Jan. 24, 1967 J. S. HUBBARD 3,299,983

OVERHEAD MAINTENANCE APPARATUS

Original Filed Oct. 31, 1963 4 Sheets-Sheet 1

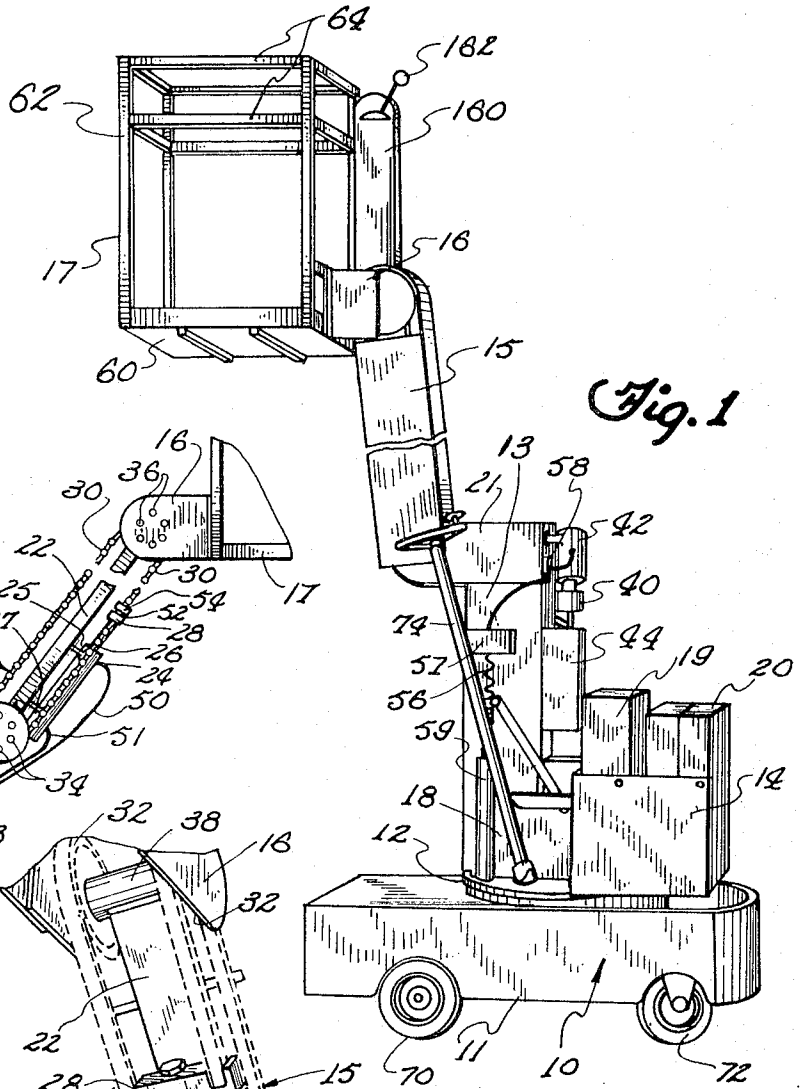

Fig. 1

Fig. 2

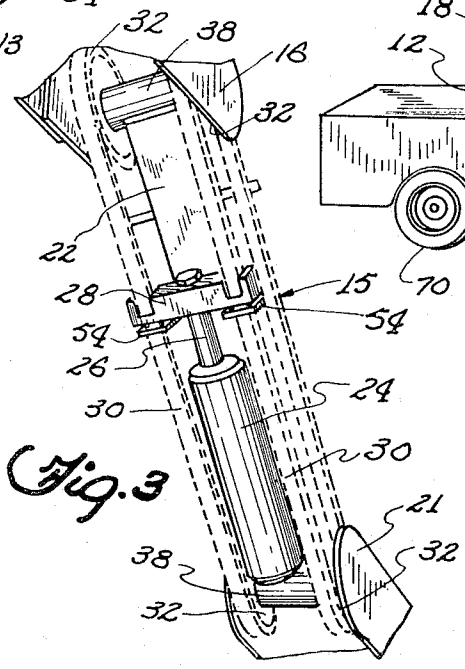

Fig. 3

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Jan. 24, 1967 J. S. HUBBARD 3,299,983

OVERHEAD MAINTENANCE APPARATUS

Original Filed Oct. 31, 1963 4 Sheets-Sheet 2

Fig. 6

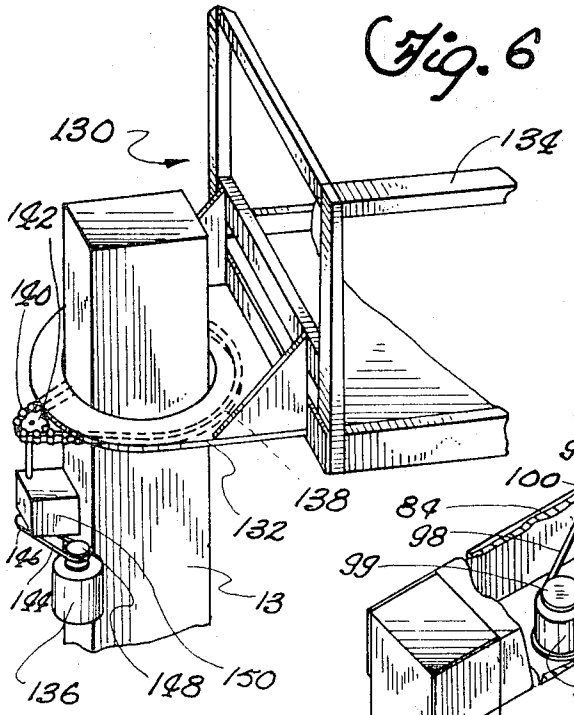


Fig. 4

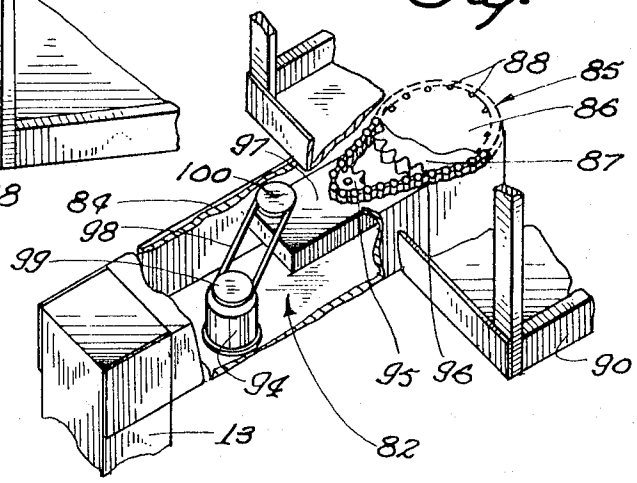
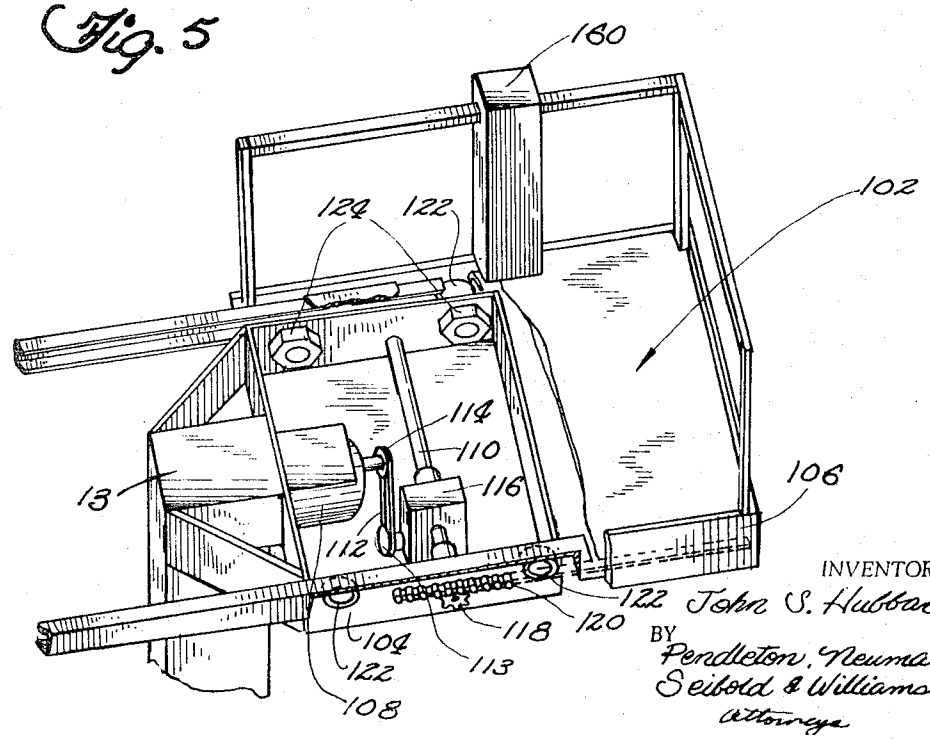


Fig. 5



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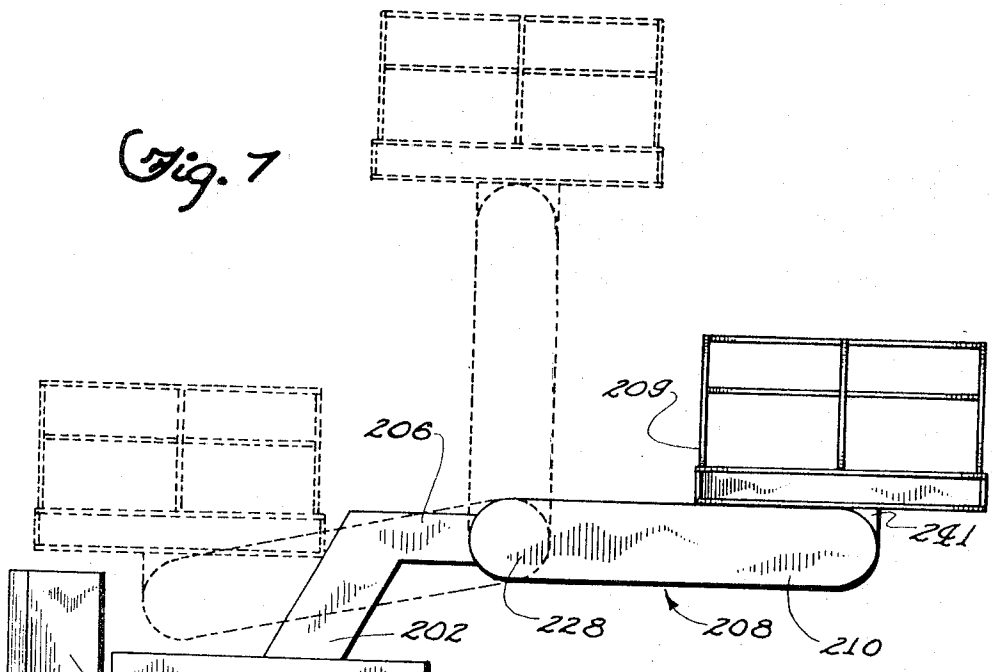
OVERHEAD MAINTENANCE APPARATUS

Original Filed Oct. 31, 1963 4 Sheets-Sheet 3

Fig. 7



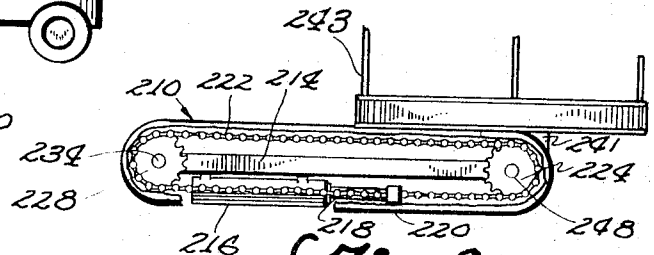


Fig. 8

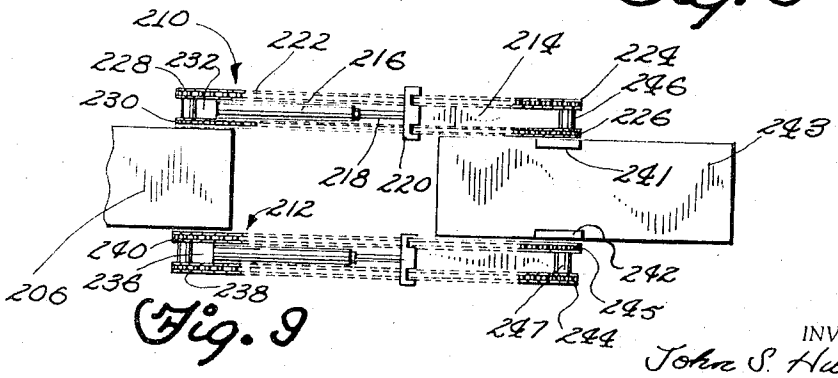


Fig. 9

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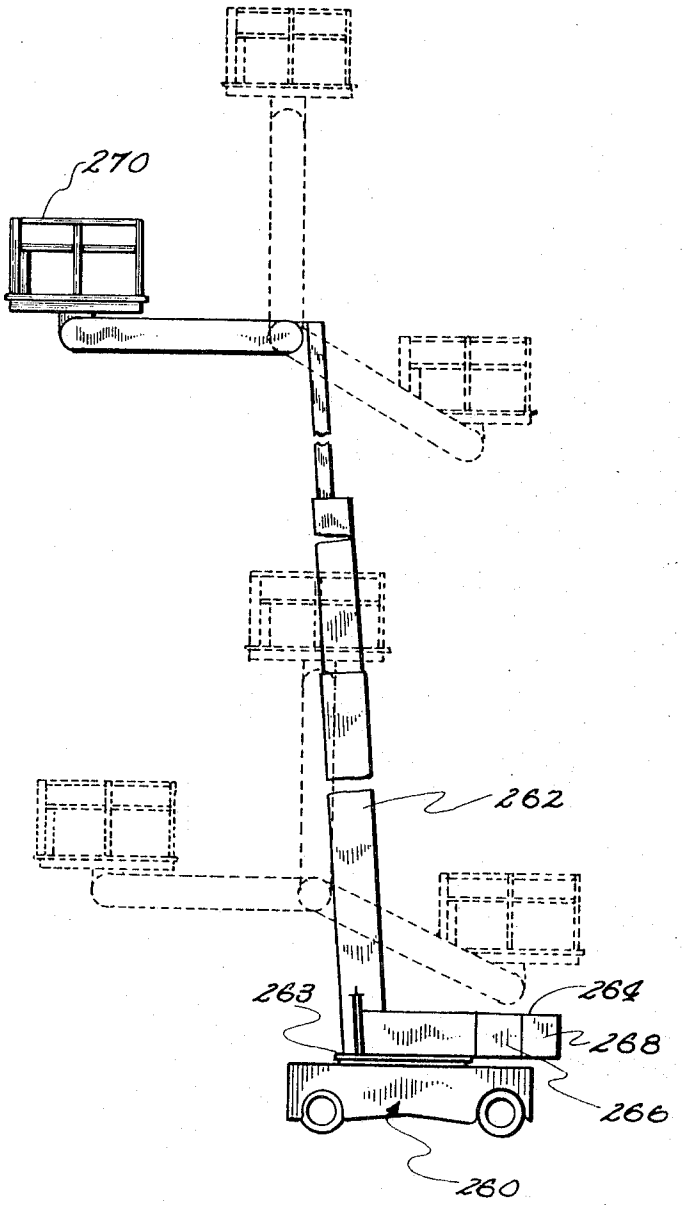
Jan. 24, 1967 J. S. HUBBARD 3,299,983

OVERHEAD MAINTENANCE APPARATUS

Original Filed Oct. 31, 1963 4 Sheets-Sheet 4

Fig. 10



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3,299,983

OVERHEAD MAINTENANCE APPARATUS

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Original application Oct. 31, 1963, Ser. No. 320,329, now Patent No. 3,224,528, dated Dec. 21, 1965. Divided and this application June 28, 1965, Ser. No. 476,226
10 Claims. (Cl. 182—63)

This application is a division of my copending prior application Serial No. 320,329, filed October 31, 1963, now Patent No. 3,224,528 entitled Overhead Maintenance Apparatus.

The present invention relates generally to apparatus for overhead maintenance work in industrial plants and elsewhere, and particularly to apparatus capable of raising one or more workmen to elevated positions at which the workmen may clean, repair or otherwise service such overhead equipment as light fixtures, electrical systems, sprinkler systems, water, steam, air and oil lines, conveyor systems, ventilating and heating systems, and the like.

Two problems with existing overhead maintenance apparatus are that they are too bulky for use in the narrow aisles of many plants and that they lack sufficient mobility to service many hard-to-reach and relatively inaccessible places. Thus, in many operations the presently known overhead service equipment cannot be employed; and instead, uneconomical and slower access equipment, such as scaffolding and ladders, must be used.

Accordingly, it is one object of this invention to provide overhead maintenance apparatus having a column or mast supporting a lift platform which is capable of carrying one or more workmen and which when positioned at the upper terminus of the supporting mast is movable outward from and above the mast.

It is a further object of this invention to provide overhead maintenance apparatus having a lift platform which is movable farther outward from the remainder of the unit than the platforms of the overhead maintenance equipment presently known.

It is another object of this invention to provide overhead maintenance apparatus having a lift platform which is movable throughout a greater area than the platforms of the overhead maintenance apparatus presently known.

It is also an object of this invention to provide overhead maintenance apparatus having a lift platform which is rotatable about an axis perpendicular to the horizontal plane of the base.

It is another object of this invention to provide overhead maintenance apparatus having a lift platform with sufficient mobility to facilitate servicing of hard-to-reach and relatively inaccessible places.

A still further object of this invention is to provide overhead maintenance apparatus having a lift platform which is sufficiently mobile so as to permit servicing of a maximum number of locations with minimum movement of the base.

Another object of this invention is to provide apparatus which greatly enhances the efficiency and substantially reduces the cost of repairing, maintaining, and installing overhead equipment in industrial plants.

Another object of this invention is to provide apparatus which may be readily adapted for and greatly improves the efficiency of such outdoor maintenance operations as the servicing and repairing of street lighting fixtures.

Still another object of this invention is to provide apparatus which is easy and economical to operate and relatively inexpensive to maintain.

Additional objects will be manifest from a consideration of the drawings, description, and claims.

In accordance with one embodiment of this invention, overhead maintenance apparatus is provided having a base, preferably a mobile, self-propelled truck or the like, a turntable mounted on the base and rotatable relative to the base, and an extensible vertical mast or lift column mounted on the turntable and rotatable therewith. A platform capable of carrying at least one workman is connected to the upper end of the mast, preferably by means of an arm which is pivotally connected both to the mast and to the platform. The platform is so arranged with regard to the remainder of the apparatus that it will remain in a substantially horizontal plane regardless of the angular position of the mast and arm. This arrangement permits the platform to be maneuvered around various equipment and piping and into small openings, many of which would be inaccessible when presently known methods and apparatus are employed.

For a more complete understanding of the present invention, drawings have been provided as follows:

FIGURE 1 is a perspective view of one embodiment of the present invention.

FIG. 2 is a back view of the embodiment of FIG. 1 showing only the mast and arm with the actuating mechanism of the arm exposed.

FIG. 3 is a perspective view of the actuating mechanism of the arm of the embodiment of FIG. 1.

FIG. 4 is a fragmentary perspective view of a modification of the platform and mast assembly shown in FIG. 1 and portions thereof cut away.

FIG. 5 is similar to FIG. 4 but showing another modification of the platform and mast assembly of FIG. 1.

FIG. 6 is similar to FIG. 4 but showing a third modification of the platform and mast assembly of FIG. 1.

FIG. 7 is a fragmentary side view showing a modification of the embodiment of FIG. 1 and showing, in dotted lines, the arm thereof in various positions.

FIG. 8 is a fragmentary side view of the arm and platform of FIG. 7 illustrating the actuating mechanism of the arm in detail.

FIG. 9 is a bottom view of the arm and platform assembly of FIG. 8, showing the two parallel sections of the arm in detail.

FIG. 10 is a fragmentary side view illustrating a modification of FIG. 5 in which the mast is mounted on a turntable and the platform is shown in various positions relative to the base of the apparatus.

Referring now to FIGURE 1, one preferred embodiment **10** of the present invention is illustrated. The apparatus includes generally a suitable base **11**, a turntable **12** mounted on the base and rotatable relative thereto, a telescoping mast **13** mounted on the turntable **12**, and a battery box **14** containing a storage battery **19** and a counterweight **20** also mounted on the turntable. An arm **15** is pivotally connected at one end to a supporting member **21**, extending at right angles from the mast **13** and forming a part thereof. The arm **15** is also pivotally connected at its other end to a platform support **16** on which a platform **17** is mounted. The arm **15** may be adjusted to pivot in a vertical plane through an arc of approximately 180 degrees, and is also adapted to move about a vertical axis together with the mast through an arc of 360 degrees. The base **11** is preferably any one of the self-contained, self-propelled, mobile types known to the art. It is preferably battery powered and supported by two drive wheels **70** and two steering wheels **72**. The

turntable **12** may be of any suitable conventional design and is power operated and preferably torque controlled. Besides supporting the mast **13** and the battery compartment **14**, the turntable may also support contactors and a fuse panel. The mast **13** is a conventional telescoping type, preferably having three or more sections. It may be actuated by a hydraulic cylinder through dual mechanical linkage having anti-friction guide bearings at load points. The hydraulic pump may be a conventional electrically operated gear type controlled by an electrically operated valve and flow regulator. In the embodiment of FIG. 1 the mast section having the smallest diameter is on the bottom and the one with the greatest diameter is at the top (See FIG. 2).

Examples of a suitable turntable, turntable arrangement with respect to the base, and telescoping mast will be found in United States Letters Patent No. 3,095,945, issued July 2, 1963 to M. E. Mitchell.

The mast **13** and battery box **14** are each mounted on the turntable **12** offset from the central axis thereof and are diametrically opposite each other. The turntable **12** is U-shaped, i.e., it is provided with two U-shaped flanges **18** which extend upward from the turntable **12** and support the battery compartment **14**. Compartment **14** contains a battery **19** and a counterweight **20** which provides the necessary stability for the unit when the arm **15** and attached platform **17** and moved through their various positions of adjustment. The battery box **14** generally extends to a position outside the flanges **18** and the counterweight **20** is disposed in the portion of the box **14** which is outside the flanges **18**. The battery **19**, on the other hand, is generally positioned in that portion of the box between the flanges when used with a counterweight. The battery **19**, in addition to supplying electrical power for operation of the unit **10**, also acts as a counterbalance, and in some operations may be used alone as a counterweight. In such operations it is desirable to mount the battery in the outermost portion of battery box **14** so that the battery will be disposed at a greater distance from the center of the turntable **12** and from the mast **13**. In this way the battery may act as a more effective counterbalance. In certain modified constructions of the present invention, the mast **13** may be disposed coaxially to the axis of rotation of the turntable **12**.

The arm **15**, best shown in FIGS. 2 and 3, is actuated by a hydraulic cylinder through dual mechanical linkage. The arm **15** comprises a frame **22**, a hydraulic cylinder **24** welded or otherwise connected to the frame (FIG. 2 shows the cylinder **24** connected to the frame **22** by members **25** and **27**), a piston **26** for movement within cylinder **24**, and a trunnion **28** attached to the piston **26**. The trunnion **28** is attached to two predetermined lengths of roller chain **30** which pass over four fixed sprockets **32**. Two of the sprockets are secured to the mast portion **21** by bolts **34**, and the other two are held to the platform support **16** by bolts **36**. The frame **22** is attached at each end to bushings **38** which rotate about fixed shafts secured to the supporting member **21** and the platform support **16**. A pump **40**, actuated by an electric motor **42**, forces hydraulic fluid from a supply tank **44** through a four-way solenoid valve **48** and into the hydraulic cylinder **24**. Depending upon the position of the movable part of valve **48**, fluid is either directed through hydraulic hose **50** to the upper part of the cylinder **24** or through hydraulic hose **51** to the lower part of the cylinder, and the piston **26** is accordingly actuated inward or outward. When the piston is moved, it actuates the trunnion which in turn applies a force on the chain **30**, causing the chain to wrap and unwrap about the sprockets **32** and thereby actuate the arm **15**. Thus, if the piston is forced outward, it actuates the trunnion **28** away from the cylinder **24** and causes the trunnion to apply a force on the chain **30** which lowers the arm **15**. If the piston is depressed, the trunnion **28** is moved toward the cylinder, applying an opposite force on the chain **30**, which raises the arm **15**.

Travel of the arm **15** is regulated by the length of the cylinder stroke. Thus, a shorter cylinder stroke is used to reduce the distance in which the arm and attached platform travel in a vertical plane. This shorter stroke is accomplished by inserting stop tubes in the existing cylinders or by using a shorter stroke cylinder. The rate of speed of the arm **15** is controlled by flow resistors disposed in the hydraulic hoses **50** and **51** at the points where the hoses connect with cylinder **24**. These resistors regulate the rate of flow of hydraulic fluid to cylinder **24** and provide a safety feature by preventing the arm **15** from falling in the event one or both of the hoses **50** and **51** break.

It is important that the chains **30** are sufficiently taut, and the length of the chains may be adjusted by altering the thickness of shims **52** (best shown in FIG. 2) which are positioned between plates **54** (see FIGS. 2 and 3) and trunnion **28**. Chain length may also be adjusted by breaking the chain and employing a turnbuckle to secure the broken ends. Operation of the turnbuckle will then adjust the length of the chains.

Although valve **48** is preferably a four-way valve, a three-way valve or a two-way valve in combination with a check valve may be used in lieu thereof. If two- or three-way valves are used, only one hydraulic line would connect the valve **48** to the cylinder **24** and the fluid would be introduced at the bottom of the cylinder. The four-way valve is more desirable than the other valves because when using the latter valves, gravitational, rather than hydraulic, force is used to lower the arm **15** from a raised position. Hydraulic force is only utilized to raise the arm. Thus, when the arm **15** is adjusted to a position 180 degrees from its retracted position, i.e., when the platform is at its uppermost position relative to the mast, the torque created by the weight of arm **15** may be insufficient to actuate it downward. Thus, to lower the arm from such a position the operator would have to initiate the downward movement by pushing the arm **15** by hand or otherwise.

The pump **40** is a conventional gear-type, which is probably the most economical, but it may be a vane-type or piston-type pump. The motor **42** actuating the pump is a typical series wound 12, 24, or 36 volt electric motor. Electrical power is supplied to the motor **42** from the battery **19**. Current from battery **19** is transmitted through coil cord **56** to terminal box **57**, then to terminal box **58**, and from there to the motor **42**. The coil cord **56** is used because it extends and retracts in correspondence with the extension and retraction of the mast **13**. When the mast is retracted, the excess cord **56** is contained in the cord receptacle **59**. Any conventional hydraulic hose or flexible tubing **50** and **51** may be used to transport the hydraulic fluid to the various parts of the hydraulic system. The pump and motor referred to earlier for operating the mast are the same kinds as those used to operate the arm. In some applications only one pump and motor may be used to operate both the arm and the mast.

In the present invention, electrical energy for operating the hydraulic system may be supplied by a generator driven by an internal combustion engine, rather than by the battery **19**; and, when the mobile base **11** is a highway truck, the hydraulic system may be driven by a power take-off from the truck engine, rather than by the battery **19**.

The platform **17** is mounted on a platform support **16** which is secured to one end of arm **15**. The platform generally comprises a floor **60**, railing supports **62**, and safety railings **64**. The platform should be large enough to support at least one man. It should also be of such dimensions that it will contribute to the compactness of the overall unit.

The platform **17** may be fixed to the platform support **16**, as shown in FIG. 1, or it may be connected in several other ways, as shown in FIGS. 4, 5, and 6.

FIG. 4 shows a modified platform unit **82** which could be substituted for the platform shown in the embodiment of FIG. 1. It will be noted that the modification **82** of FIG. 4 does not utilize an arm **15** like the one illustrated in FIG. 1 and described above. Such modification, however, could be combined with the arm **15**. The modification **82** comprises a support **84** which is either welded or bolted at one end to the mast **13** and forms a part thereof and which extends outward from the mast **13** forming a right angle therewith. Mounted on the support **84** adjacent the distal end thereof is a turntable assembly **85**, and mounted on the turntable assembly **85** is a platform **90**. The platform should be sufficiently spaced from the mast **13** so that the platform may rotate without interference from the mast when the latter is fully retracted. The turntable assembly **85** comprises a turntable **86** secured to a toothed bearing **87** by bolts **88**. The bearing **87** is attached to the support **84** and the turntable **86** is connected to the platform **90**. The turntable **86** is actuated by an electrically powered motor **94**, which drives a chain and sprocket assembly connected to bearing **87**. The latter assembly comprises sprocket **95** and roller chain **96** and is connected to motor **94** through a gear box **97**, a V-belt **98**, and V-pulleys **99** and **100**.

FIG. 5 shows another modified platform unit **102**. In this embodiment the unit **102** is provided with a support **104** welded, bolted, or otherwise joined at one end to the mast **13**. If desired, the support **104** could be connected to the mast by means of an arm similar to the arm **15** of the apparatus of FIG. 1. The support **104**, like support **84** of the embodiment of FIG. 4, extends outward from mast **13** at right angles thereto. Mounted on support **104** is a platform **106**, which is adjustable outwardly and inwardly relative to the mast **13** along the fixed support **104**. Since the platform **106** may be moved outward a substantial distance from mast **13**, the servicing of normally hard-to-reach places is greatly facilitated when this platform unit is used. Movement of platform **106** is effected by an ordinary 12 or 24 volt series wound electric motor **108** which drives a rotatable shaft **110** connected to the motor by means of a V-belt **112**, V-pulleys **113** and **114**, and a gear box **116** in which the gear ratio is about 30:1. Attached to each end of the shaft **110** and rotatable therewith are sprockets **118** which engage roller chain **120**. The chain **120** is secured at each end to the extreme ends of platform **106** so that when the sprockets **118** rotate, the platform **106** moves relative to the support **104**. Cam followers or roller bearings **122** secured to each side of the support **104** by nuts **124** are provided for supporting the platform **106**. The cam followers will rotate as the platform travels relative to support **104**. A control panel **160**, which will be hereinafter explained in greater detail, is mounted on the platform **106** for controlling movement of the platform, the mast, and the base.

FIG. 6 shows a further modification of the platform. In this embodiment a platform unit **130** is provided having a support member **132** and a platform **134**. The support member **132** is rotatable about the vertical axis of the mast **13**, which may be a telescoping type, through an arc of 360 degrees. In lieu of the embodiment shown in FIG. 6, a suitable arrangement may be employed in which an arm similar to the arm **15** shown in FIG. 1 is used. Thus, the platform may be rotated to a position where it is in registration with the base so that no part of the platform will overhang the base. The platform may be manually driven although the illustrated embodiment shows the platform driven by an electric motor **136**. Fixed to the underside of the support **132** is a sprocket **138**. This sprocket engages roller chain **140**, which in turn engages another sprocket **142**; the latter sprocket being driven by electric motor **136** connected thereto through a V-belt **144**, V-pulleys **146** and **148**, and a gear box **150** in which the gear ratio is approximately 100:1. A support bearing collar, not shown, which is located immediately below sprocket **138** and is fixed to mast **13**, retains the platform unit **130** at a fixed height relative to the top portion of the mast.

Referring again to FIG. 1, mounted on one of the railing supports of the platform **17** nearest the mast is a control panel **160**, which contains the electrical controls for positioning the various components of the unit **10**. Thus, while standing on the platform **17**, an operator may regulate movement of the arm **15**, platform **17**, mast **13**, turntable **12**, and base **11**. The control panel may include a four position "Joy Stick" control **162** for regulating movement of the arm **15** and platform **17**, a 2-position lever type control for regulating upward and downward movement of the mast **13**, and a push-pull emergency control for cutting off the electrical power regulating the upward movement on the arm and mast, and all movement of the base and turntable. Also, the panel **160** may contain a lever-type multi-position base travel and turntable control and a key-operated on-off switch.

Besides the controls located on the platform, there is a steering control **74** for regulating the direction of travel of the base. The steering control **74** operates the front wheels **72** through conventional mechanical steering linkage. Other controls may include automatic limit switches for preventing movement of the base when the mast or arm is in an extended position.

FIG. 7 illustrates a modification **200** of the apparatus **10** shown in FIG. 1. In unit **200** the mast **202**, unlike the mast **13** of unit **10**, is mounted directly on the base **204**, rather than on a turntable, and is inclined rearwardly. Even though the mast **202** is not disposed on a vertical axis or on an axis perpendicular to the base **204** of the apparatus, it operates in substantially the same manner as the mast **13** shown in FIG. 1. The angle of inclination of mast **202** will vary from less than 1° to about 20° with respect to its vertical axis. By inclining the mast rearwardly, greater rearward reach is provided without the necessity of increasing the length of the offset arm **206** connected to the mast or the pivotal arm **208** attached to the offset arm. A further advantage is that, when the mast is fully retracted and the pivotal arm **208** is positioned in its forwardly extending direction (as shown in dotted lines in FIG. 7), the platform **209** secured to the outer end of the pivotal arm will be positioned in registration with a part of the base **204**, so that portions of the platform will not project forwardly of the base.

The offset arm **206** is connected to the upper end of mast **202** and disposed in a plane substantially parallel to the plane of the base **204**. The pivotal arm **208** is secured to the distal end of this offset arm **206**. The pivotal arm **208** is similar to the arm **15** of the embodiment **10** of FIG. 1, except that it is split into two identical parallel sections **210** and **212** (See FIG. 9). Each section of arm **208** operates on the same principle as arm **15** and consists of the same component parts as that arm. Thus, section **210** comprises a frame **214**, a hydraulic cylinder **216**, a piston **218** for movement within the cylinder, a trunnion **220** connected to the exposed end of the piston, and roller chain **222** connected to the trunnion and passing over two sets of sprockets **224**, **226**, **228**, and **230**. Section **212** of arm **208** is constructed in the same manner as section **210**.

Arm section **210** is attached to a bearing **232** (see FIG. 9) which is rotatably mounted on a shaft **234** (see FIG. 8), the latter being secured at one end to sprocket **228** and at the other end to sprocket **230**. Sprocket **230** is secured to the outside surface of offset arm **206**. Arm section **212** is similarly connected to a bearing **236** which is also mounted on a shaft, such shaft being secured at its opposed ends to sprockets **238** and **240**. Sprocket **240**, like sprocket **230**, is secured to an outside surface of offset arm **206**.

Since the sections **210** and **212** are attached to the out-

side surfaces of the offset arm **206**, the pivotal arm may be adjusted to a forward substantially horizontal direction in which the upper portion of the mast **202** and the offset arm **206** are disposed between the sections. The outer ends of the sections **210** and **212** are pivotally connected to brackets **241** and **242** depending from the central axis of the platform **209**. Bracket **241** is secured to sprocket **226**, and bracket **242** is secured to sprocket **245**. Arm sections **210** and **212** are connected to bearings **246** and **247**, respectively, and the bearings are rotatably mounted on shafts joined at each end to the sprockets. Thus, bearing **246** is mounted on shaft **248** (see FIG. 8), joining sprockets **224** and **226**, and bearing **247** is mounted on a shaft joining sprockets **244** and **245**. Here, again, the sections are connected relative to the outer surfaces of the platform so that the platform may be adjusted to a forward position in which a portion of the platform is disposed between the arm sections.

The structure **200** illustrated in FIG. 7 does not include a turntable, and the inclined mast **202** is accordingly not rotatable relative to the base. Where an inclined mast is used, there is considerable overhang of the platform in certain positions of adjustment, and to maintain stability of the entire device it is necessary to position the battery and the counterweight a greater distance from the mast and generally adjacent the end of the base opposite the end closest to which the mast is disposed. In unit **200**, battery **250** and counterbalance **252** are immediately adjacent the forward end of base **204**. To mount the battery and counterbalance on a turntable in this embodiment would require a turntable of such diameter that the entire structure would be of an impractical width for normal operations. And, of course, to provide for the rotation of the mast on a turntable without having a counterbalancing weight disposed on the same turntable in diametric opposition to the mast would generally result in an unstable unit. Where the angle of mast inclination is less than 10 degrees, however, it is possible to position the mast on a turntable even without such a counterbalancing weight thereon.

FIG. 10 shows an embodiment **260** in which an extensible mast **262** is slightly inclined and is mounted on a turntable **263**. Diametrically opposed to the mast is a battery box **264** containing a battery **266** and a counterbalance **268**. The operation and structure of the unit **260** of FIG. 10 are identical to unit **200** illustrated in FIG. 7, except that the unit **260** includes the turntable **263** on which the extensible mast **262** is mounted. The platform **270** of unit **260** is shown in FIG. 10 in various positions of rotation, illustrating the considerable flexibility of the unit. It will be seen that the telescoping mast **262** of unit **260** is provided with its widest section at the bottom, whereas the telescoping mast **13** of the embodiment **10** of FIG. 1 has its narrowest section at the bottom (see FIG. 2).

While several embodiments of this invention are shown above, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made which fall within the true spirit and scope of this invention. It is contemplated, therefore, that any such modifications shall be covered by the appended claims.

I claim:

1. Overhead maintenance apparatus comprising: a mobile base; an extensible mast mounted on said base; means for actuating the mast upward and downward; a platform assembly having a support mounted on said mast and rotatable about said mast in a horizontal plane and a platform rigidly connected to one side of said support and rotatable therewith.

2. Overhead maintenance apparatus comprising: a mobile base; a turntable mounted thereon for rotation relative to said base; an upstanding extensible mast mounted on said turntable; means for actuating the mast upward and downward; a platform assembly having a support secured to the upper end of said mast and extending horizontally therefrom, a platform rotatably mounted on said support and spaced from said upper end of said mast a sufficient distance so that the platform will not intersect the longitudinal axis of the mast throughout a complete revolution of said platform.

3. Overhead maintenance apparatus comprising: a mobile base; an extensible mast mounted on said base; means for actuating the mast upward and downward; a platform having guide means extending outward therefrom; a horizontal support secured to one side of the upper end of said mast, said support having side members, said guide means mounted on the side members of said support and linearly movable relative thereto, said platform having a retracted position closely adjacent said upper end of said mast and an extended position spaced from said mast on one side thereof.

4. Overhead maintenance apparatus comprising: a mobile base; an extensible mast mounted thereon, means for actuating said mast upward and downward; an offset arm having one end connected to the upper end of said mast; a second arm having one end pivotally connected to the other end of said offset arm; a platform assembly pivotally connected to the other end of said second arm and rotatable therewith in a vertical plane relative to the direction of movement of said base, said platform assembly including a support pivotally connected to said other end of said second arm, a platform connected to said support, and means for rotating said platform relative to said second arm in a horizontal plane; means for maintaining said platform in a horizontal position parallel to the horizontal plane of the base in all degrees of rotation of said platform.

5. The apparatus of claim **4** wherein a turntable is mounted on the base for rotation relative thereto, and the mast is mounted on the turntable.

6. Overhead maintenance apparatus comprising: a mobile base; an extensible mast mounted thereon; means for actuating said mast upward and downward; an offset arm having one end connected to the upper end of said mast; a second arm having one end pivotally connected to the other end of said offset arm; a platform assembly pivotally connected to the other end of said second arm and rotatable therewith in a vertical plane relative to the direction of movement of said base, said platform assembly including a support connected to said other end of said second arm, said support having a horizontal portion, and a platform mounted on said horizontal portion and linearly movable relative thereto, said platform having a retracted position closely adjacent that end of said second arm which is attached to said platform assembly, and an extended position spaced from said end of said second arm; means for maintaining said platform in a horizontal position parallel to the horizontal plane of the base in all degrees of rotation of said platform.

7. The apparatus of claim **6** wherein a turntable is mounted on the base for rotation relative thereto, and the mast is mounted on the turntable.

8. Overhead maintenance apparatus comprising: a mobile base; an extensible mast mounted thereon; means for actuating said mast upward and downward; an offset arm having one end connected to the upper end of said mast; a second arm having one end pivotally connected to the other end of said offset arm; a platform assembly pivotally connected to the other end of said second arm and rotatable therewith in a vertical plane relative to the direction of movement of said base, said platform assembly including a support connected to said other end of said second arm, said support having a horizontal portion, and a platform rotatably mounted on said horizontal portion and spaced from that end of said second arm which is attached to said platform assembly.

9. The apparatus of claim **8** wherein a turntable is mounted on the base for rotation relative thereto, and the mast is mounted on the turntable.

10. Overhead maintenance apparatus comprising: a mobile base; an upstanding extensible mast mounted on said base; means for actuating said mast upward and downward; a platform assembly having a support secured to the upper end of said mast and extending horizontally therefrom, a platform rotatably mounted on said support and spaced from said upper end of said mast a sufficient distance so that the platform will not intersect the longitudinal axis of the mast throughout a complete revolution of said platform.

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