Oct. 3, 1967 E. E. RASMUSSEN 3,344,885

PERSONNEL LIFT

Filed May 2, 1966 3 Sheets-Sheet 1

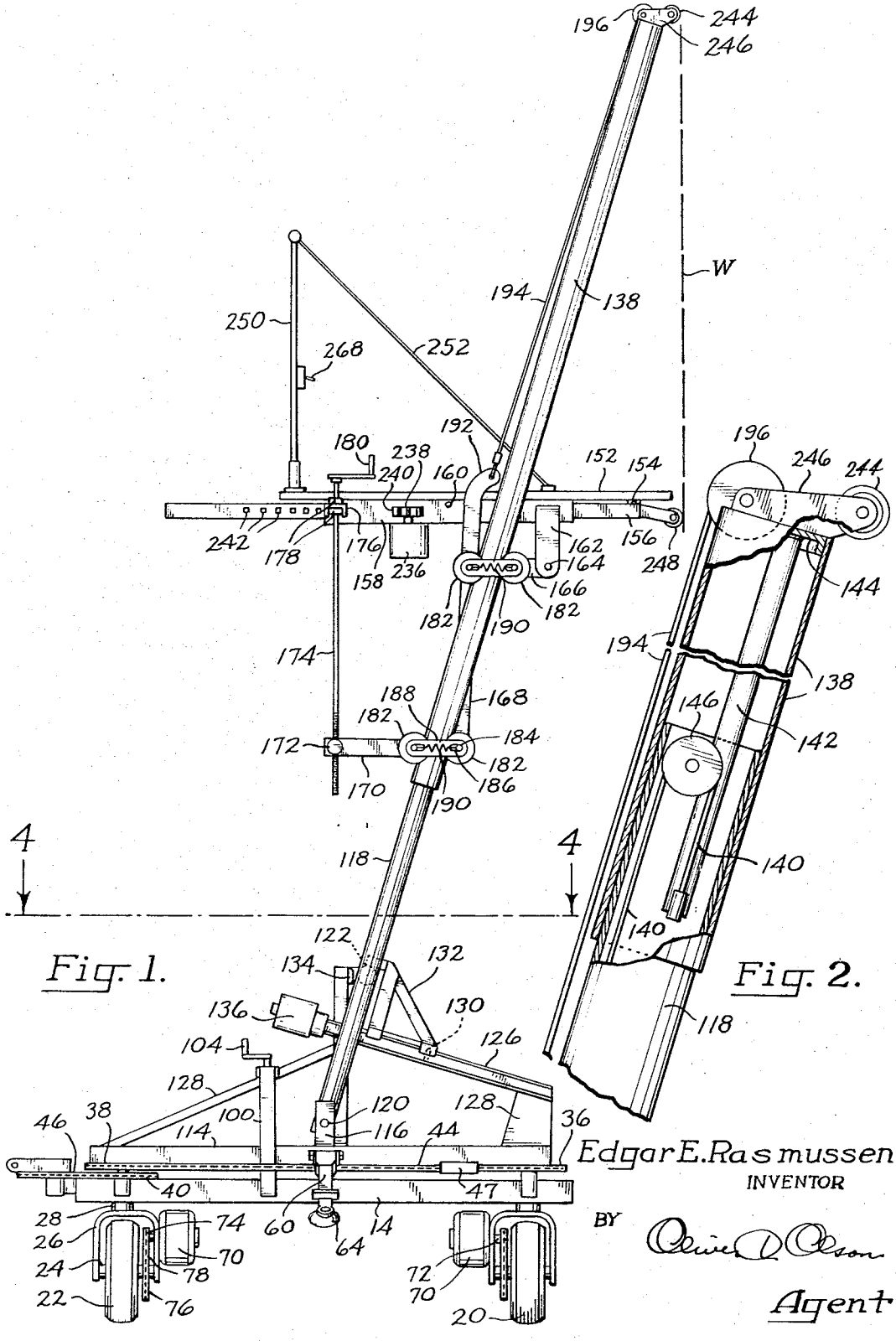


Fig. 1.

Fig. 2.

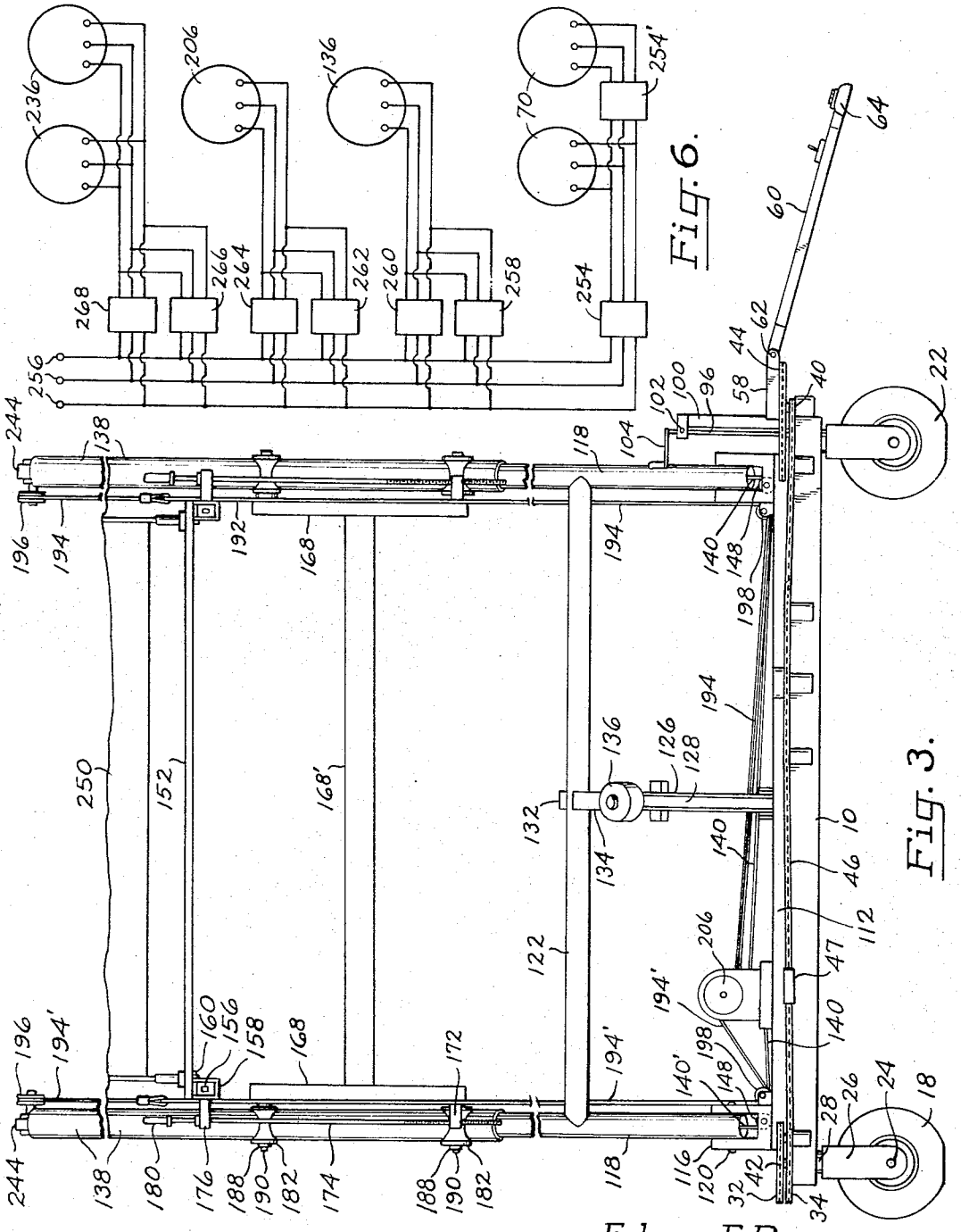
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PERSONNEL LIFT

Filed May 2, 1966 3 Sheets-Sheet 3

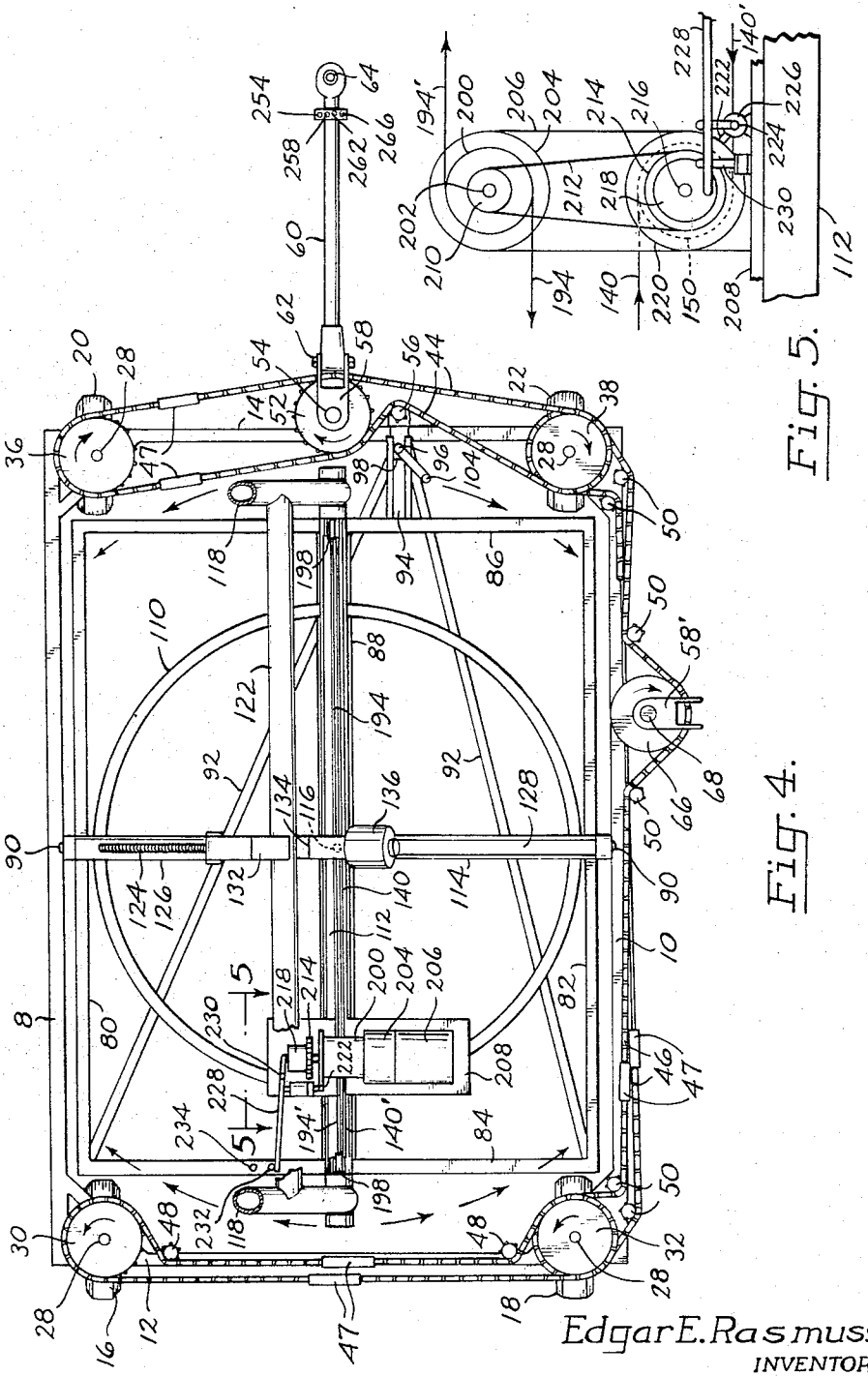


Fig. 5.

Fig. 4.

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3,344,885

PERSONNEL LIFT

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6 Claims. (Cl. 182—16)

This invention relates to personnel lifts, and more particularly to a mobile lift by which personnel may be elevated to desired working stations above the ground.

It is the principal object of the present invention to provide a personnel lift which is adjustable vertically, horizontally and rotationally with respect to a base, to accommodate the positioning of personnel at desired elevations above level or uneven ground, for painting and repairing buildings and other structures and for performing other tasks of maintenance, servicing and construction.

Another important object of this invention is the provision of a personnel lift of the class described which is mobile and highly maneuverable in confined spaces.

Still another important object of the present invention is the provision of a personnel lift of the class described which is of rugged construction, providing maximum safety in use, and is of simplified construction for economical manufacture.

The foregoing and other objects and advantages of this invention will appear from the following detailed description, taken in connection with the accompanying drawings in which:

FIG. 1 is a view in front elevation of a personnel lift embodying the features of the present invention;

FIG. 2 is a fragmentary foreshortened elevation, partially sectioned, of the upper portions of the telescoping booms;

FIG. 3 is a foreshortened side elevation as viewed from the left in FIG. 1;

FIG. 4 is a sectional view taken on the line 4—4 in FIG. 1;

FIG. 5 is a fragmentary sectional view taken on the line 5—5 in FIG. 4; and

FIG. 6 is a schematic diagram of an electric circuit for the control motors of the apparatus.

Referring to the drawings, the personnel lift of the present invention includes a rectangular main frame provided by the side frame members **8** and **10**, rear frame member **12** and front frame member **14**.

The main frame preferably is rendered mobile by support upon the two rear wheels **16**, **18** and the two front wheels **20**, **22**. Further, in the preferred embodiment illustrated, these wheels are mounted such that they all constitute steerable wheels, and they are interconnected for simultaneous steering in a manner to provide the frame with minimum turning radius.

Accordingly, each wheel is supported upon an axle **24**, supported between the spaced legs of a U-shaped yoke member **26**. A pivot shaft **28** extends upward from the closed end of the yoke member and is journaled in a bearing mounted adjacent a corner of the main frame. Secured to the upwardly projecting end of the shaft of the rear wheel **16** is a sprocket **30**. The projecting end of the shaft of the other rear wheel **18** mounts the two sprockets **32** and **34**. In similar manner, the shaft mounting the front wheel **20** on the same side of the main frame that carries the shaft for the rear wheel **16**, supports the sprocket **36**, and the shaft of the front wheel **22** on the same side of the main frame as the shaft for the rear wheel **18** supports the two sprockets **38** and **40**.

In the preferred embodiment illustrated, longitudinally adjustable turnbuckles **47** are interposed in the opposite stretches of each of the chains **42**, **44** and **46**. These serve to provide proper chain tension and also to adjust the wheels to proper alignment.

A continuous chain **42** engages and extends between the sprockets **30** and **32** at the rear of the main frame. A similar continuous chain **44** engages and extends between the sprockets **36** and **38** at the front end of the main frame. A third continuous chain **46** engages and extends between the sprockets **34** and **40** on the shafts of the rear and front wheels **18** and **22**, respectively.

Idler sprockets **48**, supported by the rear frame member **12** of the main frame, serve to guide the chain **42**. Similar idler sprockets **50** on the side frame member **10** of the main frame serve to guide the chain **46**.

The stretches of the chain **44** at the front end of the main frame, between the sprockets **36** and **38**, engage a steering sprocket **52** mounted for rotation on the shaft **54** carried by the front frame member **14** of the main frame. An idler sprockets **56**, mounted adjacent the steering sprocket, maintains the chain in positive engagement with the sprocket. A steering yoke member **58** is secured for rotation with the steering sprocket **52**, and is adapted for releasable attachment of the steering lever **60**, as by means of the connecting bolt **62**. The projecting end of the steering lever may be provided with the socket component **64** of a conventional ball and socket trailer hitch, whereby the mobile frame may be connected to a powered vehicle for transport.

An auxiliary steering sprocket **66** is mounted for rotation on the shaft **68** carried by the side frame member **10** of the main frame, and this sprocket engages an intermediate portion of the chain **46** intermediate the sprockets **34** and **40**. The auxiliary sprocket also is provided with a yoke member **58'**, substantially identical to the yoke member **58**, for releasable connection of the steering lever **60**. Manual steering of the mobile frame thus may be accomplished either from the front or side, as conditions of use dictate.

It is to be noted (FIG. 4) that the chain **46** is wrapped about the front sprocket **40** in the direction opposite its wrapping about the rear sprocket **34**. It is by this means that rotation of either of the steering sprockets in one direction effects rotation of the front wheel shafts **28** in the same direction, with simultaneous rotation of the rear wheel shafts in the opposite direction. By thus turning the front and rear wheels in opposite directions, the turning radius of the main frame is reduced to a minimum. The front and rear wheels may be turned to right angles relative to the longitudinal axis of the frame. This enables the frame to be manipulated with ease through confined areas and around sharp corners. This feature is of particular advantage when the personnel lift is used for painting the outside of a building where shrubbery and other obstructions would otherwise present problems in obtaining proper position.

The wheeled frame may be moved about by manual power, although it is preferred that a drive source be provided. In the embodiment illustrated, such source is provided by the electric motor **70** (FIG. 1) one associated with each of the front wheels. Each motor is mounted upon the supporting wheel yoke **26** and its output shaft **72** is connected to the associated wheel through the sprockets **74**, **76** and chain **78**.

The main frame supports within it a secondary frame formed of the side frame members **80** and **82**, the rear frame member **84** and the front frame member **86**. A central, longitudinal frame member **88** interconnects the rear and front frame members **84**, **86** to reinforce the frame. This secondary frame is supported by the main frame for pivotal movement on the common transverse axis of the pivot pins **90** which mount the secondary frame on the main frame. Reinforcing braces **92** extend from under the rear corners of the secondary frame and converge forwardly beyond the front frame member **86** where

they join a tongue member **94** which projects forwardly from said front frame member.

The bottom end of an elongated threaded adjustment screw **96** is connected to the projecting tongue **94** for rotation on its longitudinal axis and for limited pivotal movement on a transverse axis substantially parallel to the axis of the pivot pins **90**. The elongated screw extends upwardly through a threaded collar **98** which is mounted at the upper end of the bracket **100**. The collar is secured to the bracket against rotation but for limited pivotal movement, by such means as the transverse pins **102** the common axis of which is substantially parallel to the axis of the pins **90**. An offset handle **104** is secured to the projecting upper end of the screw to facilitate hand manipulation.

By means of the adjustment screw the secondary frame may be pivoted on the axis of the pins **90** relative to the main frame. The primary purpose of this adjustment is to maintain the secondary frame horizontal in the event the main frame is supported upon inclined or uneven ground which disposes the main frame in an inclined position in its longitudinal direction.

A circular turntable track member **110** is secured to the secondary frame with its center on the transverse axis of the pivot pins **90**. Mounted upon and guided by this track member is a base which functions as a turntable. This base is constructed of the elongated crossed beams **112** and **114**, and a pivot pin **116** interconnects these beams and the underlying central longitudinal frame member **88** of the secondary frame.

Adjacent the opposite ends of the beam **112** are secured the upstanding U-shaped supports **116**. Each of these supports pivotally mounts the lower end of an elongated, hollow lower boom member **118**, by means of the pivot pin **120**. A transverse brace member **122** interconnects the spaced boom members **118** to stabilize the latter and to interconnect them for simultaneous pivotal movement about the common axis of the pins **120**. In the embodiment illustrated, such pivotal movement is effected by means of the elongated screw **124** mounted for rotation in the elongated guide channel member **126** supported on the beam **114** of the base by the supporting brackets **128**. The screw engages a threaded collar **130** on the adjustment bracket **132** which slidably engages the channel member for movement longitudinally thereof in either direction as the screw is rotated in the appropriate direction. The adjustment bracket **132** projects upwardly to intercept the cross brace **122**, whereby to support the lower booms in various positions of angular adjustment. Projecting upwardly from the channel member **126** is a stop member **134** which intercepts the transverse brace **122** on the side opposite the adjustment bracket **132**. The stop member is positioned to limit pivotal movement of the lower booms in the counterclockwise direction (FIG. 1) such that the booms always tend to rotate clockwise and thus always bear against the adjustment bracket, in any desired position of angular inclination.

Although the adjustment screw **124** may be rotated manually by such means as a hand crank, it preferably is rotated by the illustrated gear reduction unit and electric motor **136** secured to the channel member **116**.

Slidable telescopically over each of the lower booms **118**, over a substantial range of extension and retraction, is an elongated, hollow upper boom **138**. Means for extending and retracting the upper boom relative to the lower boom is provided, in the embodiment illustrated, by the pair of cables **140** and **140'**, one associated with each boom assembly. Thus, one end of the cable **140** is secured to the lower end of an elongated post **142** which is secured at its upper end to a bracket **144** at the upper end of the upper boom. The post terminates at its lower end within and somewhat above the lower end of the upper boom. The cable extends upward from the post and is trained over a guide pulley **146** mounted for rotation within the lower boom at the upper end thereof. The cable then extends downward and out through the open lower end of the lower boom. The cable then passes around a guide pulley **148** mounted rotatably on the turntable beam **112**, and its adjacent end is secured to the winch drum **150** (FIG. 5). The other cable **140'** is associated in identical manner with the other boom assembly, and its lower terminal end is secured to the same winch drum **150** in such manner that both cables will be drawn in or payed out simultaneously upon rotation of the drum in the appropriate direction. The means for rotating the drum is described in detail hereinafter.

A personnel supporting platform **152** is mounted between the spaced boom assemblies for movement longitudinally and transversely thereof. Thus, in the embodiment illustrated, the platform is secured adjacent its forward end, by such means as the pins **154**, to the forward ends of a pair of laterally spaced, elongated, hollow rods **156**. These rods are confined slidably within a pair of laterally spaced channel guide members **158**. Each guide channel member is open at its upper end, and a bolt **160** extends between the spaced sides thereof across the upper side of the rod **156**, to confine the latter removably in the guide channel member.

Each of the guide channel members is supported adjacent one of the boom assemblies for movement longitudinally thereof. Thus, a bracket **162** is secured at one end to the guide member adjacent the forward end thereof, and projects downward therefrom. The lower end of this bracket is connected by the pivot pin **164** to the forward end of the upper horizontal section **166** of a mounting bracket. The rearward end of this upper horizontal section joins the upper end of the vertical, intermediate section **168**, and the lower end of this intermediate section joins the forward end of the lower horizontal section **170**. A brace **168'** interconnects the spaced intermediate sections **168**. The rearward end of the lower horizontal section pivotally supports a projection **172** which is provided with a threaded transverse opening. This opening receives the elongated threaded rod **174** which projects vertically upward therefrom through an opening in a bracket **176** projecting laterally outward from the guide channel member **158** adjacent the rearward end thereof. A pair of spaced collars **178**, secured to the rod **174** adjacent the upper end thereof, confines the bracket **176** between them, whereby the rod is held against axial displacement relative to the bracket but is permitted to rotate. The upper end of the rod is provided with an offset crank **180** to facilitate such rotation.

The upper and lower horizontal sections of the bracket each supports a pair of spaced guide wheels **182** which confine the associated boom assembly between them. The wheels of each pair are mounted upon shafts **184** which extend through horizontally elongated slots **186** in the associated bracket section and also through similarly elongated slots **186** in the connecting link member **188** disposed on the side of the boom opposite the bracket section. A resilient spring **190** interconnects the shafts of each pair of wheels, at each end of the shafts. In this manner the wheels of each pair are movable resiliently toward and away from each other to permit movement of the wheels across the juncture between the lower and upper booms. This arrangement also accommodates leveling of the platform to horizontal position by the adjustment rods **174** as the boom assemblies are adjusted to various angular positions.

Means is provided for moving the platform assembly along the length of the boom assemblies. In the embodiment illustrated, the lower ends of a pair of link members **192** are connected pivotally to the bracket sections **166** associated with both boom assemblies. Cables **194** and **194'** are secured one to each link member. Each cable extends upward over a guide pulley **196** mounted at the upper end of the upper boom, and thence downward along the side of the boom assembly and under a

guide pulley **198** mounted on the beam **112** of the turntable base. The cables then extend toward and are secured to the winch drum **200** (FIG. 5) in such manner that both of them are drawn in or payed out simultaneously upon rotation of the drum in the appropriate direction.

The winch drum **200** is secured to the output shaft **202** of a gear reduction unit **204**, the input of which is connected to the driven shaft of an electric motor **206**. The gear reduction unit and motor are mounted upon a plate **208** secured to the beam **112** of the turntable base. The output shaft of the gear reduction unit also carries a sprocket **210** which is connected through the chain **212** to a sprocket **214** mounted freely on the shaft **216**. A clutch unit **218** releasably interconnects the sprocket **214** and shaft **216**, and this shaft supports the winch drum **150** for rotation therewith. The shaft also supports a locking disc **220** for rotation therewith, and this disc is provided with a radial projection **222** which is adapted to be releasably engaged by the retractable stop pin **224** which is reciprocative in a sleeve **226** secured to the plate **208**.

A lever **228** pivotally interconnects the upturned end of the stop pin **224** and the clutch unit **218** and is mounted on the pivot **230** projecting from the plate **208** for pivotal adjustment to the positions determined by the stop lugs **232** and **234** (FIG. 4). Thus, upon movement of the lever in one direction the stop pin is retracted from the path of the projection **222** and the clutch unit is moved to engage the sprocket **214** with the shaft **216**. Conversely, when the lever is moved in the opposite direction the clutch unit is moved to disengage the sprocket **214** from the shaft **216** and the stop pin **224** is moved to intercept the projection **222**.

It is to be noted that when the upper boom **138** of each boom assembly is moved relative to the lower boom **118**, with the platform **152** remaining in fixed position relative to the upper boom, the amount of cable **140**, **140'** taken up or payed out from the winch drum **150** must be one-half the amount of cable **194**, **194'** payed out from or taken onto the drum **200**. Accordingly, the sprocket **214** associated with the drum **150** is twice the size of the sprocket **210** associated with the drum **200**.

With the clutch unit engaged and the stop pin **224** retracted, both drums are rotated simultaneously. With the clutch unit disengaged and the stop pin extended to intercept the projection **222**, the sprocket **214** rotates freely on the shaft **216** while its associated drum **150** is secured against rotation. Operation of the motor **206** thus enables the platform **152** to be moved vertically along the boom assemblies without moving the upper boom **138** relative to the lower boom **118**.

Means also is provided for moving the platform **152** transversely between the boom assemblies. In the embodiment illustrated, such means is provided by the synchronous electric motors **236** one mounted on each of the spaced channel guide members **158**. The output shaft of each motor carries a gear **238** which extends through an opening **240** in the channel guide member and engages the rack teeth **242** provided along the length of the rod **156**.

A resiliently surfaced roller **244** is mounted at the upper end of each of the upper booms **138**, on a bracket **246** which may also support the pulley **196**. The roller projects laterally therefrom in the direction in inclination of the boom assemblies. These rollers thus are disposed for rolling engagement with a vertical wall W or other structure, to provide support for the upper ends of the boom assemblies. A similar wall engaging roller **248** is mounted on the forward end of each of the rods **156** for cooperation with the rollers **244**, to enhance the stability of the lift assembly.

An upstanding wall **250** may be provided at the rearward side of the platform **152** as protection against falling from the latter. Stabilizing rods or cables **252** may be employed to interconnect the platform and the rear wall to stabilize the latter.

FIG. 7 illustrates electrical circuitry for controlling the various electric drive motors. Thus, the drive wheel motors **70** are connected through the reversing switches **254** and **254'** to the terminals **256** of a source of electric supply. The electric motor **136** for controlling the angular position of the boom assemblies is connected preferably through the pair of reversing switches **258** and **260**, arranged in parallel, to the supply terminals. The electric motor **206** for controlling the vertical extension and retraction of the boom assemblies and platform is connected through the pair of reversing switches **262** and **264**, arranged in parallel, to the supply terminals. The pair of electric motors **236** for controlling the horizontal adjustment of the platform **152** are connected through the pair of reversing switches **266** and **268**, arranged in parallel, to the supply terminals.

The reversing switches **254** and **254'** for the drive wheel motors and one of each of the pairs of switches, for example switches **258**, **262** and **266** for the other drive motors, are mounted adjacent the outer end of the steering lever **60** for convenient manipulation. An electrical connector is mounted adjacent each of the steering sprockets **52** and **66** for connecting these switches into the associated electric circuits for either position of the steering lever **60**. The other switches of the pairs, namely switches **250**, **264** and **268**, are mounted on the protective wall **250** at the rearward end of the platform **152**, for convenient manipulation by the person carried on the platform.

In the following description of operation of the personnel lift, let it be assumed it is desired to employ the lift for painting the outside wall of a building. While steering the vehicle, the operator manipulates the reversing switches **254** and **254'** to drive the wheels in the appropriate direction to manipulate the vehicle into proper position adjacent the building wall. In the event the vehicle thus positioned is on inclined or uneven ground, so that the vehicle frame is inclined in its longitudinal direction, the operator manipulates the crank handle **104** in the proper direction to bring the secondary frame to horizontal position. Further, if the main frame is not disposed square to the building wall, the operator may apply manual force to the turntable assembly to pivot the latter and the supported boom assemblies and platform to properly aligned position with respect to the wall.

Assuming the platform **152** is in its lowermost position of adjustment and it is desired to extend the upper booms **138**, the operator pivots the lever **228** to the position in which the clutch unit **218** connects the sprocket **214** to the shaft **216** and the locking pin **224** is retracted from the locking projection **222**. The operator then manipulates the reversing switch **262** to energize the electric motor **206** in the direction to wind in the cables **140**, **140'** on the drum **214**, thereby causing the upper booms to extend. Simultaneously with this action the drum **200** rotates to pay out twice the length of cable **194**, **194'** as the length of cable being wound in on the drum **214**. Accordingly, the platform **152** remains in its lowermost position while the upper booms extend.

The operator now pivots the lever **228** to a position in which the stop pin **224** is extended to intercept the locking projection **222** and the clutch unit **218** disengages the sprocket **214** from the shaft **216**.

Having extended the booms to the desired height, the operator now may enter upon the platform **152**. If the platform is not level, he manipulates the crank **180** to rotate the threaded rods **174** in the appropriate direction to pivot the platform assembly about the pivot pins **164** until the plafotrm is brought to level condition.

The operator now manipulates the reversing switch **264** to energize the electric motor **206** in the direction to wind in the cables **194**, **194'** on the drum **200**. The platform assembly thus is pulled upward along the boom assem-

blies until the desired elevation above the ground is reached.

Assuming that the forward end of the platform previously had been retracted to its rearwardmost position, the operator now manipulates the reversing switch **268** to energize the electric motors **236** in the direction to move the platform forwardly until the rollers **248** engage against the building wall. The apparatus now is in properly adjusted position for commencement of painting the building wall.

It will be apparent to those skilled in the art that various changes in the number, size and arangement of parts described hereinbefore may be made without departing from the spirit of this invention and the scope of the appended claims.

Having now described my invention and the manner in which it may be used, what I claim as new and desire to secure by Letters Patent is:

1. A personnel lift comprising

(a) a frame,

(b) a turntable means mounted on the frame for rotation on a substantially vertical axis and for pivotal movement on an axis normal to said vertical axis,

(c) a pair of longitudinally adjustable, laterally spaced telescoping booms mounted at their lower ends on the turntable means for pivotal movement on an axis parallel to the plane of the turntable means,

(d) platform mounting means supported between the booms for movement longitudinally thereof and having a platform engaging section and a boom engaging section adjustable relative to each other,

(e) adjustable leveling means interengaging the sections of the platform mounting means for adjusting the platform engaging section to horizontal position, and

(f) a platform supported on the platform engaging section and between the booms for movement transversely of the latter.

2. The personnel lift of claim **1** including drive means interengaging the platform and platform engaging sections for moving the platform relative thereto.

3. The personnel lift of claim **1** including

(a) a plurality of steerable wheels on the frame,

(b) a vertically disposed shaft mounting each steerable wheel on the frame,

(c) a sprocket on each shaft,

(d) drive chain means engaging the sprockets, and

(e) a steering sprocket mounted on the frame and engaging the chain means.

4. A personnel lift of claim **3** wherein the steerable wheels comprise a pair of front wheels and a pair of rear wheels, and the drive chain means engages the sprockets in such manner as to cause the front and rear wheel mounting shafts to rotate in opposite directions.

5. The personnel lift of claim **3** wherein

(a) the steerable wheels comprise a pair of front wheels and a pair of rear wheels,

(b) the drive chain means comprises a pair of chains one of which engages the sprockets on the shafts mounting the front wheels and the other of which engages the sprockets on the shafts mounting the rear wheels,

(c) a connecting sprocket is secured to one of the shafts associated with each of the chains, and

(d) connecting chain means engages the connecting sprockets in such manner as to cause the front and rear wheel shafts to rotate in opposite directions.

6. The personnel lift of claim **5** including

(a) an auxiliary steering sprocket associated with the connecting chain means,

(b) a control lever, and

(c) connecting means on each steering sprocket for securing the control lever selectively thereto.

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