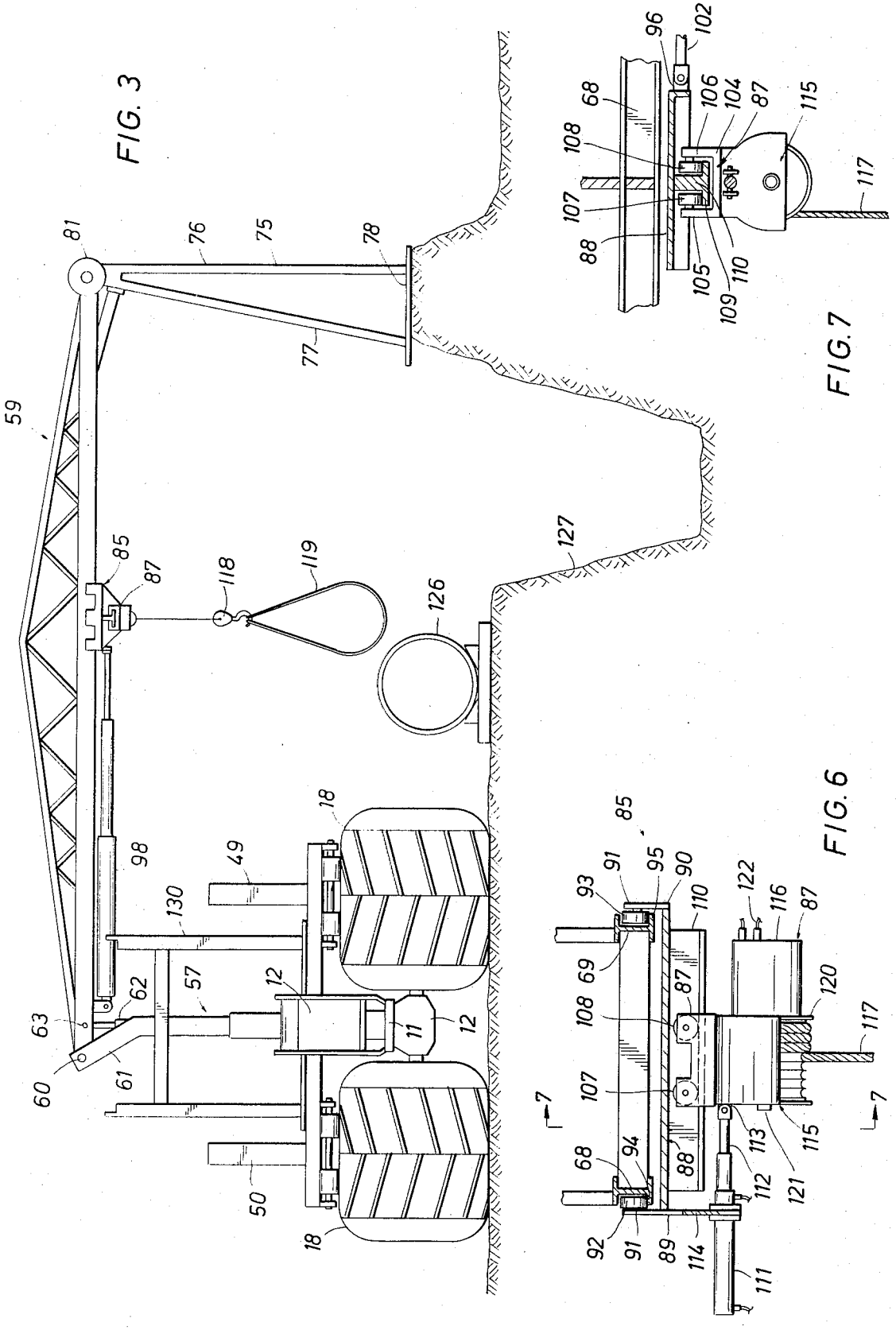

FIG. 7

FIG. 6

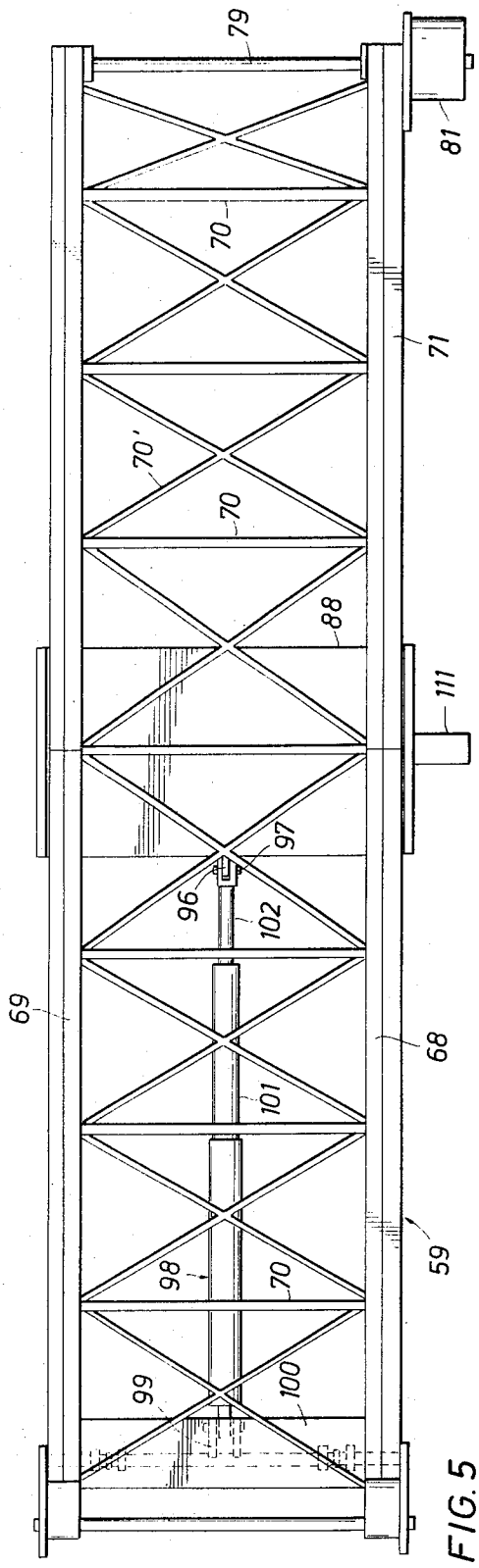
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FIG. 5

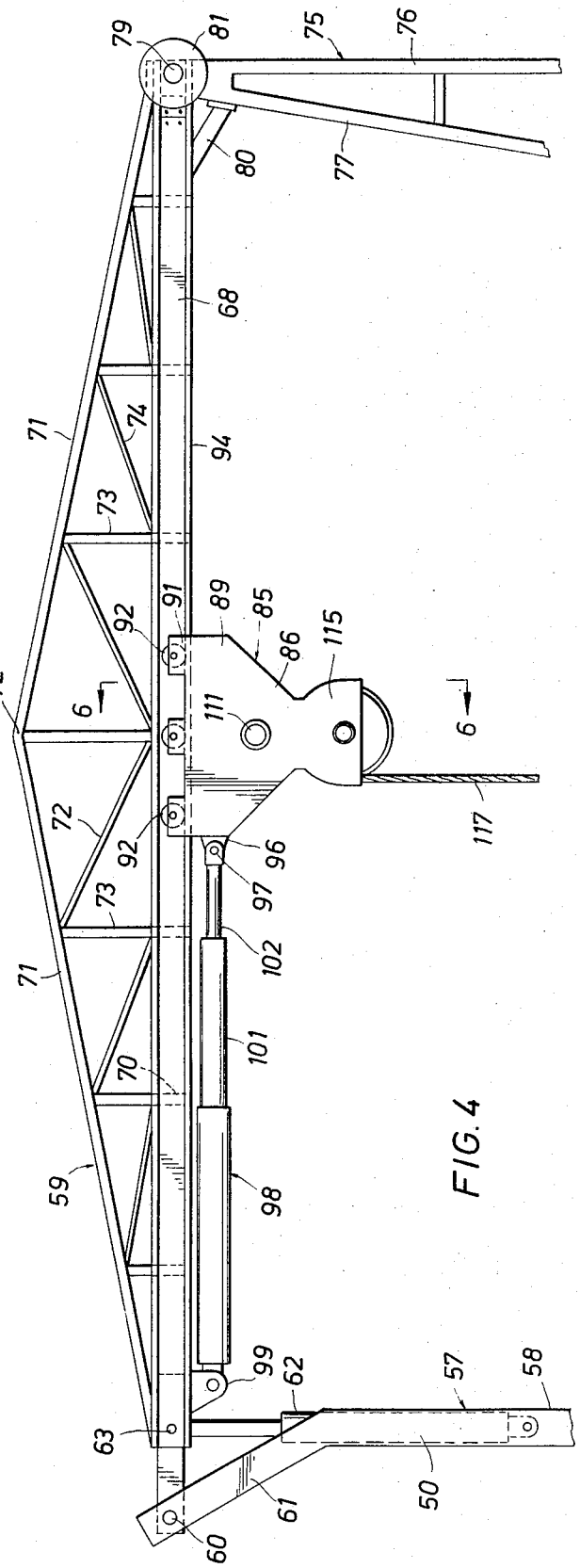
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FIG. 4

SIDE BOOM PIPE LAYING MACHINE

This invention relates generally to a mobile hoisting device, and more particularly to a new and improved boom-type hoisting or loading vehicle adapted for off-the-road construction operations such as pipe laying or the like.

In the prior art, a typical machine that has been used in pipe laying operations is the so-called side boom tractor having an A-frame or other mast pivoted to one side and with the top guyed by cables. The winch works together with extremely heavy counter balance weights are placed on the other side of the tractor to maintain it in a stable condition as loads are being handled. These machines although widely used have a number of significant disadvantages. For example, the vehicle is required to carry the additional load of the weights, making it quite heavy and unwieldly and difficult to use in unfavorable terrain such as marsh and swamp. Moreover, other equipment is sometimes required to add or remove weights to adjust for various load conditions. Many other types of boom and truss arrangements have been used as static structures in the building and construction trades, however, these devices are not mobile and are massive and are thus not suitable in concept for off-the-road operations.

It is the leading object of this invention to provide a new and improved, mobile material handling and hoisting machine that does not require heavy counterweights for stability, and is arranged and particularly adapted for off-the-road usage such as pipe laying or the like in the most rugged terrain conditions.

This and other objects are attained in accordance with the concepts of the present invention through the provision of a vehicle unit including a frame having ground engaging means such as low pressure pneumatic tires or the like having great ground bearing areas that enable mobility even in the most rugged and marshy terrain, and a boom structure having one end pivoted to the upper end of an upright, rotatable mast mounted on a deck that is attached to the frame. A hoist arranged for handling a load is suspended from a carriage assembly that is movable longitudinally along the boom and can be positioned and fixed at any selected location within its range of travel thereon. The carriage assembly also includes means that enable limited movement of the hoist at right angles to the boom structure. The outer end of the boom is provided with a support means such as a leg having its upper end pivotally attached thereto and adapted to be placed in a working position where the lower end thereof engages the ground with a shoe area sufficient to provide vertical support for the outermost end of the boom. The support also can be disposed in a traveling position substantially parallel to and above the boom, out of the way of the carriage assembly and hoist which are movable along the boom. With the support in the traveling position the boom can be aligned with the longitudinal axis of the vehicle unit when moving between operating locations, and the boom structure can be tilted upwardly for handling certain loads, as well as for loading articles onto, or unloading articles from, the deck of the vehicle unit itself.

The present invention has other objects and advantages which will become more clearly apparent in connection with the following detailed description of a preferred embodiment, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a somewhat schematic view of the over-all configuration of the vehicle and the boom structure shown in the traveling position;

FIG. 2 is a top view of the vehicle with the boom structure positioned to the side in working conditions;

FIG. 3 is a front view similar to FIG. 2 to illustrate the vehicle in use for pipe laying operations;

FIG. 4 is a side view with enlarged detail of the various structural components of the side boom structure;

FIG. 5 is a top view of the side boom structure;

FIG. 6 is a cross section on line 6—6 of FIG. 4; and

FIG. 7 is a cross section on line 7—7 of FIG. 6.

Referring initially to FIG. 1, a vehicle that is constructed in accordance with the principles of the present invention is shown as including a front unit **10** having a frame **11** that carries an engine **12** and an operator's station **13.** Transmission **14** couples the output of the engine **12** to the input of a typical transfer case **15** having two outputs located at the level of the frame **11,** the forward output being coupled by a drive shaft **16** to the differential and axle housing **17** for the front wheels **18,** and the other output pointing toward the rear. The front wheels **18** may be of any suitable type, but preferably are low pressure pneumatic tires of the type shown in the Albee U.S. Pat. No. 24,272.

A rear unit **20** is coupled in tandem with the front unit **10** by means of an articulative coupling assembly indicated generally at **21.** The coupling assembly may be of the type disclosed and claimed in my U.S. Pat. No. 3,630,302 to provide for articulation of the front and rear units about orthogonal axes, however as shown here the coupling assembly includes upper and lower forks **22** and **23** on a plate **24** that defines the rear of the front frame **11.** Tongues **25** and **26** are connected to the respective forks by king pins **27** and **28,** the pins being aligned on a vertical steering axis. The tongues **25** and **26** are welded to a transverse plate assembly **29** that has outwardly and forwardly extending arms **30** and **31** (FIG. 2), the arms being connected to hydraulic cylinders **32** and **33** which are in turn connected to appropriate brackets **34** on the sides of the front frame **11.** The cylinders **32** and **33** can be hydraulically actuated in a conventional manner to cause the front unit **10** to swing laterally relative to the rear unit **20** in order to effect steering of the vehicle.

The rear unit **20** includes a frame **38** having the plate assembly **29** at its front end, the frame having spaced differential and axle housings **39** and **40** attached thereto by any suitable means. Each axle housing supports tires **41** and **42** of the same general type as the front tires **18,** the tires being driven from the rearwardly pointing output of the transfer case **15** by means of drive shafts **43** and **44** and appropriate universal joints so that all six wheels of the vehicle are driven. For further structural details of the drive train, reference may be had to may aforementioned Pat. No. 3,630,302. Preferably, a tire loading system is incorporated into the rear unit **20** as described and claimed in my copending application Ser. No. 148,585, filed June 1, 1971. The system, which includes a series of spaced apart rollers located underneath each of the four corner portions of the deck **48** of the vehicle unit **20** (only

one series of rollers being shown in fragmentary section in FIG. 2 for purpose of simplicity), includes separate pairs of rollers **36** and **37** that are mounted on shafts **44** and **45** located above the tires **41** and **42** and to either side of the vertical plane containing the center line of tire. The shafts **44** and **45** can have their ends connected to vertically arranged guides that cooperate with companion channels to give the roller units the capability for vertical movement into and out of engagement with wear pads **46** and **47** on a respective tire. Vertical movement can be accomplished, for example, through use of hydraulic rams (not shown) coupled between the shafts **44** and **45** and the underside of the deck **48.** When engaged, the rollers transfer load directly from the deck **48** to the tires to relieve stress in the axles upon which the tires are mounted and thereby significantly increase the load carrying capacity of the rear vehicle unit. Of course, the rollers could be driven from the output of the transfer case **15** to effect a top roller drive for the rear tires **41** and **42,** and can be utilized for braking the vehicle also. However, a typical use is in the load transferring mode of operation as discussed above.

The deck **48** is structurally mounted and horizontally arranged on the rear frame **38** by any suitable means, for example, transverse pivot pins on the front and a turnbuckle coupling on the rear to enable operation of the tire loading system. If the loading system is not used, of course the deck **48** would be rigidly connected to the frame **38.** The deck **48** is provided with hydraulic stabilizer cylinders **49** and **50** that are fixed to either side thereof by appropriate means. The cylinders **49** and **50** (FIG. **3**) have extensible and retractable rods **51** with ground engaging feet **52** that function when extended to provide lateral support and stability for the deck **48.** Of course when the vehicle is conditioned for traveling, the rods are retracted as shown in FIG. **1.** The deck **48** carries a circular turret plate **53** that is appropriately mounted to be rotated to various angular dispositions by suitable means such as a drive pinion **54** that meshes with a ring gear **55** on the turret plate as shown in FIG. **3,** the pinion being selectively operated by a reversible hydraulic motor or the like (not shown). The turret plate **53** carries an upright mast assembly **57** having spaced apart side members **58** with their lower ends rigidly fixed to the plate **53.** The inner end of a side extending truss or boom assembly **59** is pivoted to the upper end of the mast **57** by an elongated pivot pin **60.**

Although several structural methods can be readily visualized by those skilled in the art for effecting vertical tilting of the boom assembly **59** about the pivot pin **60,** one manner as shown in FIG. **1** includes providing the upper end portion **61** of each side member of the mast **57** with a bent or outwardly deflected configuration, and positioning hydraulic cylinders **62** each having one end pivoted to a cross pin **63** on the boom **59** and its opposite end pivoted to a cross pin **64** on the mast **57.** Inasmuch as the lateral spacing between the pins **63** and **60** provides a moment arm, it will be appreciated that extension and retraction of the cylinders **62** will respectively raise and lower the outer end of the boom assembly **59** as desired. The cylinders **62** are coupled by hydraulic lines (not shown) to a suitable pump and hydraulic circuit that can be operated from a control panel **66** located for convenience directly to the rear of the operation's station **13** on the front vehicle unit **10.**

The boom assembly **59** as shown in FIGS. **4** and **5** has main structural members **68** and **69,** for example I beams, that are spaced apart and connected together by suitable cross bracing **70** and **70'.** To lend further rigidity, truss members **71** are welded near the ends in the members **68** and **69** and extend upwardly at low inclination to an apex **72** near the center of the boom. The members **68** and **71** are further joined at spaced points by vertical and diagonal braces **73** and **74.**

The outer end of the boom assembly **59** has pivotally attached thereto an outrigger support or leg **75** having structural side members **76** and **77** with a support foot or plate **78** disposed at their lower ends. The support **75** is pivoted by means of a shaft **79** and can be rotated through an angle of about 270° between a working position as shown in FIG. **4** where the foot plate **78** can rest upon the ground, and a traveling position as shown in FIG. **1** wherein the support is positioned on top of the boom assembly **59.** When in the working position a stop **80** locates the support at approximate right angles to the boom assembly **59.** Rotation of the support **75** is accomplished through use of a conventional hydraulic rotator **81** that is fixed to the boom assembly **59** and is arranged to drive the shaft **79** which is rigidly secured to the support **75.** Here again the rotator **81** is coupled by a hydraulic circuit (not shown) to the control panel **66** in order to provide for convenient actuation thereto on a selective basis.

A hoisting device indicated generally at **85** in FIG. **4** can be positioned at various stations along the boom assembly **59,** and preferably comprised a compound carriage system including a upper carriage assembly **86** that is movable along the boom and a lower carriage assembly **87** that is movable at right angles to the boom. The upper carriage assembly **86** may be constituted by a plate **88** that is welded or otherwise secured to end flanges **89** and **90** (FIG. **6**) having upwardly extending hanger brackets **91** that journal the respective shafts of rollers **92** and **93** that ride on the outwardly extending lips **94** and **95** of the beams **68** and **69.** A bracket **96** (FIG. **4**) is also provided on the side of the plate **88** and is coupled by a pin **97** to the outer end of a hydraulic cylinder or ram **98** that has its inner end pinned to a bracket **99** on a cross piece **100** at the inner end of the boom **59.** Preferably the cylinder **98** has a compound arrangement of pistons **101** and **102** that are telescopically disposed one within the other so that the cylinder when completely retracted occupies a small dimension compared to its length when fully extended. Of course the cylinder **98** also is connected by a suitable hydraulic circuit to the aforementioned control panel **66** so that the operator can readily position the hoisting device **85** along the boom **59** at any desired station.

As previously mentioned, the lower carriage assembly **87** is suspended from the upper carriage assembly **86** and includes a channel member **104** as shown in FIG. **7** whose upwardly extending sides **105** and **106** carry the shafts or rollers **107** and **108** so that the rollers can ride on the outwardly extending lips **109** of a beam **110** that is rigidly secured by welding or the like to the lower face of the plate **88** of the upper carriage assembly **86.** The lower carriage assembly **87** can be positioned transversely to the boom **59** by a hydraulic motor **111** (FIG. **6**) having its piston **112** coupled to the

channel member **104** at **113** and its cylinder suitably fixed to a lower portion **114** of the end flange **89.** Hereagain the cylinder **111** is suitably coupled by hydraulic circuit to the control panel **66** so that actuation thereof functions to move the lower carriage assembly within limits transversely to the boom assembly **59.**

The lower carriage **87** includes a winch **115** that is suitably driven by a hydraulically operated motor **116,** the winch carrying a cable **117** that suspends a hook **118** together with a pipe sling **119** or the like. The spool **120** of the winch **115** is mounted on a driven shaft **121** that is coupled through typical gearing to the output of the motor **116.** Of course the motor **116** is a reversible device with the hydraulic lines **122** extending to the operator's control panel **66** so that the winch can be utilized to raise and lower the hook **118.** Of course although a pipe sling **119** is shown, it will be appreciated that any of the various impliments useful in handling materials may be connected to the cable depending upon the use being made of the vehicle.

In operation, the vehicle is conditioned for traveling by actuating the hydraulic rotator **81** to fold the outrigger support **75** to a position on top of the boom **59,** whereupon the turret plate **55** is rotated until the boom is aligned with the longitudinal axis of the vehicle as shown in FIG. **1.** A standard **130** fixed to the deck **48** of the rear unit **20** can be used to support the boom **59** with the mast cylinders **62** retracted. In the working position, on the other hand, the boom assembly **59** is disposed in the side position and the support **75** is pivoted against the stop **80** so that the foot **78** can rest upon the ground as shown in FIG. **8.** The hoisting device **85** can be positioned where needed along the boom assembly **59,** and the hydraulic hoisting winch **115** is operated to raise, lower and otherwise handle a load such as the pipe line **126** which is being laid in a trench **127.** Where fore and aft positioning is necessary in order to make up pipe joints for welding or the like, the transverse cylinder **111** can be operated to appropriately position the lower carriage assembly **87.**

The present invention is also adapted for loading or unloading materials on the deck **48** inasmuch as it will be appreciated that the boom **59** can be tilted upwardly to various angular positions with respect to the mast **57,** and of course the turret plate **53** can be rotated as desired. The cylinders **49** and **50** can be used to stabilize the deck **48** when the boom **59** is used in the tilted condition. The cable spool **120** can be located along the boom by extending or retracting the cylinder **98** to correspondingly position the hoist **85,** and can be fixed in any desired position by hydraulically locking the cylinder. Thus it will be apparent that the present invention has a variety of uses in connection with general hoisting operations, and is quite versatile in application.

The provision of the pivoted outrigger support **75** that can rest on the ground during working conditions and thus support the outer end of the boom assembly **59,** obviates the need for using guy lines and heavy counter-weights as in the prior art, with attendant advantages as discussed above. Moreover, the fact that the support **75** can be positioned on top of the boom assembly **59** expedites use of the boom in a tilted condition, since the support will not interfere with the longitudinal position of the carriage assemblies and is otherwise out of the way of the articles being handled or loaded. The vehicle is highly mobile and adapted for operation in off-the-road conditions of almost any type of terrain.

Certain changes or modifications may be made by those skilled in the art without departing from the scope of the present invention. For example, and not by way of limitation, the outrigger support may be made to be adjustable in length so as to accommodate different ground elevations with the boom still level. Also, although hydraulic cylinders have been shown as a mode for positioning the carriage assemblies, it will be appreciated that systems of cables and pulleys could be used to accomplish the same purpose. Thus it is the aim of the appended claims to cover all such changes and modifications following within the true spirit and scope of the present invention.

I claim:

1. Apparatus for use in off-the-road hoisting operations, comprising: a vehicle unit having ground engaging means; an upright mast on said unit; boom means having one end pivotably attached to the said mast; hoist means movable longitudinally along said boom means and adapted for handling a load; support means pivotally attached to the other end of said boom means, said support means being adapted for pivotal rotation between a supporting position at right angles to said boom means where the lower end of said support means rests on the ground and provides vertical support, and a traveling position substantially parallel to and above said boom means; and selectively operable motor means for pivotally rotating said support means between said supporting position and said traveling position.

2. The apparatus of claim **1** further including means for tilting said boom means to various angles of inclination with respect to horizontal.

3. The apparatus of claim **1** wherein said hoist means includes an upper carriage assembly and a lower carriage assembly, said lower carriage assembly being movable transversely of said boom means.

4. The apparatus of claim **3** further including first selectively operable motor means for moving said hoist means longitudinally of said boom means and second selectively operable motor means for moving said second carriage means transversely of said boom means.

5. Apparatus for use in off-the-road hoisting operations, comprising: a mobile vehicle unit having ground engaging means; an upright mast on said unit; elongated boom means having one end pivoted to the upper end of said mast; means for rotating said mast and said boom means about a vertical axis to enable said boom means to be selectively disposed in a working position extending to the side of said unit and a traveling position aligned with the longitudinal axis of said unit; carriage means suspending an article handling device and being movable longitudinally along said boom means; support means pivoted to the other end of said boom means and adapted for pivotal rotation between a supporting position at right angles to said boom means where the lower end of said support means rests on the ground and provides vertical support, and a traveling position substantially parallel to and above said boom means; and selectively operable motor means for rotating said support means between said supporting position and said traveling position.

6. The apparatus of claim 5 further including means for tilting said boom means to various angles of inclination with respect to horizontal.

7. The apparatus of claim 5 wherein said selectively operable means includes a hydraulic rotator fixed to said boom means and coupled to said support means.

8. The apparatus of claim 5 wherein said carriage means comprises an upper carriage and a lower carriage, said upper carriage being suspended underneath said boom means and said lower carriage being suspended underneath said upper carriage.

9. The apparatus of claim 8 further including first motor means for moving said carriage means longitudinally along said boom means, and lower motor means for moving said second carriage transversely of said upper carriage and said boom means.

10. The apparatus of claim 9 wherein said first motor means includes a hydraulic cylinder having one end coupled to said carriage means and its other end coupled adjacent to said one end of said boom means, and said second motor means includes a hydraulic cylinder having one end coupled to said lower carriage and its other end coupled to said upper carriage.

11. The apparatus of claim 8 further including first roller and track means for suspending said upper carriage underneath said boom means, and second roller and track means for suspending said lower carriage underneath said upper carriage.

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