July 19, 1966 P. D. GERNHARDT ETAL 3,261,476

VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

Filed Jan. 6, 1965 5 Sheets-Sheet 1

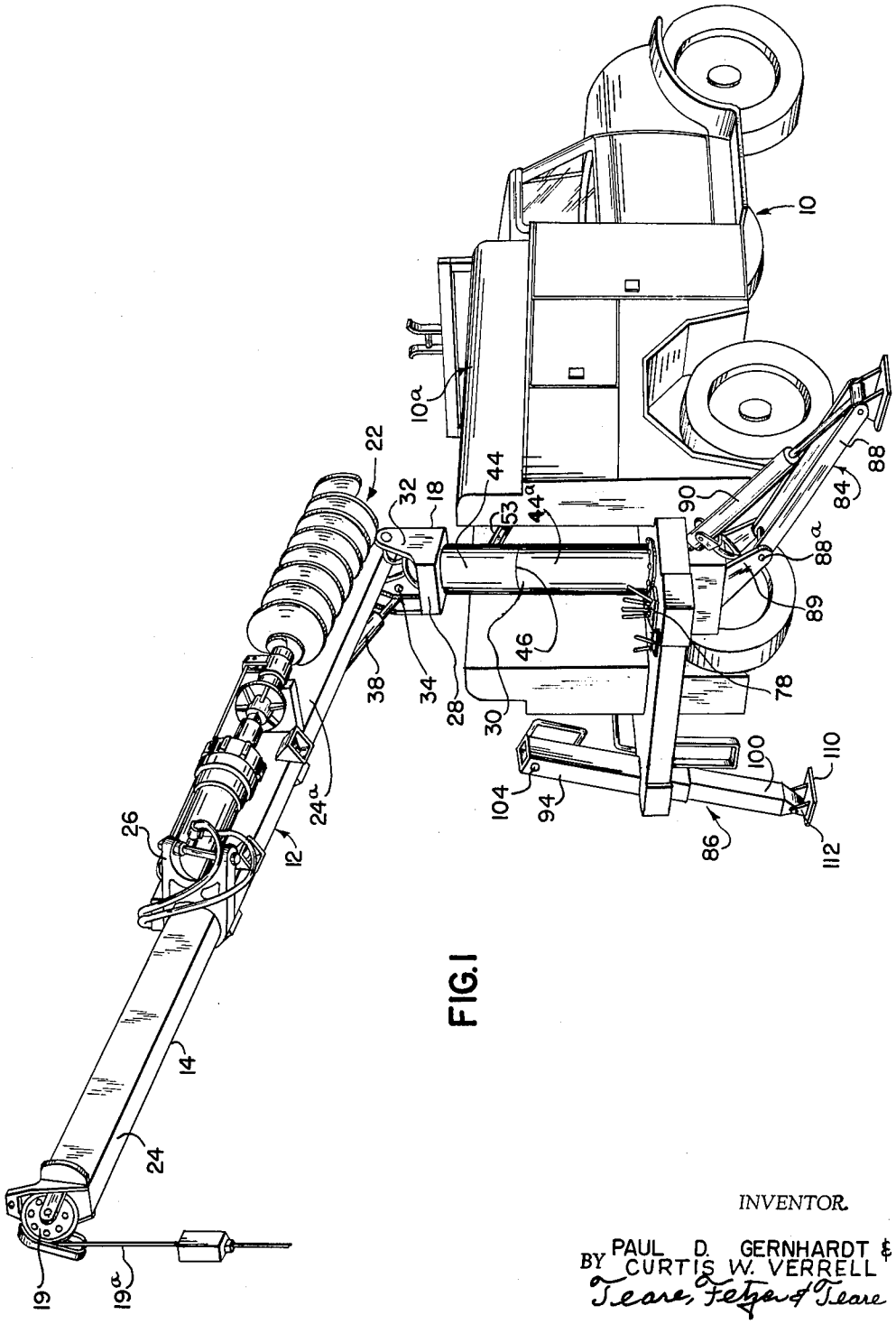

FIG. 1

INVENTOR.

BY PAUL D. GERNHARDT &
CURTIS W. VERRELL
Teare, Teare & Teare

ATTORNEYS

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VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

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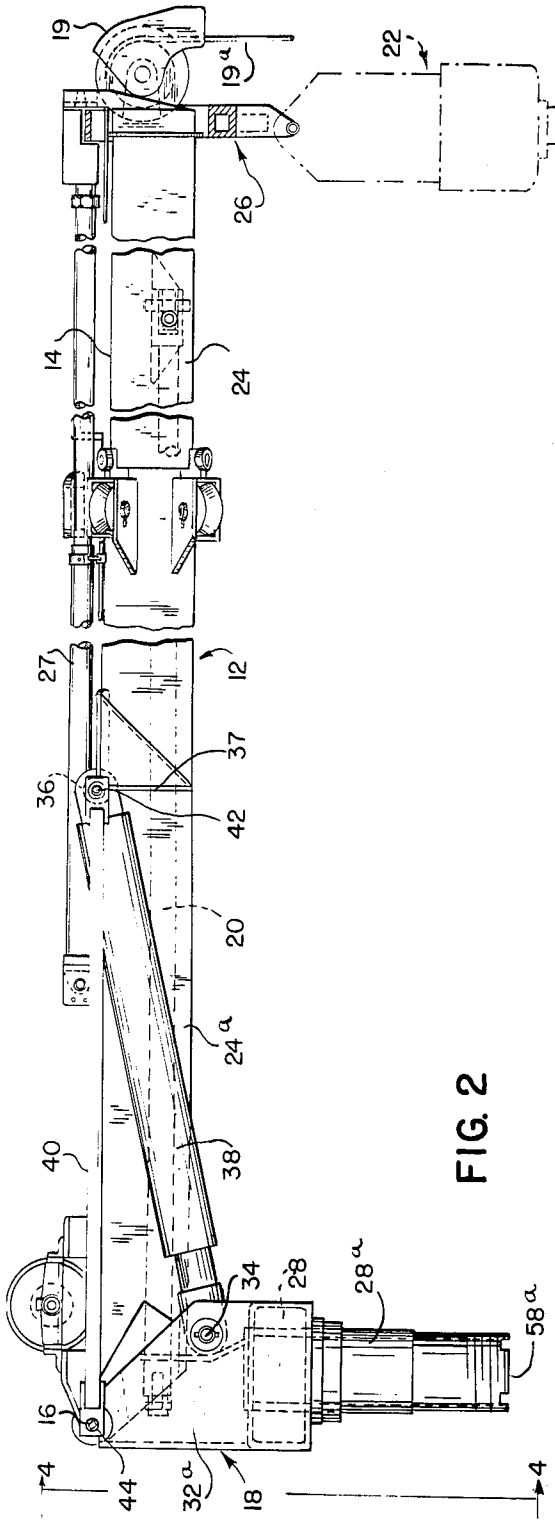

FIG. 2

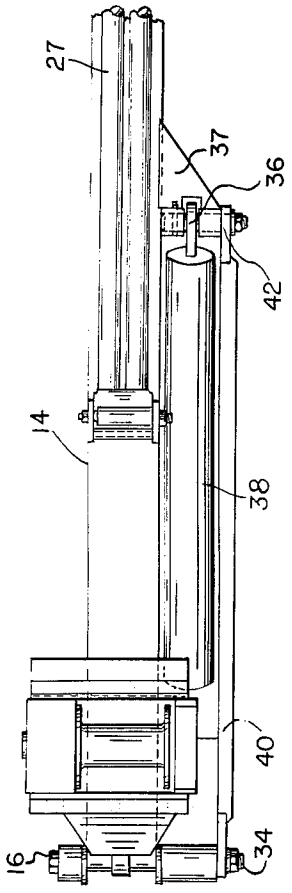

FIG. 3

INVENTOR.

BY PAUL D. GERNHARDT &
CURTIS W. VERRELL
Teare, Fetgen & Teare

ATTORNEYS

July 19, 1966 P. D. GERNHARDT ETAL 3,261,476

VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

Filed Jan. 6, 1965 5 Sheets-Sheet 3

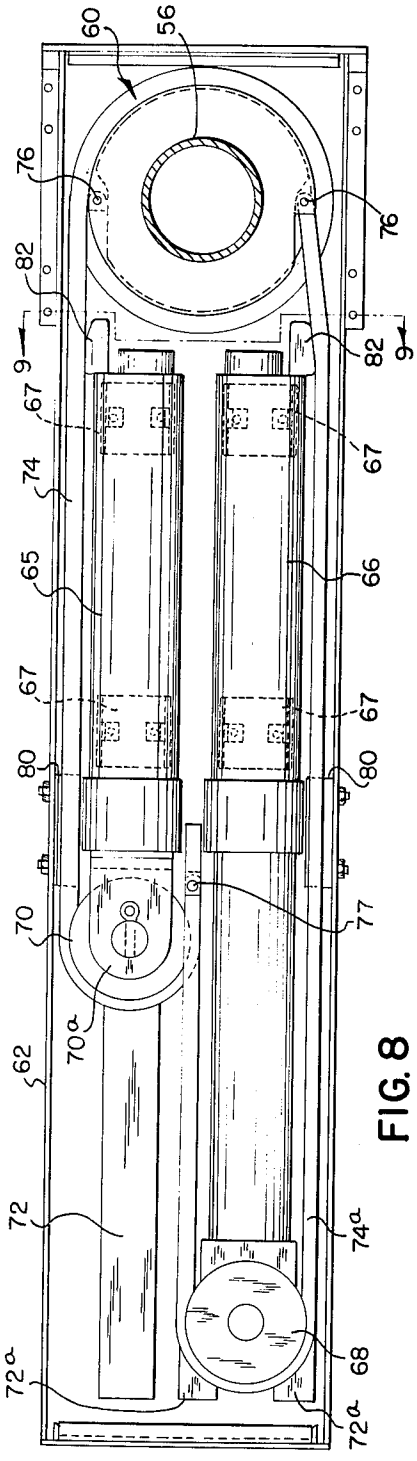

FIG. 8

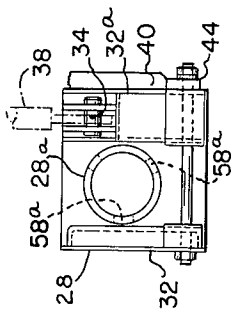

FIG. 5

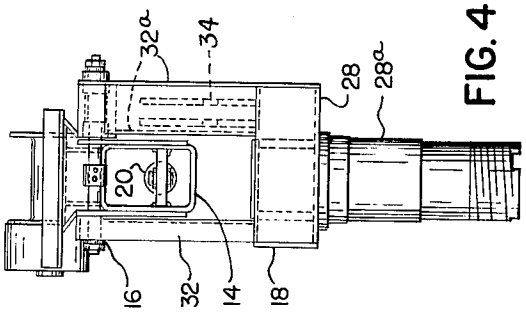

FIG. 4

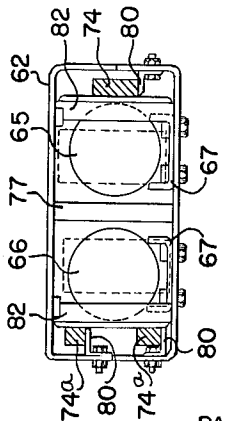

FIG. 9

INVENTOR.

PAUL D. GERNHARDT &
BY CURTIS W. VERRELL

Teare, Teare & Teare

ATTORNEYS

July 19, 1966 P. D. GERNHARDT ETAL 3,261,476

VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

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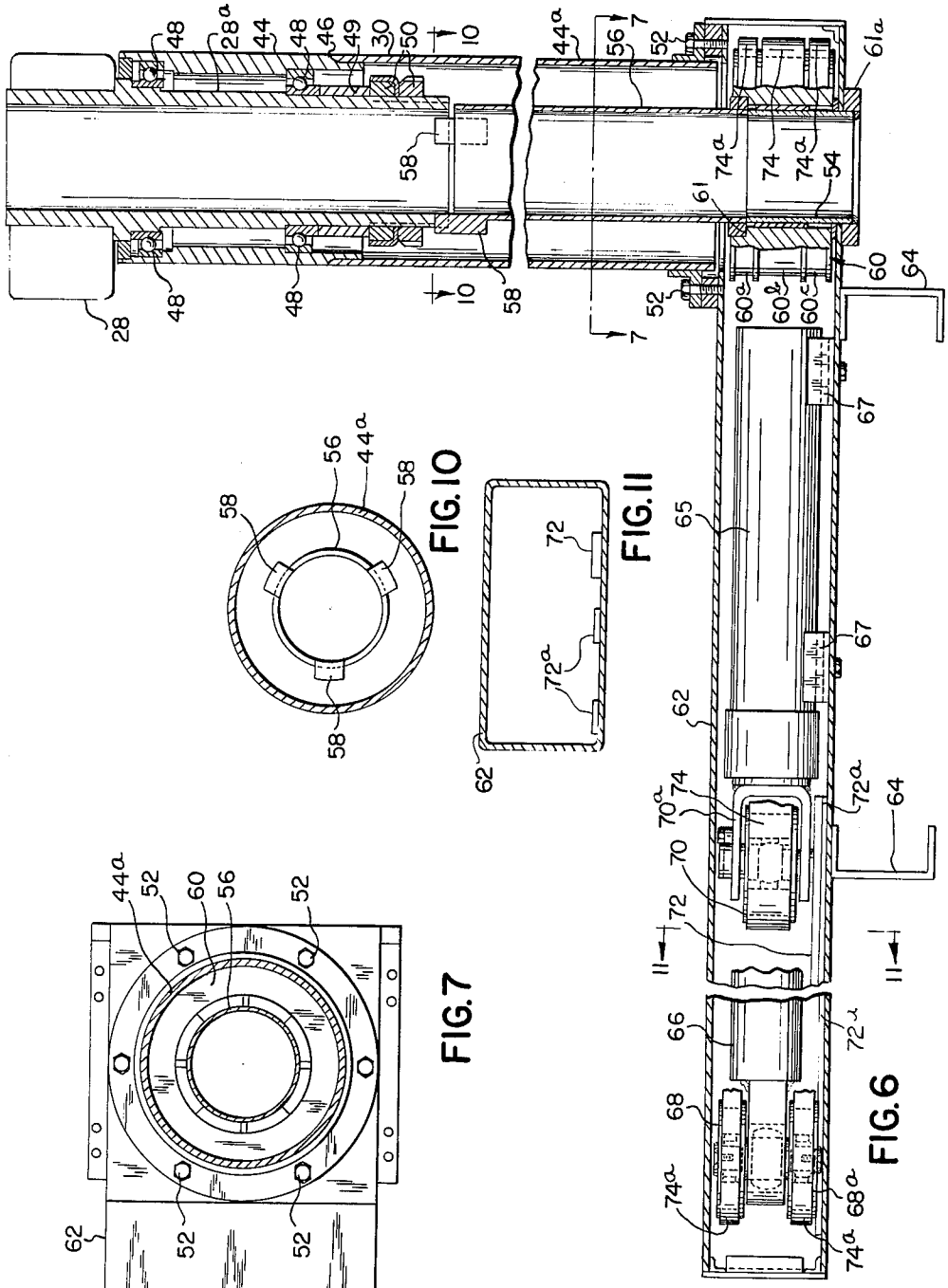

FIG. 10

FIG. 11

FIG. 7

FIG. 6

INVENTOR.

BY PAUL D. GERNHARDT &
CURTIS W. VERRELL
Teare, Teford & Teare
ATTORNEYS

July 19, 1966 P. D. GERNHARDT ETAL 3,261,476

VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

Filed Jan. 6, 1965 5 Sheets-Sheet 5

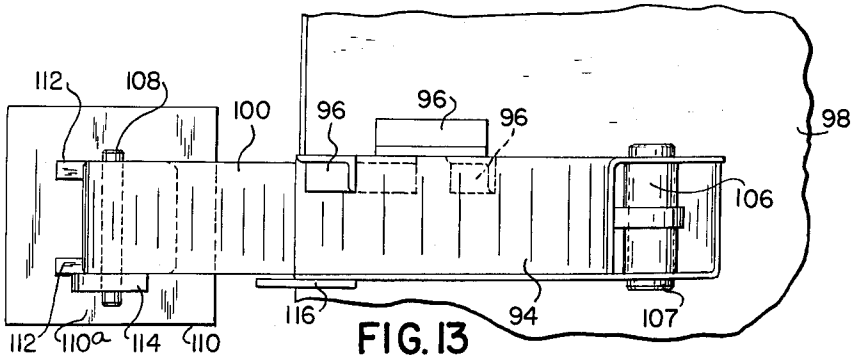

FIG. 13

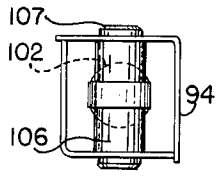

FIG. 15

FIG. 12

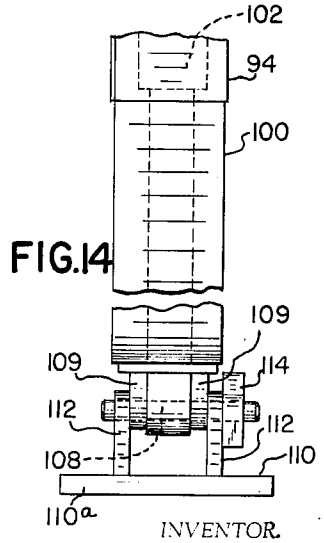

FIG. 14

INVENTOR.

BY PAUL D. GERNHARDT &
CURTIS W. VERRELL
Teare, Fetzer & Teare
ATTORNEYS

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Patented July 19, 1966

3,261,476
VERTICALLY SWINGING BOOM HAVING ASYMMETRICAL ACTUATION

Paul D. Gernhardt, Overland Park, Kans., and Curtis W. Verrell, Fairview Park, Ohio, assignors to The Ohio Brass Company, Mansfield, Ohio, a corporation of Ohio

Filed Jan. 6, 1965, Ser. No. 423,808
8 Claims. (Cl. 212—35)

This invention relates in general to derricks, and more particularly to derrick structure which provides for rotation of the derrick in a generally horizontal plane about a generally vertical axis, and also provides for pivoting of the derrick in a generally vertical plane.

An example of the environmental use of the derrick of the invention is the utility truck field wherein the derrick may be mounted on a vehicle, and which derrick may be adapted for handling and erecting various objects, such as for instance telephone or telegraph poles. The derrick may also be used to support and operate an earth boring auger, as well as its usual function of lifting. Such derrick being as aforementioned rotatable in generally horizontal plane about a generally vertical axis, and being pivotal in a generally vertical plane about a generally horizontally disposed axis, provides for convenient positioning of the derrick with respect to the vehicle, without necessitating continuous repositioning of the vehicle.

The present invention provides a novel structural arrangement for providing for the pivotal movement of the derrick boom in a generally vertical plane and about a generally horizontal axis, and for the swinging movement of the derrick boom in a generally horizontal plane about a generally vertical axis. The invention also provides a novel arrangement of powered jack mechanism for the vehicle, for stabilizing the vehicle chassis during operation of the derrick.

Accordingly, an object of the invention is to provide a novel arrangement of derrick.

Another object of the invention is to provide a novel arrangement of derrick having a vertically swingable boom as well as a boom that is rotatable about a generally vertical axis, and embodying novel means for accomplishing such movement of the boom.

A still further object of the invention is to provide a novel arrangement of derrick of the above type which utilizes a single reciprocal motor unit for actuating the derrick in a generally vertical plane, and with such motor unit being so arranged as to be in non-interfering relation with a vehicle super structure on which the derrick is mounted.

A further object of the invention is to provide a derrick of the latter type which embodies a novel, relatively compact arrangement of reciprocal motor units for rotating the derrick in a generally horizontal plane, and through a range of approximately 360°.

Another object of the invention is to provide a novel extensible and retractable jack mechanism for stabilizing a vehicle on which a derrick is operatively mounted.

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 generally diagrammatic, perspective view of the derrick of the invention as mounted on a utility-type of vehicle, and illustrates an earth boring auger supported by the boom and disposed in storage position thereon;

FIG. 2 is an enlarged, broken side elevational view of the derrick boom showing the mechanism for causing swinging movement of the derrick in a generally vertical plane, and about a generally horizontal extending axis;

FIG. 3 is a fragmentary, top plan view of the rearward end portion of the FIG. 2 derrick;

FIG. 4 is a rear end, elevational view taken generally along the plane of line 4—4 of FIG. 2 looking in the direction of the arrows;

FIG. 5 is a top plan view of the rear end of the derrick structure of FIGS. 2 to 4 with the boom having been removed;

FIG. 6 is an enlarged, vertical sectional view showing the mechanism for rotating the derrick in a generally horizontal plane about a generally vertical axis;

FIG. 7 is a sectional plan view taken along the plane of line 7—7 of FIG. 6, looking in the direction of the arrows;

FIG. 8 is a sectional plan view of FIG. 6;

FIG. 9 is a sectional view taken generally along the plane of line 9—9 of FIG. 8 looking in the direction of the arrows;

FIG. 10 is a sectional view taken generally along the plane of line 10—10 of FIG. 6, looking in the direction of the arrows;

FIG. 11 is a sectional view taken generally along the plane of line 11—11 of FIG. 6, looking in the direction of the arrows;

FIG. 12 is a fragmentary, broken, elevational view of the novel stabilizer or jack mechanism for use with the derrick, to stabilize the mounting vehicle, and showing the mechanism in operative position;

FIG. 13 is a top plan view of the stabilizer mechanism shown in FIG. 12;

FIG. 14 is a fragmentary, elevational view taken generally along the plane of line 14—14 of FIG. 12 looking in the direction of the arrows; and

FIG. 15 is an end view taken generally along the plane of line 15—15 of FIG. 12, looking in the direction of the arrows.

Referring now again to the drawings, there is shown a wheeled utility vehicle **10** having a truck body including superstructure **10***a*, which carries a movable derrick **12** thereon. The derrick boom **14** which may be of the telescopic or extensible type, may be pivotally mounted as at **16** (FIG. 2) on a frame **18** for swinging movement in a generally vertical plane and about the generally horizontally extending axis **16**.

The derrick boom may mount a sheave assembly **19** at its outer end, adapted for coaction with a cable **19***a*, for handling a load. Suitable means may be provided for selective retraction and extension of the boom, such means being, for instance, a reciprocal fluid powered motor unit **20** mounted interiorly of the boom.

An earth boring mechanism **22** may be supported on the boom and may be selectively coupleable to either the outer extendible section **24** of the boom or to the inner section **24***a* of the boom. The arrangement for so accomplishing the latter may comprise a collar-like tool supporting member **26** mounted on the extendible section of the boom, and which is adapted for pivotal connection to the earth boring tool. The supporting member is preferably of the type which is rotatable with respect to the boom in a direction transversely thereof so that the supporting member **26** and associated earth boring tool can be disposed beneath the boom for digging operations, or laterally to a side of the boom for storage. Fluid transmitting lines **27** may be provided on the boom for carrying actuating fluid to and from the fluid motor driven earth borer.

The aforementioned framework **18** for supporting the boom may comprise a fabricated, box-like base portion **28** (FIGS. 1 and 4) offset laterally to one side thereof (FIG. 4) and attached to a depending tubular stem portion **28***a*. Tubular portion **28***a* is adapted to be received in a rotatable relation in a stationary, hollow pedestal **30**, in a manner to be hereinafter described. Side wall structure **32**, **32***a* projects upwardly from base portion **28** and

mounts the boom pivot **16** thereon, adjacent the upper portions thereof.

Pivoted as at **34** to side wall structure **32***a* of the frame **18** and pivoted at its other end, as at **36**, to bracket **37** projecting laterally from the boom, is a reciprocal double acting fluid powered motor unit **38**, which motor unit is adapted to pivot the boom in a generally vertical plane about the pivotal axis **16**. The motor unit **38** is mounted high on the frame **18** and avoids interference with any of the body superstructure **10***a* of the vehicle, thus enabling the derrick to be conveniently mounted on most existing designs of vehicle bodies, without necessitating reconstruction or redesigning of such body.

In accordance with the invention, to aid in preventing twisting of the boom due to the offset relation of motor unit **38**, there is provided a rod or bar **40** (FIGS. 2 and 3) which may be pivotally attached as at **42** to the boom bracket **37** and pivotally attached as at **44** to the frame **18** at pivot **16**, outwardly of motor unit **38**. This bar structure is disposed in relatively close proximity to the boom and to the boom actuating motor unit **38**, and thus does not interfere with swinging or rotation of the boom about the generally vertical pedestal **30**.

As aforementioned, the generally hollow pedestal **30** is mounted upon the truck body, and preferably adjacent a corner thereof as shown in FIG. 1. Pedestal **30** preferably comprises two sections **44**, **44***a* subsequently joined, as by welds, along separation joint **46** (FIG. 6), after assembly of the derrick with section **44**. Bearings **48** may be provided for rotatably mounting the derrick stem **28***a*, and sleeve **49** and nuts **50** may be provided for locking stem **28***a* in place against axial movement with respect to pedestal **30**. Lower pedestal section **44***a* is adapted, at its upper end, to mount upper section **44** thereon in partially telescoped relation, as shown, and at its lower end is adapted for attachment as by means of bolts **52**, to the horizontal base frame of the vehicle. Pedestal section **44** may be provided with a strut **53** (FIG. 1) for strengthening the pedestal.

Rotatably mounted in lower pedestal section **44***a* and as by means of bearing structure **54**, is a lower stem assembly **56** coupled to upper stem **28***a* as by means of lugs **58** (FIGS. 6 and 10) on the upper end of stem **56** and received in slots **58***a* (FIG. 2) adjacent the bottom extremity of stem **28***a*. Lower stem **56** is provided with drum **60** detachably connected thereto as at **61** and thus rotatable therewith about a generally vertical axis, and about bearing structure **54**. Bearing structure **54** may be detachably connected to the vehicle base frame by ring **61***a* (FIG. 6). Drum **60** may be provided with three sections, **60***a*, **60***b* and **60***c* for a purpose to be hereinafter described.

Projecting outwardly or laterally from the stationary mast **30** is a housing **62** which can be formed as an integral part of the rear end of the truck, or which may be attached to existing trucks by extending support structure **64** on the vehicle chassis. The housing **62** embodies therein a pair of reciprocal, preferably single acting fluid powered motor units **65**, **66** which may secured as at **67** to the housing floor. One (**66**) of the motor units comprises a pair of vertically disposed pulleys **68**, **68***a* rotatably mounted adjacent the outer end of the associated piston rod, while the other motor unit (**65**) comprises a single rotatable pulley **70**, mounted as by means of U-shaped bracket structure **70***a* on the outer end of its associated piston rod. Wear strips or slides **72**, **72***a* are disposed beneath the respective pulleys for facilitating reciproal movement of the motor units **65**, **66**. Chain or flexible means **74**, **74***a* are looped about the respective pulleys **68**, **68***a* and **70**, and extend lengthwise of housing **62** to be looped about the respective drum section **60***a*, **60***b* and **60***c*, and are attached thereto as at **76** (FIG. 8). The other end of each chain **74**, **74***a* is attached as at **77** to the housing **62**. It will be seen therefore that extension of one of the motor units **65** or **66** causes retraction of the other, as controlled by suitable valve mechanism (i.e. **78** (FIG. 1)) on the vehicle, and will cause rotation of drum **60** and thus rotation of tubular mast or stem structure **56**, **28***a* about a generally vertical axis, and thus rotation of the derrick boom in a generally horizontal plane. Guides or supports **80** may be provided on the housing **62** in conjunction with cam blocks **82** (FIG. 8) for supporting and guiding the drum actuating chains **74**, **74***a*. The generally loose lug and slot connection between stem sections **28***a* and **56**, and between the latter and drum **60**, provides for flexure of pedestal **30** with respect to housing **62** without structural failure of the rotatable drum and stem construction.

An important aspect of the present structural arrangement is that the pedestal and the actuating means, therefore, can be mounted as a unit on a vehicle chassis, and on existing vehicles with minimum reconstruction of the vehicle. It will be seen that reciprocal movement of the motor units will cause a full 360° rotation of the stem members **56**, **28***a*, and thus rotation of the derrick through a full 360°, and with a relatively small stroke for the motor units. It will also be noted that stem sections **54**, **56** and **28***a* provide a hollow passageway open at both ends for convenient extension therethrough of fluid transmission lines for carrying pressurized fluid to and from the fluid motor of the earth borer, or for passage therethrough of a winch cable which may extend along the boom and be adapted for winding coaction with a conventional winch mechanism mounted on the vehicle body.

In order to stabilize the vehicle on which the derrick is mounted and maintain the vehicle chassis level during operation of the derrick, there may be provided stabilizing mechanisms **84**, **86** extending generally laterally from the vehicle. One (**84**) of the stabilizing mechanisms may be of the more or less well known pivotal jack type, including an arm **88** pivoted as at **88***a* to a bracket **89** depending from the underside of the vehicle, and having a pivotally mounted motor unit **90** connected to the arm, for swinging the arm down to an operative position as shown in FIG. 1, and upwardly to an inoperative position for storage purposes.

The other (**86**) stabilizing mechanism illustrated, in accordance with the invention, comprises an upper tubular-like member **94** which is preferably of polygonal configuration in cross-section, and which may be rigidly mounted in generally diagonal or oblique relation on the vehicle chassis and, as by means of brackets **96**, attached to the horizontal base frame **98** of the body. A lower member **100** is disposed in telescoping relation with respect to the upper member. A reciprocal double acting, preferably fluid powered motor unit **102** may be disposed interiorly of the members, and is pivotally connected as at **104** to the upper member, and as by means of sleeve **106** and transverse pin **107**, and pivotally connected as at **108** to the lugs **109** on lower member.

The lower member is provided with a pivoted foot **110** thereon, which is adapted to engage the ground with the flat base portion **110***a* and support the vehicle. Foot **110** has lugs **112** projecting upwardly therefrom for attaching the foot to the pivot **108**, and a cam **114** may be secured to one of the lugs in laterally oriented relation to member **100**. A cam actuator **116** may be fixed to the upper member and project downwardly therefrom so as to automatically move the foot **110** about its axis and to a position where it is substantially within the confines of the vehicle chassis upon predetermined retraction of the motor unit **102**. It will be seen therefore that upon sufficient actuation of the motor unit **102** so as to move the lower member **100** telescopically within the upper member **94**, the cam actuator **116** engages the cam **114**, and swings the foot inwardly into the position illustrated in dot-dash lines in FIG. 12. The flat portion **118** on the cam coacting with the finger-like actuator, locks the foot in inwardly swung position in the retracted condition of the motor unit **102**. The upper end of lower member **100**

may be cut away or recessed as at **120** (FIG. 12) in the generally L-shaped configuration illustrated, to provide for clearance of member **100** with respect to upper pivot **107** in the retracted position of the stabilizer, while maintaining a maximum overlap for the lower member in its extended operative position. Stabilizer **86** may be generally encompassed with plate structure, as shown in FIG. 1, to even off the rear end of the vehicle. The arrangement is extremely compact and provides good stabilizing characteristics to the vehicle.

From the foregoing discussion and accompanying drawings it will be seen that the invention provides a novel derrick for mounting on a mobile vehicle, and one which embodies a novel arrangement for swinging the derrick in a generally vertical plane and about a generally horizontal axis, as well as novel means for swinging the derrick in a generally horizontal plane about a generally vertical axis. The invention also provides a novel arrangement for stabilizing the vehicle when the derrick is mounted thereon.

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, or described, or portions thereof, and it is recognized that various modifications are possible within the scope of the invention claimed.

We claim:

1. In a derrick comprising a support, a boom pivotally mounted on the support, a reciprocal motor unit extending between the support and boom for swinging the boom in a generally vertical plane, said motor unit being offset laterally from the lengthwise axis of the boom, and means extending between the boom and the support for resisting offset loading applied by the motor unit to the pivotal connection of said boom to said support.

2. A derrick in accordance with claim **1** wherein said means comprises a rod disposed laterally outwardly of said motor unit.

3. A derrick in accordance with claim **2** wherein said rod is pivoted at one end to said boom at the pivotal connection of said motor unit to said boom, and at its other end is pivoted to said support in alignment with the pivotal connection of the boom to said support.

4. A derrick in accordance with claim **2** wherein said support comprises a superstructure frame including a stem depending therefrom, a generally rigid pedestal, said pedestal being generally hollow and receiving said stem therein in rotatable relation.

5. A derrick in accordance with claim **4** including another stem rotatably mounted in said pedestal below the first mentioned stem, means detachably coupling said stems together for rotation as a unit about a generally vertical axis, and powered means operably coupled to said other stem for rotating the latter.

6. A derrick in accordance with claim **5** wherein said pedestal is of sectional configuration, means detachably connecting said first mentioned stem to said pedestal for preventing axial movement of said first mentioned stem with respect to said pedestal while permitting rotational movement of said first mentioned stem with respect to the pedestal, and means holding the pedestal sections together as a unit.

7. A derrick in accordance with claim **5** wherein said powered means comprises a pair of reciprocal fluid powered motor units mounted generally horizontally adjacent said pedestal, and flexible means operably connected to said motor units and to said other stem for rotating the latter upon actuation of said motor units.

8. A derrick in accordance with claim **7** wherein said motor units are mounted in a housing, said other stem extending into said housing, and means in said housing for guiding said flexible means during actuation of said motor units.

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EVON C. BLUNK, *Primary Examiner.*

HUGO O. SCHULZ, *Examiner.*

A. LEVINE, *Assistant Examiner.*