This invention relates to a mobile overhead service unit for use in performing construction and maintenance service on overhead equipment, such as in cleaning, relamping, and repairing overhead light fixtures, especially in the interior of industrial, commercial and like buildings.

It is the object of the invention to provide a mobile service unit which will be of sufficiently small and compact dimensions and of sufficient versatility to be best adapted to move through small interior halls and aisles and from them through ordinary interior doorways of a building; which unit will have an elevating mast, supporting a projecting work platform to which a workman can readily step from the floor and which will elevate to enable the workman to work at any level up to a high maximum; and which unit will support the platform and its elevating mast on a turntable which also carries within its area various items of construction equipment in counter-balancing relation with the platform and which turntable can be swiveled relative to its supporting base through full-circle and continuous rotation at any level, by control means on the platform, to carry the workman thereon for work at any angular or lateral reach position in a wide range over and from the access passages.

It is a further object of the invention in its preferred form to provide a mobile overhead service unit which will have power-driven travel, swivel, and elevating mechanism, all controlled from the platform, together with steering mechanism operable from the platform, so that a single operator can step onto the platform at the beginning of a work shift and while remaining on the platform can move himself and his equipment through passageways of normal height and width to successive work locations, heights, and lateral positions for performing construction and maintenance and like services over a prolonged work period without ever being required to step down from the platform.

It is a further object of the invention to provide various convenience and safety relationships in overhead service units embodying one or more of the foregoing features, for example to provide a control treadle on the platform which when the platform is in lowered position can be operated by the workman to actuate the travel drive at slow and fast speeds as the workman desires, and which treadle upon elevation of the platform becomes inoperative and causes the drive to be deenergized and the brakes to be locked. It is a further object of the invention to provide steering mechanism which is operable from the turntable and which enables the mobile unit to turn on a short radius, for example to turn about a point on the axis of the rear wheels within a few inches out from the side of the unit.

In accordance with the invention, I provide a compact base having a deep central well which may be tangential to the sides of the base and the walls of which cooperate with the walls of the base to form an especially sturdy structure. The base is supported on front and rear wheels mounted in the spaces outside the well. A sub-shaped turntable is rotatably mounted in the deep well and carries a projecting cantilever platform and a counter-balancing battery or other weight. The platform is mounted for vertical sliding movement on the outer section of an inverted telescopic mast which is mounted by its inner section on the bottom wall of the turntable, so that in lowered position the platform mounting extends downward into the turntable and into the well of the base. This increases the permissible length of the mast sections and gives higher elevation of the platform for the same collapsed clearance height of the unit. Preferably, the platform is power elevated, the turntable is power swiveled, and the unit is power driven; and all controls are operable from the platform. To this end, the steering train extends from a steering wheeled on the turntable through a hollow shaft coaxial with the turntable axis; and the steering train includes drag links which produce differential steering which is amplified by a gear drive to produce differential steering over wide angles which permit the unit as a whole to be turned about a center within a few inches from the inside rear wall.

A single control switch is actuated from a treadle on the platform controls both the brakes and travel drive. Such a treadle extends from the platform to the turntable through a connection which may be broken when the platform is elevated. It extends from the turntable to the base through a shaft coaxial with the swivel axis. Travel drive control switches are actuated by the brake linkage on the base, and brake-release operation of the brake-release treadle closes a travel drive switch for slow travel drive, and further actuation of the treadle throws a switch to change from slow to fast travel drive.

These and other objects and features of the invention will more fully appear from the following description of specific embodiments of the invention.

The accompanying drawings illustrate the invention.

In such drawings:

FIG. 1 is a side elevation of an overhead service unit embodying the invention;
FIG. 2 is a plan view of the unit shown in FIG. 1 and indicating the continuous swiveling rotation of its turntable and platform;
FIG. 3 is a side elevation of the unit shown in FIG. 1, with its turntable swiveled 90° and its platform in elevated position;
FIG. 4 is a vertical section of the platform-elevating mast, in extended position;
FIG. 5 is a horizontal section taken on the line 5--5 of FIG. 4;
FIG. 6 is a central section through the unit of FIG. 1, showing the turntable construction;
FIG. 7 is a bottom plan view of the unit shown in FIGS. 1 and 6, showing the steering and brake linkage;
FIG. 8 is a transverse section taken on the line 8--8 of FIG. 7, and showing the brake linkage and its relation to certain drive-controlling switches;
FIG. 9 is a diagram indicating the electrical control arrangement but showing direct electrical connections between the controlling and controlled elements instead of the relay or contactor arrangement which is desirable used with the high amperage currents needed for battery operation of the several motors;
FIG. 10 is a side elevation of a modification adapted to be manually pushed from place to place rather than power driven and having manually operated swiveling mechanism and battery-powered lift mechanism;
FIG. 11 shows a modification of the unit of FIG. 10, which instead of having a self-contained battery power supply, has a cable reel for connection to available 110 volt A.C. outlets.

The unit shown in FIG. 1 comprises a generally rectangular base 10 having a top wall 12 and side walls 14, and is supported on front wheels 11 and rear wheels 13. A large well 16 is formed in the base, defined by a
circular side wall 18 which is substantially tangent to the two side walls 14. The well has a bottom wall 20 at a relatively low level a substantial distance below the tops of the wheels. The side walls of the well and base are joined to each other and to the top wall 14 and bottom well wall 26, and such assembly forms an exceptionally compact and sturdy structure in which the well extends substantially below the tops of the wheels.

A turntable 22 is rotatably mounted in the well 16 and carries substantially all of the service mechanism. This includes a platform 24 mounted on a telescope elevating mast 26 and movable from the lowered position shown in FIG. 1 to any elevated positions up to a high extreme position such as shown in FIG. 3. The turntable 22 also carries a steering column 38 supporting a steering wheel 40 in position for operation from the platform 24. The platform has a border railing which at the rear side includes a chain section which is removable to permit a work table to enter. As best seen in FIG. 2, the platform is provided with a control panel 43 for controlling forward and reverse drive of the unit, right and left swiveling of the turntable, and elevation and lowering of the platform. It also carries a control trolley 44 which in lowered position of the platform controls the brake and travel drive of the unit. The platform is also provided with a pair of splash curtains 46 shown in upright position but adapted to be swung outward to project laterally from the sides of the platform. When the platform is to be used for washing overhead lights or other equipment, it is provided with a pair of wash buckets 48 which may be hung on the front rail 49 of the platform. As is indicated in FIG. 2, the turntable and its platform can be rotated about the central swivel axis of the turntable continuously in either direction.

Elevation

As is shown in FIGS. 1 and 3, the platform 24 has a lowered position as shown in FIG. 1 and can be raised therefrom to any elevation up to a high top position such as that shown in FIG. 3. For this purpose, the platform 24 is mounted on the telescoping mast, shown in FIGS. 4 and 5, mounted on the bottom of the turntable 22. The mast comprises an inner or bottom section A, one or more intermediate sections, here shown as two intermediate sections B and C, and a top or platform section D. This latter section D has side wall extensions, shown as projecting to the right, on which the platform is mounted. The platform is thus carried as a cantilever arm to the right of the mast shown in FIG. 4, and the parts are arranged to support cantilever load and to operate readily under such load.

The bottom or inner section A of the mast is formed of a square tubing 60 inserted through a fitting opening in a base plate 62 and secured to such base plate by weld metal 64 deposited in a groove in the bottom side of the assembly, forming what may be termed a compression weld in which the weld metal is under compression rather than under tension. The upper left-hand corner of the tube 60 carries a pair of rollers 66 to bear against the inner face of the second section B. The other three walls of the tube 60 carry on their outer faces guide slippers 68 for guiding the upper end of the tube 60 in the second section B. The inner face of the left-hand wall of the lower section A also carries a chain anchor 69 adjacent the top of that section.

The second mast section B is also formed of a length of square tubing 76, of larger size than the tubing 60. This carries a pair of rollers 72 at its lower right corner, for riding on the surface of the bottom section A, and its other three walls carry guide slippers 71 for guiding the lower end of the second section on the first. The upper end of the second section tubing 70 carries a pair of rollers 73 at the left and has guide slings on its other three walls, to guide telescopic mast section C. In addition, the upper end of the second section tubing 70 carries three edgewise plates 74 between which are mounted two pairs of chain rollers 75 and 76. The three plates 74 also carry on their bottom sides a collar 77 for the reception of the piston rod or ram 78 of a hydraulic cylinder 80 mounted in the mast section A. Such hydraulic cylinder 80 is mounted on a square plate 82 loosely fitting within the square opening of the tube 69 and supported on a rounded boss 84, and therefore has free angular movement and will not be stressed by any resilient bending of the mast.

A pair of chains 86 extend from the chain anchor 69 on the mast section A upward and over the two pairs of chain rollers 75 and 76 and thence downward to a chain anchor 92 at the bottom lower corner of the third mast section C.

The third mast section C comprises a length of square tubing 90, of still larger size, provided at its lower right corner with a pair of rollers 94 to ride on the adjacent face of the second section B, and provided on its other three sides with guide slippers 95. At its upper right corner it carries a pair of spaced chain rollers 96. A pair of chains 97 extend from a chain anchor 99 on the third section B upward and over the chain rollers 96 on the third section C and thence downward to a chain anchor 102 on the fourth section D.

The fourth section D comprises a tubular lower portion 108 by which it is mounted on the next lower section C, by means of a pair of rollers 106 at the upper left and a pair of rollers 108 at the lower right corner, which rollers ride on the front and rear walls of the third mast section C. The side walls 104 of the top or fourth section D extend upward beyond the mounting portion and have rightward projections 110 to which the platform is mounted. The mounting may be braced by diagonal braces 111 shown in FIG. 3. FIG. 4 shows the hydraulic ram 80 in substantially fully extended condition. In its collapse from this extended position, the second section B will telescope downward over the first section A. This will lower the rollers 75 and 76 and will allow the chains 86 to run off the sections A, B, and C and the platform will telescope downward over the lowering second section B. The lowering of such third section C will lower the chain rollers 96 which it carries and the chains 97 will run over such rollers and lower the top section D along the third section C. Accordingly the three sections A, B, and C of the mast will telescope to nested positions, and the fourth section D will ride downward on the third section to lowered position at the bottom of the collapsed mast assembly as shown in FIG. 1.

Conversely, when the hydraulic cylinder 80 is actuated to raise its ram 78, this will directly raise the second section B. The upward movement of such second section will act on the chains 86 to cause it to raise the third section C relative to the second section B. For convenience, the chains 86 may be called the A-B-C chains, since they run from A section, over the B section, and to C section, forming a pair of rollers 106 at the lower chains 97 which may be referred to as the B-C-D chains—are actuated by the elevation of the C section to lift the D section and the platform.

When the platform and mast are fully lowered, the mounting portion of the platform-carrier section D will lie 68 inches above the platform which will be close to the top of the turntable and only a short distance, 18 inches, from ground level. With the platform in this position, the upper end of the telescoped mast sections A, B, and C will project above the platform. For protection, the upward extending mast structure is covered.
by a light-weight shield, conveniently comprising lower tubular shield section 112 mounted on the mast section D (FIG. 4), and a second shield section 114 slidably received over the first section 112 and closed at the top. As the mast rises relatively through the platform carrier D, it enters the shield members 112 and 114, engaging the top wall of the outer shield 111 to raise that shield relative to the lowering platform. When the mast is fully collapsed, the shields stand above the platform, as shown in FIG. 1.

Swiveling

The turntable 22 which supports the platform and substantially all of the other power and accessory equipment is rotatably mounted in the well of the base 10 to swivel through continuous rotation in either direction. With this full swivel action, drive and brake and steering connections are continuously maintained between the turntable and the supporting base. Moreover, the construction and mounting of the turntable and mast cooperate to increase the maximum height to which the platform can be elevated.

As seen in FIGS. 1 and 6, the base is provided with a central circular well of a diameter substantially equal to the width of the base and with its bottom wall at a relatively low level substantially below the tops of the supporting wheels 11 and 13. The turntable 22 is a circular box-like structure having a bottom wall 128, a side wall 122 and a top wall 124. This is mounted by its bottom wall 120 on the outer race 126 of a sheave-type ball bearing whose inner race 125 is fixed on the bottom wall 20 of the well. Additional support is provided by angularly spaced rollers 139 mounted on the turntable bottom wall 120 and riding on the bottom well wall 20.

The bottom wall 120 of the turntable has a central opening through which there projects upwardly a fixed post 132 carried by the bottom wall of the well. Such post 132 is hollow and supports a hollow steering shaft 134 and a central brake actuating rod 136 as will be more fully described below. Such central post 132 also serves to carry a swivel-reaction sprocket 140 which is fixed to the post within the turntable above its bottom wall 120. Such fixed swivel-reaction sprocket 140 is connected by a chain 142 to the drive sprocket 144 of a reduction gear box 146 driven by a motor 148. The motor 148 and gear box 146 are mounted within the turntable and fixed thereto, and rotation of the gear 146 acts through the chain 142 to drive itself about the fixed reaction sprocket 140, and hence to rotate or swivel the turntable 22 on its swivel axis. Electrical supply and control leads for the swivel drive motor 148 can be connected directly to the battery and, through one of the extensible cords 250, to the platform control panel 42, since all such parts are carried by the turntable.

The platform supporting mast 26 extends downward through an opening in the top wall 124 of the turntable and is mounted by its bottom plate 62 on the bottom wall 120 of the turntable, so that when the platform is in lowered position the mounting portion 160 of the platform-carrier section D extends downward into the turntable. This low-level mounting for the mast and the arrangement of the mast and platform-carrier not only gives a low bottom position for the platform, but also increases the permissible length of the several mast sections while maintaining the overall collapsed height of the mast within permissible limits as to pass through standard doorways, and the increased length of the mast sections substantially increases the height to which the platform can be elevated.

Steering

The steering post 28 is mounted on the turntable and supports a steering shaft 150 which extends downward through the top wall of the turntable. A small sprocket 152 on the steering shaft 150 is connected by a chain to a larger sprocket 154 on the upper end of the hollow shaft 134 which is rotatably mounted in the fixed central post 132. The bottom end of such steering shaft 134 carries a small sprocket 156 which is connected by a chain 158 to a large part-sprocket pivotally supported from the bottom wall 20 of the base wall 16. This part sprocket 160 is connected by a pair of steering links 162 and 164 to two steering arms 166 and 168 fixed to independent concentric shafts 167 and 169 rotatably supported between a bracket 170 and a collar 172 fixed on the base. Such concentric shafts respectively carry at their upper ends a pair of large sprockets 174 and 176, which are respectively connected by chains to smaller sprockets 178 and 180 fixed to the rotatable forks in which the front steerable wheels 11 are mounted.

The steering links 162 and 164 are connected to the part-sprocket 160 at points spaced angularly forward from the transverse diameter of such part-sprocket, and the two arms 166 and 168 normally lie at a small angle forward from a true vertical line. Such connections produce a differential steering action for the two steerable wheels, in a manner analogous to conventional steering geometry for dirigible wheels. For example, clockwise steering movement of the part-sprocket 160 in FIG. 7 acts through the links 162 and 164 to produce clockwise angular movement of the arms 166 and 168, and the differential action produces greater angular movement of the arm 166 than of the arm 168, so that the inside wheel on any turn always undergoes greater steering rotation than the outside wheel. Such differential steering action is amplified by the gear ratio between the large sprockets 174 and 176 and the smaller fork-supporting sprockets 178 and 180. The steering mechanism permits the inside wheel to turn through a wide angle, of the order of 80° in each direction from forward, and permits the unit to be turned on an extremely short radius. Thus, in the mechanism of FIG. 7, the front wheels 11 can be turned to the desired positions shown, in which they are both normal to radii from a common point 182 on the axis of the rear wheels 13 and substantially adjacent to the side of the unit, so that the unit can be turned about that point 182 as a center, with a turning radius less than a few inches from the inside wheel.

Braking and Travel

As is seen in FIGS. 6-8, the rear wheels 13 are independently mounted in fixed forks 290 bolted to the top wall 12 of the base. Each wheel is provided with a brake drum 202 on the external surface of which are fixed a pair of sprocket rings 204. These are connected by chains to sprockets 206 on the shafts of independent motors 208 for the separate wheels. The brakes are of conventional construction and are each operated by a crank 212 on a rock shaft 210. The free end of each crank 212 is shackled to a transverse lever 214 which is biased by a spring 216 in a direction to apply the brake. Each lever 214 is pivoted in a center bracket 218 and its inner end is shackled to a common actuating lever 220. This is pivoted in a bracket 222 on the bottom wall of the well of the base, and extends forward so that its front end underlies the brake actuating rod 136 slidably mounted through the hollow steering shaft 134 on the swivel axis of the turntable.

Such rod is actuated from above. To this end, a rock shaft 224 is mounted on the top wall 124 of the turntable, and its inner end carries an arm 226 overlying the upper end of the actuating rod 136. The outer end of the rock shaft 224 carries a lever arm 228 in position to be engaged by a bell crank 230 when the platform 24 is lowered in position. Such bell crank is pivoted to a bracket 232 carried by the platform and is actuated by a push rod 234 operated by the treadle 44. Depression of the treadle rocks the rock shaft 224 to depress the rod 136 and release the brakes.

As is shown in FIG. 8, the brake mechanism is arranged

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to actuate two switches mounted on the base adjacent the motors 208. The first of these is an on-off switch 240 which is held in "off" position when the brakes are applied and which moves to "on" position when the brakes are released. The second switch is a slow-fast switch 242 which normally is in "slow" position but is movable to its brake-applying position as shown in full lines in FIG. 8, and such mechanism actuates the on-off switch 240 to its "off" position to inactivate the drive mechanism. When the treadsde 44 on the platform is released (or the platform elevated) the springs 216 at the wheels pull the brake mechanism to its brake-applying position as shown in dotted lines in FIG. 8, and such mechanism actuates the on-off switch 240 to its "on" position, which energizes the drive motors 208 to drive the drive wheels 13 at slow speed, either forward or reverse as the controls may be set. Upon further depression of the platform treadle 44, the same operating train moves the brake levers 214 through an overtravel to the extreme position shown in dotted lines in FIG. 8. This switches the switches 242 from its "slow" to its "fast" position, which energizes the drive motors 208 to drive the wheels 13 at fast speed. The treadle 14 serves as a "dead-man" control, for whenever it is released, the brakes are applied and the drive motors deenergized. Moreover, the platform-supported bell crank 230 will operate the arm 228 of the rock shaft 224 only when the platform is in its fully lowered position, and during the first inch or so of platform elevation, the operating connection is broken between the treadle 44 and the brake and drive mechanism, and it is impossible to release the brakes or actuate the drive when the platform is in any higher elevated position.

Electrical

The electrical control panel 42 on the platform 24 conveniently carries nine control buttons as will be described below in connection with FIG. 9. Such panel 42 is connected to the turntable by a pair of self-coiling expansion cords 250 received in a pair of upstanding tubes 252 at opposite sides of the platform mast. On the turntable, the cords are connected to the fuse and control panel 32 and are there connected to the various operating circuits. In actual practice the electrical circuitry is of the conventional type in which heavy power leads are connected as directly as possible from the battery to the motors through relays or contactors controlled by relatively low-amperage control circuits. For convenience, however, the electrical operation is diagrammatically shown in FIG. 9 by means of direct circuits, controlled directly by push-bottom switches, and the conventional relay and contactor arrangements are omitted. As is shown in FIG. 9, the control panel 42 carries a central key operated switch 254 by which all circuits are controlled and can be locked open. This is connected to the battery 30 through a power lead 257 and an emergency circuit breaker 258 operated by a push button 259 and re-closed by a reset button 260. From the key operated switch 254 power is supplied to the other push button switches. These include "right" and "left" swivel switches 262 and 264 which respectively control the operating circuits of the swivel motor 148.

The panel also includes "raise" and "lower" switches 266 and 268 controlling the elevation and lowering of the platform. The raise button 266 is connected by a wire 270 to the motor 28 driving the pump 272 in the hydraulic reservoir 36. The pump has its inlet open to the reservoir and discharges through a pipe 274 to the bottom of the hydraulic cylinder 80, so that when the motor 36 is energized hydraulic liquid is pumped to the cylinder 80 to lift its piston and ram 78.

The delivery pipe 274 from the lift pump 272 is also connected to a normally closed valve 276 arranged to be energized by a solenoid 278 connected to the "lower" button 268 of the control panel 42. Upon opening of such valve 276, liquid drains from the cylinder 80 back to the reservoir 36 to collapse the mast and lower the platform. In case of power failure, the valve 276 can also be opened manually by the handle 279.

The delivery pipe 274 from the lift pump 272 is also connected to a pressure relief valve 280 which is set to limit the lift force which the hydraulic system is capable of exerting on the platform, and this serves as a safeguard to prevent overloading of the platform, and to maintain the platform load within the limits of which is safety counterbalanced by the ballast weight of the unit thus avoiding danger of tipping when the platform is in elevated position. The control panel 42 also carries "forward" and "reverse" buttons 282 and 284 for controlling the direction of travel produced by the drive motors when the treadle 44 is depressed to release the brakes and energize such drive motors.

The power supply battery 30 and the control panel 42 are carried by the turntable 22, and the connection of these elements to the drive motors in the base 10 is maintained continuously with a continuous direct connection of the turntable 22. These connections are shown in FIG. 6. The fixed central post 132, which stands upward within the turntable 22 from the bottom well wall 20, carries four fixed slip rings 291, 292, 293, and 294. These are connected by suitable conductors 296 to a control panel 298 associated with the drive motors 208 and with the on-off switch 240 and the slow-fast switch 242. As is shown in FIGS. 6 and 7, these conductors 296 pass downward along the fixed post 33 through the central opening in the bottom wall 120 of the turntable 22 and thence through an opening in the fixed bottom wall 20 of the central well of the base. The outer surfaces of the slip rings 291-4 are engaged by brushes 301, 302, 303, and 304 which are carried by the turntable 22 and which maintain contact with the slip rings as the turntable swivels. The four slip rings are respectively used for forward and reverse control circuits and for power supply and ground circuits to energize the drive motors 208.

Operation

Operating details of various aspects of the overhead service unit of FIGS. 1-9 are set forth above under the several sub-headings. In general, it is pointed out that such overhead service unit is a self-contained unit capable of sustained overhead service and construction operations over a prolonged period. With the unit suitably equipped with appropriate tools, cleaning equipment, replacement parts, etc., a single workman can step onto the platform 24 from ground level at the beginning of a workshift and can completely control the travel, swiveling, and elevation of the unit from such platform.

One commercial embodiment of this unit has a base 32 inches wide and 54 inches long and, with a 30 inch by 36 inch platform, has an overall length of 82 inches. In a model in which the platform floor can be elevated to 17 feet above ground level, the platform in lowered position is approximately 18 inches from the floor and the overall height of the unit—for the top of the collapsed mast—is 82 inches and thus low enough to pass through a standard 7-foot doorway, and to do so with the operating workman in operating position on the platform. The low position of the lowered platform provides access to work at levels down to those accessible from ground level. With the platform in its rearward position, no part of the unit projects beyond the 32-inch width of the base. A workman can step onto the platform from ground level (by way of a rear opening through the plat-
form railing) and can drive the unit along all normal aisles of industrial and commercial buildings. He controls the brakes and travel drive with the single trolley 44, which provides both a slow speed (in which the motors 208 are connected in series to the battery) and a fast speed (in which the motors are connected in parallel to the battery). Steering is by means of the steering wheel 40, which stands in convenient position ahead of the platform and to the side of the narrow mast 26. The unit is sufficiently compact and the steering is such that the unit can routinely turn from a 4-foot aisle into and through a standard 3-foot doorway. Turns in even less clearance space can be made by partially swivelling the platform sideways.

At each location where construction or maintenance service is desired, the workman can operate the elevation and swivel controls to reach any point at any height down to heights accessible from ground level and up to a high maximum level over a large area extending considerably distances laterally and angularly from the area in which the base of the unit stands, without need to move the base itself. In the 32 inch by 82 inch by 82 inch model mentioned above, having a 30 inch by 36 inch platform, the upper (and larger) end of the mast is approximately 8 inches by 10 inches in overall cross-sectional area and is thus substantially concerned with the platform. While it projects above the lowered platform, its top stands about 5 feet above the floor of the platform, which permits the workman to readily reach over and past the mast for service operations above the front of the unit. Moreover, as the platform is elevated, it immediately travels upward toward the top of the mast, and the mast thus drops downward relative to the platform, and at a low elevation the top of the mast drops completely below the platform rail and thus entirely out of range of normal service movements of the workman. The shape and construction of the mast thus materially enhance the useful range of operations from the platform.

The platform and turntable can be swivelled at any level of the platform. The counter-balancing weight is carried by the turntable, and is carried in a position substantially within the periphery of the turntable. The counter-balancing weight provides full counter-balancing effect and high stability for the unit in all positions of swivelling movement of the platform about the turntable axis. Moreover, it is possible to swivel the turntable in a narrow aisle and in locations closely adjacent to fixed equipment, for the counter-balancing weight is within the area occupied by the base of the unit and additional clearance area for swinging counter-balance mass is not required. The swivelling gives the workman a large reach area, extending considerable distances outward from the area occupied by the base. Thus, in the commercial unit mentioned above, the outer end of the platform swings in a circle extending nearly three feet beyond each side of the 32-inch wide base, and the accessible service area is extended beyond that circle by the length of the workman's own reach. At the same time, as noted above, the entire unit and the base is also directly accessible to the workman, and the lift makes the whole reach area accessible at any level from ground-working level up to a high maximum. Further, when work is completed within the large area accessible at any one location of the base, the workman himself, without leaving the platform, can drive the unit to the next point of service requirement.

The invention gives a small workman himself a freedom of power-driven mobility and range of readily accessible reach horizontally and vertically greatly beyond any previous equipment; and provides for speedy and efficient overhead service operations of construction and maintenance with little or no interference with other normal activity in the serviced areas.

FIG. 10 is a somewhat schematic view of a modified unit in which the platform lift is battery powered and other functions are manual. The platform comprises a base 510 mounted on rear fixed axis wheels 512 and front caster wheels 514. The base supports a turntable 516 mounted as in FIG. 1, which supports a 3-section extensible mast 518 carrying a platform 520. A central fixed post 522 on the base supports a swivel-reaction sprocket 524 in the turntable and such sprocket 525 at the lower end of an extensible swivel-drive shaft 526 of square section. Such drive shaft carries a worm wheel at its upper end which is driven by a worm gear 530 connected for operation by a hand wheel 532 on the platform. Rotation of the hand wheel drives the shaft 525 and the sprocket 525, and the same to progress about the fixed reaction sprocket and swivel the turntable in either direction.

The modification of FIG. 10 is intended to be pushed manually from place to place, and its front wheels are therefore caster wheels. Elevation of the platform is power operated, from a battery 534 mounted in counter-balancing relation with the platform.

The modification of FIG. 11 is like that of FIG. 10, except that the battery is replaced by a counterweight 536 and an electric cable reel 538 adapted to be connected to any standard electric outlet. In this case, the lift motor used will be one suitable to the available electric supply, and will usually be a 110 volt A.C. motor.

Any of the modifications described above, and especially the push models of FIGS. 10 and 11, may be made in smaller sizes than the commercial model referred to above. A fully powered model like that of FIG. 1 has been made in a smaller size for office and like use, adapted to travel in narrower aisles and to pass through narrower and lower doorways.

I claim as my invention:

1. An overhead service unit, comprising a base having a turntable well, front and rear wheels mounted on the base outside said well, a turntable mounted in said well, a fixed mast section mounted on said turntable with its lower end extending downward into the well below the tops of the wheels, a second mast section mounted for vertical movement relative to the fixed mast section and being of tubular configuration and telescoped over the fixed section and supported from within by said fixed section, said second section in lowered position extending to below the top of the wheels, a platform carrier mounted on the exterior of said second section, a cantilever platform fixed on said carrier and projecting outward from said mast and turntable and having a length extending a substantial distance beyond the size of the mast, counterbalance means means in fixed position on said turntable, said carrier supporting the platform on said second section by means of a supporting portion extending downward from the platform, said portion in lowered position extending downward into the well, whereby said mast construction and low mounting cooperate to give the platform a low bottom position and a high maximum elevation in relation to the overall height of the unit, said base lying wholly below the level of the platform in its bottom position and said turntable and the platform and counterweight carried thereby being rotatable through 360° of continuous movement in either direction, with the platform at any level between its said low bottom position and its high maximum elevation.

2. An overhead service unit, comprising a generally rectangular base, a central turntable well formed therein and substantially covering a circular area inscribed within and substantially tangent to the sides of the area of spaced front and rear supporting wheels for the base positioned between the sides in front of and behind the well, said front wheels being steerable about individual spaced vertical axes, a turntable rotatably mounted in said well, a platform mast in fixed standing position on said turntable, a platform mounted on the mast for up and down movement thereon and being positioned at one side
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of the mast and projecting outward from said side sufficiently to extend beyond the side of the base a distance of the order of the width of the base when swiveled to a lateral position, counter-balance means on said turntable on the opposite side of the swivel axis thereof from the platform, means to swivel the turntable to carry the platform through full-circle continuous swivel movement in either direction with the platform at any level on the mast, and thereby to carry the platform to positions projecting laterally beyond the mast said turntable and platform having a travel position in which the platform is substantially at the base of the mast and extends rearward with respect to the base and over and beyond the rear wheels, whereby the rear wheels lie intermediate the overall length of the unit, the front wheels being turnable through large angles to permit said unit to be turned about a point substantially adjacent the side of the unit on the axis of the rear wheels.

3. An overhead service unit as defined in claim 2 with the addition of power means controlled from the platform in travel position for driving the rear wheels with a differential action, and steering means operable from the platform in travel position and operative to turn the front wheels through said wide angles sufficient to permit the unit to be turned about a point substantially adjacent to the side of the unit on the axis of the rear wheels.

4. A mobile service unit, comprising a base having rear wheels and front wheels steerable about an individual spaced vertical axes, a steering shaft, a pivot member mounted on said base, drag links connecting said pivot member to independent steering arms to produce differential movement thereof and means connecting said steering arms respectively to said steerable wheels, a turntable rotatably mounted on said base, gear means for swivelling said turntable, said steering shaft being mounted on said turntable, a steering drive shaft extending coaxially with said swivel axis between the turntable and the base, means connecting said steering shaft to operate said drive shaft at its turntable end, and means connecting the base end of said drive shaft to activate said pivot member and thereby steer the steerable wheels.

5. A mobile service unit as defined in claim 4 in which said means connecting the steering arms to the steerable wheels comprises gear means having a ratio to amplify said steerable wheels the differential angular movement of said steering arm.

6. An overhead service unit, comprising a base having brake-equipped travel drive wheels and motor means for driving the same, a turntable mounted on said base, a control member on said turntable, an operating train from said member to said base and including a thrust member movable axially with respect to the turntable, means biasing the wheel braces to braking position, means on said base responsive to initial movement of said operating and thrust members for releasing said brakes and energizing said wheel driving motors, and switch means on said base responsive to further movement of said operating and thrust members for increasing the driving speed.

7. An overhead service unit according to claim 6 with the addition of an electric power source on said turntable and slip-ring connections between said turntable and base for transmitting power from said source to energize said motors.

8. An overhead service unit as defined in claim 6 with the addition of a platform and elevating means therefor mounted on said turntable, said operating member being mounted on the platform, and said operating train including a separable linkage which is engaged when the platform is in lowered position and which is then operative to transmit brake and drive operating movement, said linkage being separated upon initial elevation of the platform to permit said biasing means to actuate the brakes and deenergize said wheel-driving motors.

9. An overhead service unit, comprising a base having a pair of drive wheels respectively connected to separate drive motors, brakes on said wheels, a brake control member biased to brake-applying position, a power source, a normally open switch closed by movement of said brake control member and responsive to said switch closing for connecting said motors in series to the power source for slow speed operation, second switch means operable by further movement of said member, and means responsive to operation of said second switch means for connecting said motors in parallel to the power lines and for fast speed operation.

10. An overhead service unit, comprising a low mobile base, a turntable swiveled on the base, an upstanding mast fixed on the turntable, a platform mounted for up and down movement on the mast and projecting radially from the swivel axis a distance to extend substantially below the sides of the base, said mast being constructed and arranged to raise the platform to any level up to a predetermined maximum and to lower the same downward along the mast to a level substantially below the top of the mast and within stepping distance from the floor, counter-balancing means for the platform carried by the turntable, and means operable from the platform for swivelling the turntable through full-circle continuous movement with the platform at any level thereon and for raising and lowering the platform whereby the platform can be moved by a workman thereon for access to work axes wheels and from said platform for swivelling the platform to a level substantially below the top of said mast drops below the working level of a workman on the platform.

11. An overhead service unit as defined in claim 10 in which the counter-balancing means comprises a mass mounted for swivelling movement substantially within the mast and means for the raising and lowering of the platform for raising and lowering the turntable to extend substantially beyond the area of the mobile base.

12. An overhead service unit, comprising a mobile base having spaced wheels, a mast mounted thereon, a platform carried by the mast and projecting laterally therefrom, said mast having an inner square-tube section fixed on the base, one or more intermediate square-tube sections telescoped downward over the fixed section and guided thereby, a platform carrier section mounted for vertical movement on the outermost intermediate section, power means to raise the first intermediate section relative to the inner section, and means for raising each other section relative to its next inward section in response to movement of said next inward section relative to its next inward section, said platform having a lowered position adjacent the base of the mast wherein said sections stand as a telescoped assembly projecting above the platform, said raising movement of the sections causing said platform to rise along the tops of said sections at a low level of elevation the top of said mast drops below the working level of a workman on the platform.

13. An overhead service unit as defined in claim 12 with the addition of a mast cover shield carried with the platform, said shield comprising a bottom section standing below the working level of a workman on the platform, and a top section telescopically mounted over the bottom section and slideable upward thereon when the mast rises above the bottom section.

14. An overhead service unit as defined in claim 12 in which the inner section of the mast is fixed to its mounting on the base by means of a compression weld.

15. An overhead service unit as set forth in claim 12 with the addition of a turntable well on said base between the wheels thereof, a turntable mounted in the well, said mast being mounted on the turntable with its base below the tops of the wheels, and said lowered position of the mast and bottom sections above the mobile base and substantially within stepping distance from ground level.

16. An overhead service unit as defined in claim 12 in which said power means comprises a hydraulic ram housed within said fixed section.

17. An overhead service unit, comprising a generally rectangular base having a top wall, a well in said base
defined by fixed side and bottom walls, a turntable in said well and having a central opening therein, bearing means outward of said opening and supporting said turntable from said walls for swivel rotation in said well, a fixed post carried by said well walls and extending upward through said opening to within the turntable, an upright mast fixed on said turntable, an elevating platform on said mast and projecting laterally from said turntable, an electric battery power source carried by said turntable in counterbalance relation with said platform, wheels and electric drive means therefor on said base, control means on said platform, electrical slip ring means carried by said fixed post within said turntable for connecting said battery and control means to said drive means, and electrical connectors extending through said turntable opening externally of said post, and mechanical connections between the turntable and base extending centrally through said post.  

18. An overhead service vehicle adapted for use in office-type environment, comprising a mobile base mounted on front and rear ground engaging wheels and of compact configuration adapted to pass through door- and passage-ways of predetermined width and lower than the height a man can step from the floor, a turntable well formed in said base between the wheels and extending below the tops thereof, said turntable in said well, and rotatable through 360° continuous movement in either direction about a central vertical axis, an upwardly extendable mast fixed in upright position on the turntable and extending from the well upward and above the base, said mast in retracted position having a predetermined clearance height adapted to pass upright through doorways of predetermined height, a platform mounted on the turntable and having a portion extending below the tops thereof, said turntable being rotatable on the base through 360° of continuous movement in either direction about a central vertical axis, a mast fixed in an upward position on the turntable and extending upward relative to and above the base, said mast having a predetermined clearance height for passage upright through doorways of predetermined height, a platform mounted on the turntable and having a portion extending below the tops thereof, said platform having a lowered position closely above the low base to permit a workman to mount the platform from the floor and to work thereon at levels substantially contiguous with those to which the workman can reach from the floor, and being positionable up and down along the mast between such lowered position and a top position substantially at the top of the mast, said platform being rotatable with the turntable through 360° of continuous movement in either direction about the central turntable axis at all levels between its said lowered position and its said top position, whereby to give working access to a full circular area at all levels between the platform and the drive motor means in the base drivingly connected to the drive wheels, swivel and lift motor means on the turntable operatively connected for rotating the turntable on the base and for raising the platform on the mast, self-contained electric supply means for energizing said motor means and mounted on the turntable for rotation therewith as counterbalance means for the platform, means to connect the turntable-mounted electric supply means to the base-mounted drive motors, control means on the platform for controlling said swivel and lift motor means, drive control means operable from the platform in a lowered position for energizing the drive motors from the electric supply means, and steering means operable from the platform in a lowered position for steering said front wheels, whereby a workman can mount the platform from the floor and while remaining thereon can drive the vehicle through doorways and passage-ways to work locations and can lift the platform and rotate the turntable and platform to position himself for work at any level of the platform over a full circular area at each such location.  

21. An overhead service vehicle as defined in claim 20, in which the mast is fixed in upright position on the turntable and extends beyond the side of the base a distance of the order of the width of the base and the counterbalance means projects such a short distance in the opposite direction as not to extend substantially beyond the opposite side of the base.  

22. An overhead service vehicle as defined in claim 20 in which the platform in laterally projecting position extends beyond the side of the base a distance of the order of the width of the base and the counterbalance means projects such a short distance in the opposite direction as not to extend substantially beyond the opposite side of the base.  

23. An overhead service vehicle as defined in claim 22 in which compact base lies wholly within the limits of the circular area swept by the platform in its swinging movement about the turntable axis.  

24. An overhead service vehicle adapted for use in office-type environment, comprising a mobile base mounted on rear drive wheels and front steerable wheels and of compact configuration and low height less than the order of 2 feet, a turntable rotatably mounted on the base between the wheels and having a portion extending below the tops thereof, said turntable being rotatable on the base through 360° of continuous movement in either direction about a central vertical axis, a mast fixed in an upright position on the turntable and extending upward relative to and above the base, said mast having a predetermined clearance height for passage upright through doorways of predetermined height, a platform on the turntable and having a portion extending below the tops thereof, said platform having a lowered position closely above the low base to permit a workman to mount the platform from the floor and to work thereon at levels substantially contiguous with those to which the workman can reach from the floor, and being positionable up and down along the mast between such lowered position and a top position substantially at the top of the mast, said platform being rotatable with the turntable through 360° of continuous movement in either direction about the central turntable axis at all levels between its said lowered position and its said top position, whereby to give working access to a full circular area at all levels between the platform and the drive motor means in the base drivingly connected to the drive wheels, swivel and lift motor means on the turntable operatively connected for rotating the turntable on the base and for raising the platform on the mast, self-contained electric supply means for energizing said motor means and mounted on the turntable for rotation therewith as counterbalance means for the platform, means to connect the turntable-mounted electric supply means to the base-mounted drive motors, control means on the platform for controlling said swivel and lift motor means, drive control means operable from the platform in a lowered position for energizing the drive motors from the electric supply means, and steering means operable from the platform in a lowered position for steering said front wheels, whereby a workman can mount the platform from the floor and while remaining thereon can drive the vehicle through doorways and passage-ways to work locations and can lift the platform and rotate the turntable and platform to position himself for work at any level of the platform over a full circular area at each such location.
for up and down movement thereon, a platform non-
rotatably mounted on the carrier and positioned at one
side of the mast and extending outward therefrom and
radially of said central turntable axis and beyond the turn-
table, the platform having a length to extend substantially
beyond the sides of the base and beyond at least one end
of the base when swung with the turntable about said cen-
tral axis, said carrier having mast-engaging means below
the platform and having a lowered position in which said
mast-engaging means extends downward into the low
base and positions the platform substantially at the base
of the mast and closely above the low base to permit a
workman to step onto the platform from the floor and to
work thereon at levels substantially contiguous with those
which a workman can reach from the floor, said carrier
having a top position in which said mast-engaging means
is at the top of the extended mast and the carrier supports
the platform above the mast, and said carrier and plat-
form being positionable vertically up and down along the
mast between said lowered position and said top position,
said platform being swingable with the turntable through
360° of continuous movement in either direction about
the central turntable axis at all levels between its said low-
ered position and its said top position, whereby to give
working access to a full circular area at all levels of the
platform, counterbalance and power means carried by the
turntable and rotatable therewith in counter-balance rela-
tion with the platform, and control means on the plat-
form for controlling the power means to raise and lower
the platform between its said lowered and top positions,
and means operable from the platform for rotating the
turntable on the base, whereby said vehicle will have a
collapsed height for movement through doorways of pre-
determined height and will support a workman for work
over said full circular area at all work levels ranging
from work levels reachable from the floor to work levels
higher than the extended height of the mast.

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