June 29, 1965 W. C. UPDEGRAVE 3,191,780

BOOM ROTATING MECHANISM

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Fig. 1.

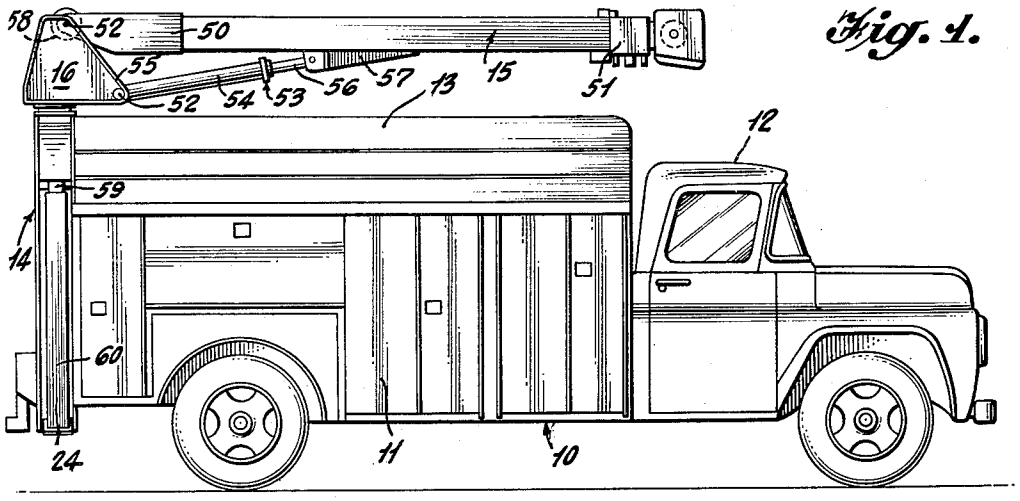
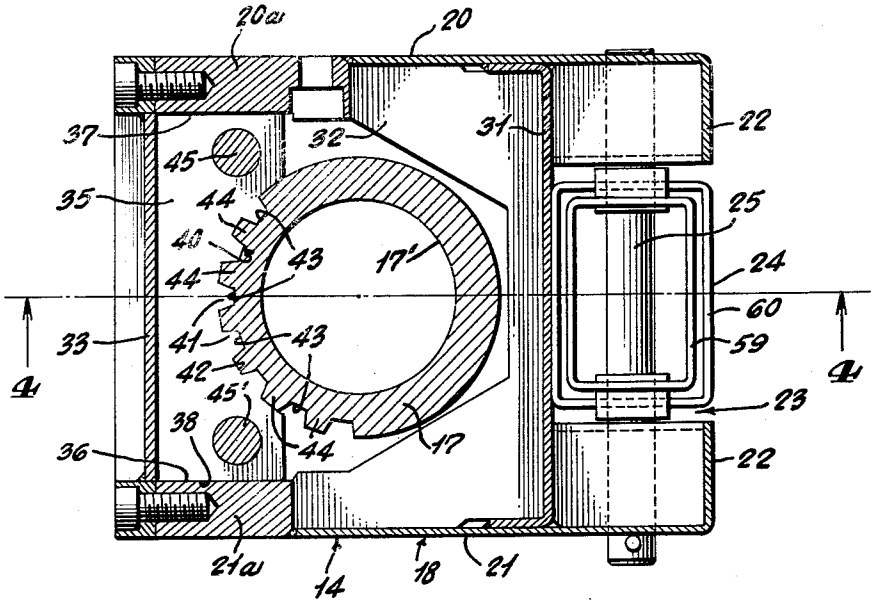


Fig. 3.



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Fig. 4.

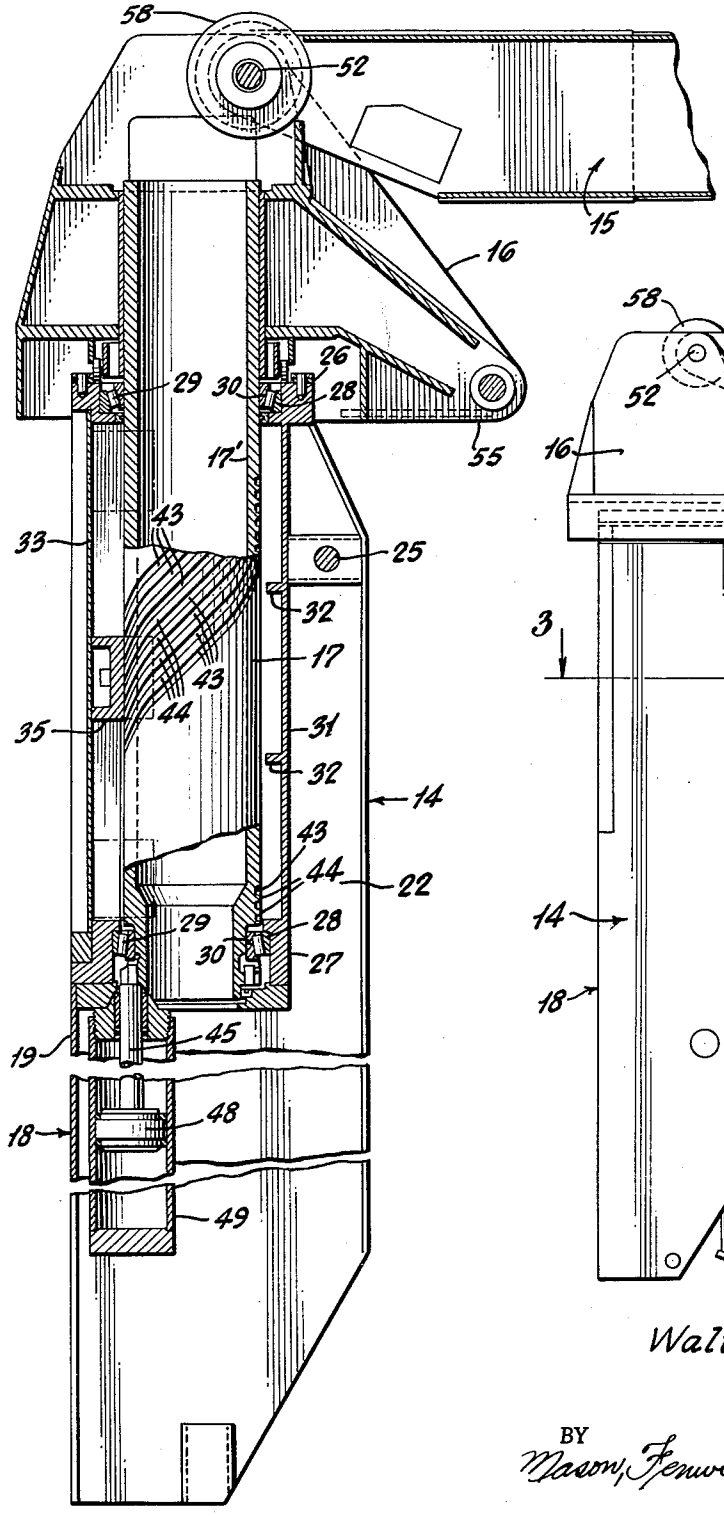
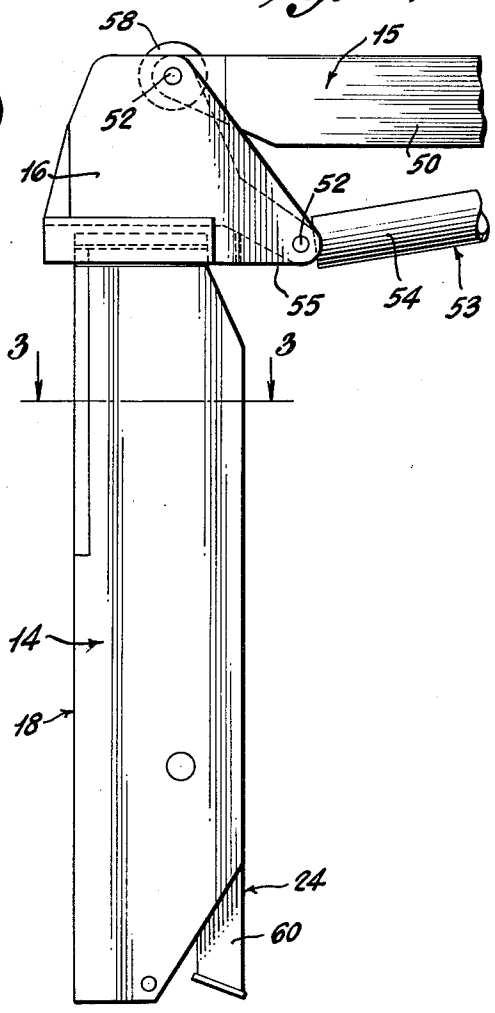


Fig. 2.



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BOOM ROTATING MECHANISM

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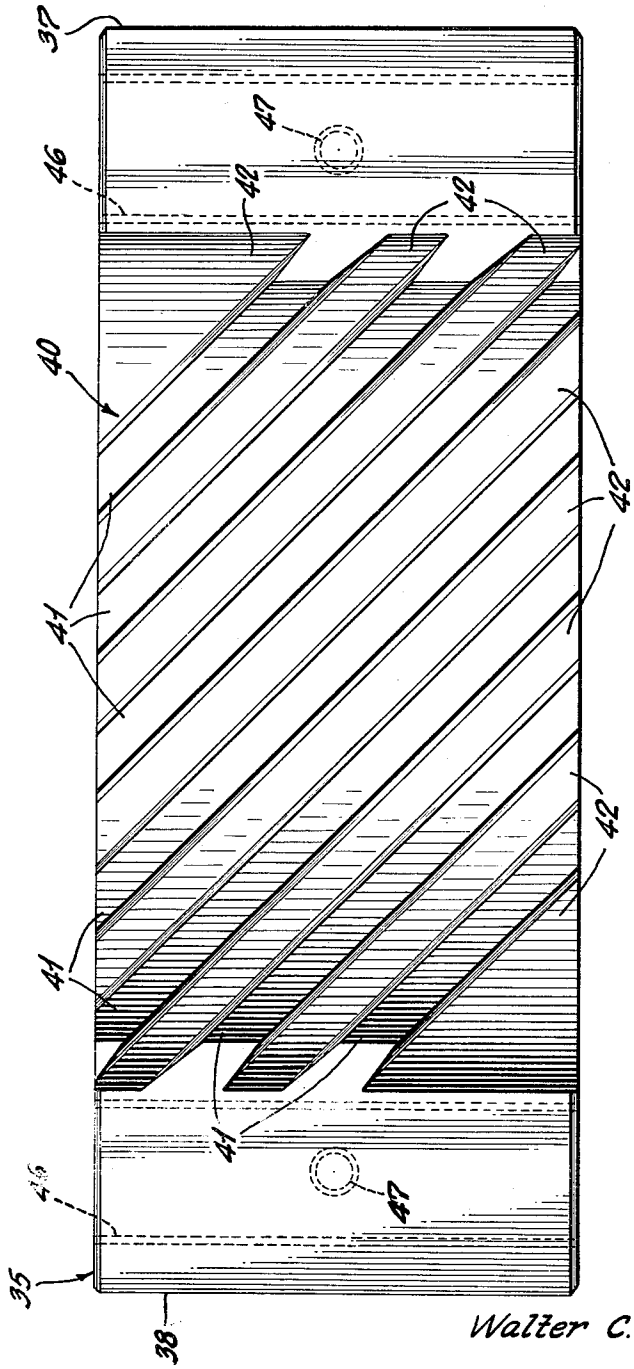


Fig. 5.

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BOOM ROTATING MECHANISM

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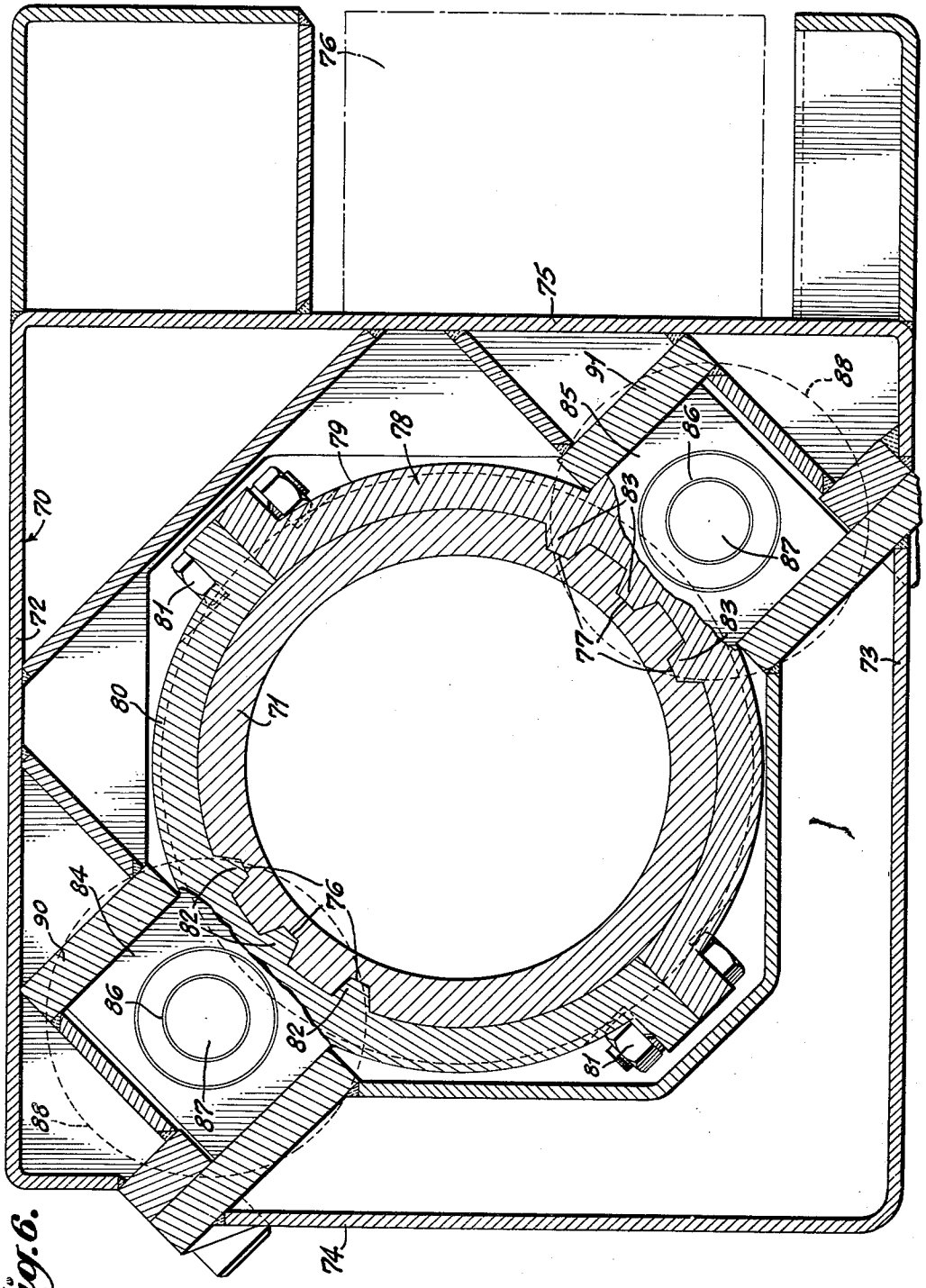


Fig. 6.

United States Patent Office 3,191,780 Patented June 29, 1965

3,191,780

BOOM ROTATING MECHANISM

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Filed Aug. 30, 1963, Ser. No. 305,710
8 Claims. (Cl. 212—66)

The present invention relates in general to a boom drive mechanism for boom pedestals, and more particularly to a mechanism for effecting rotation of a boom arm in azimuth about a boom pedestal mounted on a utility vehicle, wherein the swinging of the boom arm about the pedestal is achieved by rectilinear reciprocation of a hydraulic jack.

Service and maintenance trucks employed by public utilities and similar companies are ordinarily provided with some type of boom arm pivotally supported on a mounting structure, such as a boom pedestal, for raising and lowering movement about horizontal and vertical axes. The boom arm is often used as a derrick for lifting equipment up and down, setting poles, removing worn out or defective poles and replacing them, and similar types of work. The boom arm may also carry a ground auger for drilling the pole holes. Alternately, such utility truck boom structures may have aerial platforms on the outer end thereof to support a worker at elevated positions. Such aerial tower structures are particularly useful in servicing overhead traffic lights, street lamps, elevated illuminated signs and similar objects.

The rotating drive system commonly employed for driving pivoted booms about a vertical boom pedestal have usually employed one of three basic types of drive mechanisms: a cylinder driving a chain which passes about a sprocket keyed to a pivot tube to which the boom arm is connected, a cylinder driving a cable attached to an anchor point on the frame and to a drum on the pivot tube and passing around suitable sheaving, or compound gear trains of various sorts.

The basic problem of each of these design approaches is to effect a large impedance change, since the boom is required to rotate at relatively low speed at a given horsepower rating and the power to accomplish the boom rotation is usually obtained at a power take off from the truck transmission where it is converted from mechanical form to hydraulic form by a pump rotating at a very high r.p.m. The energy in hydraulic form derived from the pump is conducted to whatever rotational drive motor may be employed. Somewhere between the power take off and the boom pivot tube, an impedance change of a given horsepower at high rotational speed to a given horsepower at low rotational speed must be effected. This can be done either hydraulically or mechanically or in a combination of the two systems.

The conventional types of hydraulic impedance changing devices take the form of a small area piston in a cylinder displacing fluid to a large area piston in a cylinder or a small displacement rotary pump supplying fluid to a large displacement rotary motor, or a small displacement rotary pump supplying fluid to a large displacement linear motor. If linear motors such as hydraulic cylinders are used, some means of converting linear rotary motion is also required.

If a combination gear train employing a worm gear set is used as the impedance changing and motion converting system, generally very little impedance change is effected in the hydraulic portions of the system, i.e. the rotary motor runs at about the same speed as the pump and the balance of the impedance change is taken up in the gear sets. With such a construction, a high overall gear ratio is required so that the worm set may be made self-locking to keep the boom in the position where it has been set, as for example, when using a post hole digging auger attached to the boom. Such a system has the disadvantage, however, that if the boom pivot axis is appreciably inclined from the vertical, as is often the case when the truck is parked on the shoulder of a road, as the boom passes top dead center position and is trying to drive the gear, a jerky rotation develops as the gear alternately locks from the boom torque and unlocks when the motor pressure builds up to drive the worm free into the gear backlash space. This oscillation continues until the boom has reached the low point in its path and the motor is again driving uphill.

Drive systems which employ linear motors or cylinders, if they work through an efficient linear to rotary motion converting device, do not have this jerking problem, but, those that employ some sort of flexible element such as a chain or cable, for motion conversion, have no fail-safe feature and are not desirable from a safety standpoint even though they may employ pilot-operated check valves to block cylinder motion. The flexible member is generally a weak link and is the connection between the boom pivot tube and the locked cylinder and a failure here could prove disastrous.

An object of the present invention is the provision of a novel power-operated vehicle-mounted pivoted boom wherein impedance change from the power take off of the vehicle to the boom drive motor is predominately made hydraulically and wherein very rugged motion conversion from a linear hydraulic motor is provided.

Another object of the present invention is the provision of a novel boom rotating mechanism of the type described in the preceding paragraph, wherein the system is fail-safe so long as the cylinder and lines are not worked beyond their burst pressure.

Another object of the present invention is the provision of a novel boom rotating mechanism wherein a boom is swung in azimuth about a vertical boom pedestal by means of a hydraulic jack unit having a drive block or blocks surrounding a boom pedestal or pivot tube journalled for rotation about a vertical axis and wherein a helical gear connection is provided between the adjacent surfaces of the drive block or blocks and the boom pedestal to effect the desired motion conversion.

A further object of the present invention is the provision of a rotation mechanism for swinging a pivoted boom in azimuth wherein a hollow or tubular pivot member supporting the boom is arranged so that a number of hydraulic fluid lines and a winch line may be routed therethrough in order to activate or supply fluid to devices which may be mounted on the boom or actuate other functions associated with the boom.

Other objects, advantages and capabilities of the present invention will become apparent from the following detail description, taken in conjunction with the accompanying drawings showing two embodiments of the invention.

In the drawings:

FIGURE 1 is a side elevation of a typical type of utility maintenance truck equipped with a portable boom serving as a derrick constructed in accordance with a first embodiment of the present invention;

FIGURE 2 is an enlarged elevation of the boom supporting and driving mechanism, viewed from a position to the left of FIGURE 1, with the boom head rotated 90° from the position shown in FIGURE 1.

FIGURE 3 is a horizontal transverse section view taken through the boom pedestal along the line 3—3 of FIGURE 2;

FIGURE 4 is a vertical longitudinal transverse section view taken along the line 4—4 of FIGURE 3, with one of the hydraulic cylinders for the drive block broken away;

FIGURE 5 is an elevation view of the working face of the drive block; and

FIGURE 6 is a horizontal transverse section view of a modified form of boom drive mechanism embodying the present invention, taken from a position corresponding to the section view of FIGURE 3.

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures and particularly to the embodiment shown in FIGURES 1–5, the invention is shown for illustrative purposes as applied to a utility maintenance truck **10** equipped with a utility body **11** of conventional configuration including a driver's cab **12** and the usual rearwardly extending side walls **13** disposed in spaced parallel relation and having, for example, a series of built-in cabinets incorporated therein for the storage of tools, small parts, and similar items. The side walls **13** may be spaced laterally from each other and with the rear wall of the cab or a front built-in cabinet wall disposed just rearwardly of the cab, define a cargo space which is open at the top and rear. In the example herein illustrated, the truck body carries a vertical mast or pedestal **14** forming part of the boom drive assembly of the present invention at the rear end of one of the side walls **13**, it being understood that the boom pedestal **14** may be located at other parts of the truck body if desired.

The boom pedestal **14** supports a boom **15** for swinging movement about the pedestal **14** as an axis, the boom being pivotally connected to a boom head **16** for angular movement of the boom about a horizontal axis. The boom head **16** is mounted on a pivot tube **17** supported for rotation about a vertical axis in pedestal **14**.

The pedestal **14**, in the example herein shown, is of generally rectangular cross-sectional configuration and includes a casing **18** defining an inner side wall **19**, front and rear end walls **20**, **21** and parallel flange members **22** at the outer side opposite the side wall **19**. The flange members **22** are spaced from each other in flanking relation to a vertically elongated, outwardly opening well **23** for receiving a telescoping outrigger brace **24** pivotally mounted between the flange members **22** as by pivot pin **25**. In one practical form of construction, the pedestal **14** has an upper bearing ring **26** and a lower bearing ring **27** for the pivot tube **17**, each of which is shaped to support an outer roller bearing race member **28**, coacting with roller bearings **29** and inner bearing race members **30** to journal the pivot tube for rotation about a vertical axis. An internal vertical partition **31** paralleling the side wall **19** extends between and connects the bearing rings **26**, **27** to provide a closed chamber for the pivot tube **17**, which partition may be stiffened by spaced reinforcing plates **32** welded thereto. The corresponding portion of side wall **19**, in this example, is preferably provided with a removable cover plate **33**, by which access can be conveniently gained to the chamber occupied by the pivot tube **17**.

In the embodiment shown in FIGURES 1–5, the driving force for rotating the pivot tube **17** and boom **15** about the vertical axis of the pivot tube **17** is applied to the pivot tube by a vertically sliding drive block **35** movable in a slideway **36** provided between the pivot tube **17** and the cover plate **33**. The drive block **35** is of a width to provide a close sliding fit between its opposite sides **37**, **38**, and the thickened guide wall portions **20***a*, **21***a* of the end walls **20**, **21** of pedestal **14**. The middle portion of the drive block surface facing the pivot tube **17** is formed with a concave recess **40** adjacent the external surface of pivot tube **17**, the surface of the concave recess **40** being milled to provide drive teeth **41** and grooves **42** therebetween extending along a selected helical segment path and mating with helical grooves **43** and intervening teeth **44** on the external surface of the pivot tube **17** to provide a driving connection therebetween. In one practical example, seven teeth **41** on the drive block **35** and seven grooves **43** on the pivot tube

are provided which extend along a helical path having a 45° helix angle.

The drive block **35** is driven along a rectiliniar path by a pair of parallel piston rods **45**, **45'** extending through tapped openings **46** therefor in the block **35** located in symmetrical flanking relation to the concave recess **40**, the piston rods being preferably locked therein by set screw **47**. The piston rods **45**, **45'** project to the zone within the pedestal **14** below the pivot tube **17** and terminate in a pair of pistons **48** located in the cylinders **49** of hydraulic cylinder units, one of which is shown in FIGURE 4, and controlled in the usual manner by control valves to regulate flow of hydraulic fluid from a suitable pump to the opposite end regions of the cylinders **49**. As the drive block **35** lies along only one side of the pivot tube **17** in this embodiment, the hydraulic cylinders **49** are offset to one side of the center of the pivot tube, leaving the space below the center portion of the pivot tube free for passage of derrick cables, hydraulic fluid lines, and the like vertically along the center portion of the pedestal **14**. The pivot tube **17** is preferably a hollow tube having the bore **17'** extending the length of the pivot tube to accommodate such cables and fluid lines in this region.

In the pole setting utility derrick application herein illustrated, the boom **15** may be of the telescopically extensible type having inner and outer telescoping boom sections **50**, **51**, respectively, the inner boom section **50** being pivoted to the boom head **16** by pivot pin **52** and being positioned vertically by a hydraulic cylinder unit **53** including a cylinder **54** pivotally coupled at one end to the anchor formation **55** of boom head **16** and having a piston rod **56** coupled to an anchor formation **57** on the inner boom section **50**. The cable pulley **58** at the pivoted end of the boom **15** may be supported on the pivot pin **52** with the pulley groove disposed substantially tangentially to the center axis of the pivot tube **17**, so that the cable portion below the pulley **58** can pass directly through the bore **17'** of the pivot tube **17** and alongside the cylinders **49**, **49'**. The boom **15** in accordance with conventional practice may have the usual derrick pulley at the outer end thereof together with suitable fittings for the post hole auger and other attachments customarily provided on utility derrick booms.

The outrigger brace **24** disposed in the well **23** between the flanges **22** of the pedestal is of conventional construction including the elongated pivoted leg **59** which is coupled to the pivot pin **25** near its upper end and a hydraulically extended foot **60** telescopically associated with the leg **59**, together with a connecting link extending laterally from a lower portion of the leg **59** to a pivoted coupling point on the pedestal **14**.

By the arrangement hereinabove described, an extremely simple boom supporting and driving mechanism is provided which will effectively and reliably impart the desired slow speed horizontal rotation to the boom head **16** and boom **15** and still facilitate achievement of most of the impedance change hydraulically. By simply regulating hydraulic fluid flow to the two chambers of the hydraulic cylinders **49**, **49'** on opposite sides of the pistons, the piston rods **45**, **45'** may be rectilinearly driven in the desired direction at the desired speed to so move the drive block **35** as to effect the selected rotation of pivot tube **17** and boom **15** relative to the vertical axis through the center of the pivot tube **17**. The provision of the helical drive teeth **41** in the concave recess **40** of the drive block **35** interfitting grooves **43** on the external surface of the pivot tube **17** produces a very rigid conversion device for translating the linear reciprocative movement of the piston rods associated with hydraulic cylinder units to rotary movement at the desired rate. The use of such a hydraulic control system provides a very simple means for effecting the necessary impedance change between the power take-off of the utility truck

from which the driving force is originally derived to the boom pivot tube.

A modified form of the present invention is illustrated in FIGURE 6 wherein the fundamental advantages of the first described embodiment are preserved while a more symmetrical variation of driving force to the boom pivot tube is achieved. In the modified version illustrated in FIGURE 6 the general configuration of the pedestal **70** will be the same as that of the pedestal **14**, with the boom pivot tube **71** being located in the upper region of the pedestal **70** substantially aligned with the center of the pedestal portion boxed in by the end walls **72, 73**, the side wall **74** and the partition **75** at the base of the outrigger well **76**. The pivot tube **71** is similar to the form described in the first embodiment, except that helical grooves **76, 77** are arranged in diametrically opposite portions of the external periphery of the pivot tube **71**. These helical grooves **76, 77** may be similar to the helical grooves **43** of the pivot tube **17** except that a lesser number of helical grooves may be provided on each side of the pivot tube, if desired, than would normally be employed where the single drive block **35** is used.

In this modified form, the pivot tube **71** is encircled by a drive ring **78** formed, in the illustrated example, of two semi-circular sections **79, 80** bolted together as indicated at **81** by suitable bolts and coupling flanges so as to form a strong ring concentric with the pivot tube **71**. The drive ring **78** has helical teeth segments **82, 83** thereon corresponding in number and location to the helical grooves **76, 77**, respectively, on the pivot tube **71** and mating with the latter. In two diametrically opposite zones of the drive ring **78**, for example, the zones occupied by the teeth **82, 83**, the ring is provided with radially outwardly extending guide formations **84, 85** having tapped openings **86** therein to receive and be fixed to a pair of piston rods **87** extending in parallelism with the axis of the pivot tube **71** and located in oppositely flanking relation to the pivot tube. The lower ends of the piston rods **87** terminate in conventional pistons disposed in hydraulic cylinders **88** which are controlled and operated in the usual manner to effect axial reciprocative movement of the piston rods **87**. The guide formations **84, 85** are restrained for movement in vertical reciprocative paths by fixed guide channels **90, 91** formed by welded plates mounted within the walls **72–75** forming the boxed housing portion of the pedestal **70**.

The operation of this modified construction is similar to that of the first described construction, except that the driving forces exerted on the pivot tube **71** are more symmetrically applied by virtue of the teeth **82, 83** located in the diametrically opposite regions of the pivot tube **71**.

While but two preferred examples of the present invention have been particularly shown and described, it is apparent that various modifications may be made therein within the spirit and scope of the invention, and it is desired, therefore, that only such limitations be placed on the invention as are imposed by the prior art and set forth in the appended claims.

In the claims:

1. A utility truck boom system and the like comprising a boom arm, a stationary boom pedestal, a pivot tube having a boom head fixed thereon, bearing means journaling said pivot tube in said boom pedestal for rotation about a selected axis, means connecting the boom arm to said boom head for movement with the latter about said axis, drive block means slidably supported immediately adjacent an exterior surface portion of said pivot tube, guide means for confining movement of said drive block to a rectilinear reciprocative path parallel to the axis of said pivot tube, said drive block means and the exterior pivot tube surface having interfitting helical teeth and grooves for converting rectilinear reciprocative motion of said drive block into rotary motion of said pivot tube about said axis of rotation for moving said boom arm about said axis of rotation, and power means for driving said drive block along said rectilinear reciprocative path.

2. A utility truck boom system and the like comprising a boom arm, a stationary boom pedestal, a pivot tube having a boom head fixed thereon, bearing means journaling said pivot tube in said boom pedestal for rotation about a selected axis, means connecting the boom arm to said boom head for movement with the latter about said axis, at least one hydraulic jack unit having a cylinder arranged parallel to the axis of rotation of said pivot tube and a reciprocative piston rod projecting therefrom along at least one side of said pivot tube, a drive block fixed to said piston rod of said hydraulic jack unit and disposed immediately adjacent an exterior surface portion of said pivot tube, guide means for said drive block guiding said drive block for movement in a rectilinear reciprocative path parallel to the axis of said pivot tube, and said drive block and the exterior pivot tube surface having interfitting helical teeth and grooves for converting rectilinear reciprocative motion of said drive block into rotary motion of said pivot tube about said vertical axis of rotation for moving said boom arm about said axis of rotation.

3. A utility truck boom system and the like comprising a boom arm, a stationary boom pedestal, a pivot tube having a boom head fixed thereon, bearing means journaling said pivot tube in said boom pedestal for rotation about a selected axis, means connecting the boom arm to said boom head for movement with the latter about said axis, a pair of hydraulic jack units disposed within said boom pedestal on opposite sides of the pivot tube each having a cylinder arranged parallel to the axis of rotation of said pivot tube and a reciprocative piston rod projecting therefrom along the opposite sides of said pivot tube, a drive ring fixed to said piston rods of said hydraulic jack units and disposed in encircling relation to the exterior surface of said pivot tube, guide means for said drive ring restraining said guide ring against rotation and guiding said drive ring for movement in a rectilinear reciprocative path parallel to the axis of said pivot tube, said drive ring and the exterior pivot tube surface having interfitting helical teeth and grooves for converting rectilinear reciprocative motion of said drive ring into rotary motion of said pivot tube about said vertical axis of rotation for moving said boom arm about said axis of rotation.

4. A pedestal for supporting a boom on a powered vehicle and the like comprising a boom pedestal, a pivot tube having a boom head fixed thereon and an unobstructed bore extending the full height thereof for passage of control lines therethrough, bearing means journaling said pivot tube in said boom pedestal for rotation about a selected axis, means for connecting a boom to said boom head for movement with the latter about said axis, a drive block slidably supported for movement immediately adjacent said pivot tube and having a concave surface portion embracing a portion of the circumference of the pivot tube, guide means for said drive block guiding said drive block for movement in a rectilinear reciprocative path parallel to the axis of said pivot tube, said concave surface portion of the drive block and the exterior pivot surface having interengaging means for converting rectilinear reciprocative motion of said drive block into rotary motion of said pivot tube about said axis of rotation for moving said pivot tube and boom in azimuth.

5. A pedestal for supporting a boom arm on a powered vehicle and the like comprising a boom pedestal, a pivot tube having a boom head fixed thereon, bearing means journaling said pivot tube in said boom pedestal for rotation about a selected axis, means for connecting a boom arm to said boom head for movement with the latter about said axis, at least one hydraulic jack unit disposed within said boom pedestal having a cylinder arranged parallel to the axis of rotation of said pivot tube below said pivot tube having a rectilinearly reciprocative piston

rod projecting therefrom along at least one side of said pivot tube, a drive block fixed to said piston rod and disposed immediately adjacent an exterior surface portion of said pivot tube, guide means for said drive block in said boom pedestal guiding said drive block for movement in a rectilinear reciprocative manner parallel to the axis of said pivot tube, said drive block and the exterior pivot tube surface having helical teeth and grooves for converting rectilinear reciprocative motion of said drive block into rotary motion of said pivot tube about said axis of rotation for moving said pivot tube and boom arm about said axis.

6. A pedestal for supporting a boom arm on a powered vehicle and the like comprising a boom pedestal, a pivot tube member including a vertically elongated tubular shaft having a boom head fixed to the upper end thereof and a central bore extending the full height thereof for passage of control cables and the like therethrough, means for pivotally connecting the boom arm to said boom head for angular movement about a horizontal axis, bearing means at a plurality of vertically spaced levels in said boom pedestal journaling said shaft of said pivot tube for rotation about a vertical axis, at least one hydraulic jack unit disposed within said boom pedestal having a cylinder arranged parallel to the axis of rotation of said pivot tube below said pivot tube and offset laterally from the bore of said pivot tube shaft and a rectilinearly reciprocative piston rod projecting upwardly from said cylinder alongside said pivot tube shaft having a stroke spanning substantially the height of said shaft, a drive block fixed to said piston rod and disposed in sliding contact with an exterior surface portion of said pivot tube shaft, guide means for said drive block in said boom pedestal guiding said drive block for movement along a rectilinear axis parallel to the axis of rotation of said pivot tube shaft, the exterior surface of the pivot shaft having helical grooves therein extending substantially the height of said shaft, and said drive block having a concave recess receiving and corresponding to the curvature of a portion of the exterior surface provided with helical teeth interconnecting in said helical grooves for converting rectilinear motion of said drive block into rotary motion of said pivot tube about said vertical axis of rotation responsive to operation of said hydraulic jack unit.

7. A pedestal for supporting a boom arm on a powered vehicle and the like comprising a boom pedestal, a pivot tube having a boom head fixed thereon and an unobstructed bore extending the full height thereof for passage of control lines therethrough, means for pivotally connecting a boom to said boom head for rotation about a horizontal axis, a pair of vertically spaced bearing means journaling said pivot tube in said boom pedestal for rotation about a vertical axis, a pair of hydraulic jack units disposed at diametrically opposite points offset laterally from the pivot tube bore within said boom pedestal each having a rectilinearly reciprocative piston rod projecting therefrom alongside said pivot tube in parallelism with the axis of rotation thereof, a drive ring fixed to said piston

rod and encircling the exterior surface of said pivot tube, guide means for said drive ring in said boom pedestal guiding said drive ring for movement in a rectilinear path paralleling the axis of said pivot tube, said exterior pivot tube surface having helical grooves substantially spanning the height of the pivot tube and said drive ring having helical segment teeth projecting radially inwardly therefrom inter-engaging said helical grooves for converting rectilinear reciprocative motion of said drive ring into rotary motion of said pivot tube about said vertical axis of rotation for moving said pivot tube about said vertical axis of rotation for moving said pivot tube boom in azimuth responsive to operation of said hydraulic jack units.

8. A pedestal for supporting a boom arm on a powered vehicle and the like comprising a vertically elongated boom pedestal, a pivot tube member including a vertically elongated tubular shaft having a boom head fixed to the upper end thereof and an unobstructed central bore extending the full height thereof for passage of control lines and the like therethrough, means for pivotally connecting a boom arm to said boom head for angular movement about a horizontal axis, a pair of vertically spaced bearings in an upper zone of said boom pedestal journaling said shaft of said pivot tube for rotation about a vertical axis, a pair of hydraulic jack units disposed in a lower zone of said boom pedestal having cylinders arranged parallel to the axis of rotation of said pivot tube below said pivot tube and offset laterally from the bore of said pivot tube shaft and rectilinearly reciprocative piston rods projecting upwardly from said cylinders alongside diametrically opposite parts of said pivot tube shaft and having a stroke spanning substantially the height of said shaft, a drive ring fixed to said piston rods and disposed in encircling sliding contact with the exterior surface portion of said pivot tube shaft, guide means for said drive ring in said boom pedestal guiding said drive ring for movement in concentric relation to said pivot tube shaft parallel to the axis of rotation thereof, the exterior surface of the pivot tube shaft having helical grooves therein at diametrically opposite parts thereof extending substantially the height of said shaft and said drive ring having correspondingly positioned helical segments interconnecting said said helical grooves for converting rectilinear motion of said drive ring into rotary motion of said pivot tube about said vertical axis of rotation responsive to operation of said hydraulic jack units.

References Cited by the Examiner

UNITED STATES PATENTS

2,948,411	8/60	Lynch	212—66
3,090,244	5/63	Davis	74—89

FOREIGN PATENTS

971,934	10/64	Great Britain.	

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