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Wehmeyer

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[54] **MOBILE SCAFFOLDING**

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[51] **Int. Cl.** **E04g 1/22**

[58] **Field of Search** 182/141, 148, 63, 69, 16, 182/13, 14; 254/122; 52/109; 60/6, 7

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[57] **ABSTRACT**

There is disclosed a mobile scaffolding which is powered by self contained electrical storage batteries. The electric drive is mechanically linked to the lift mechanism of the scaffolding by mechanical means comprising screw means and a mating nut means interconnected by rolling means to provide a high efficiency coupling. The lift mechanism employs very compact spring means which is biased to extend the lift mechanism from its contracted position to provide a force that supplements the electric drive when the mechanism has the most unfavorable lever moment for extension of the scaffolding. The unit has a self contained power means for mobility and a self contained directional control means with remote control means whereby the entire unit can be controlled from the scaffolding platform with a single lever that actuates the lift, drive and steering motors.

17 Claims, 7 Drawing Figures

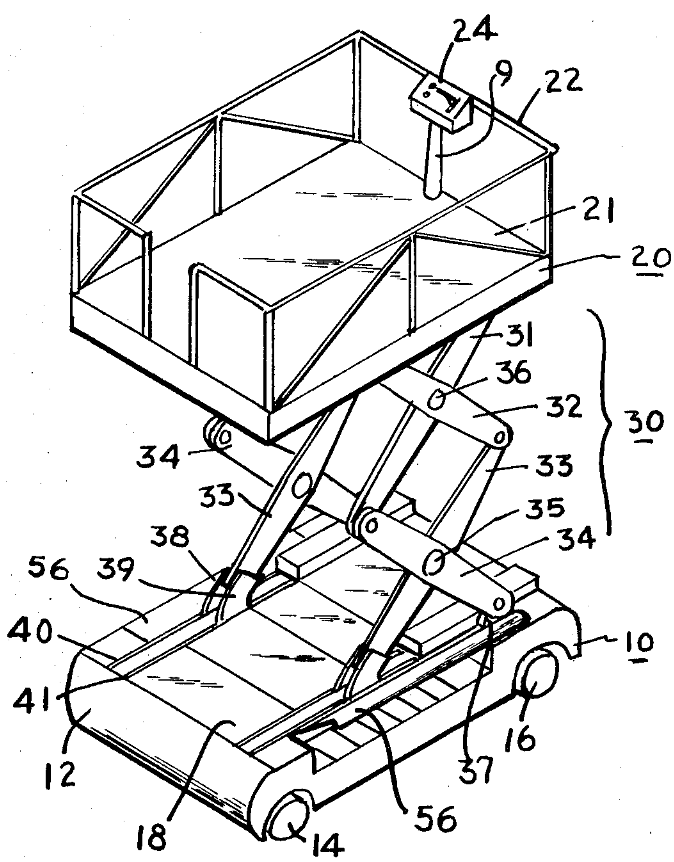


FIGURE 4

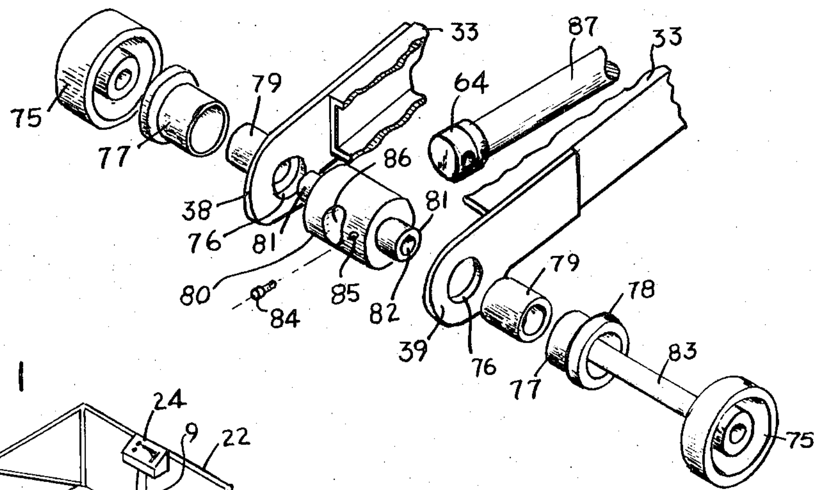


FIGURE 1

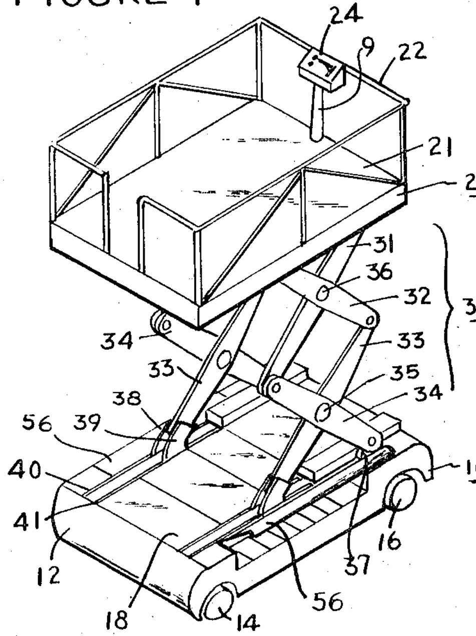
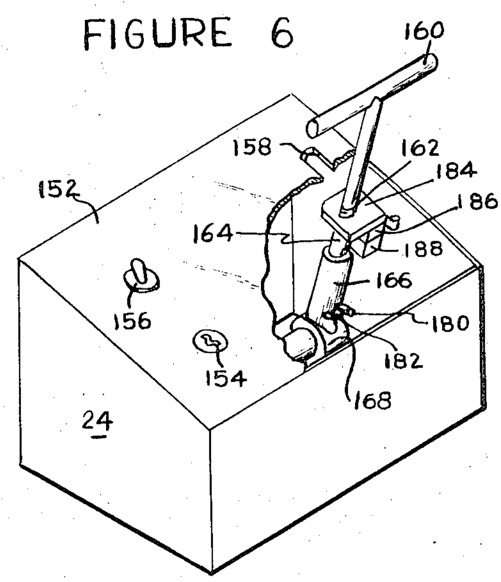


FIGURE 6



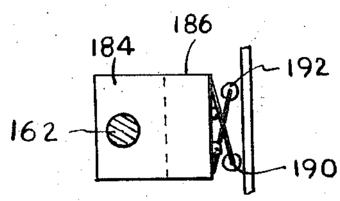


FIGURE 7

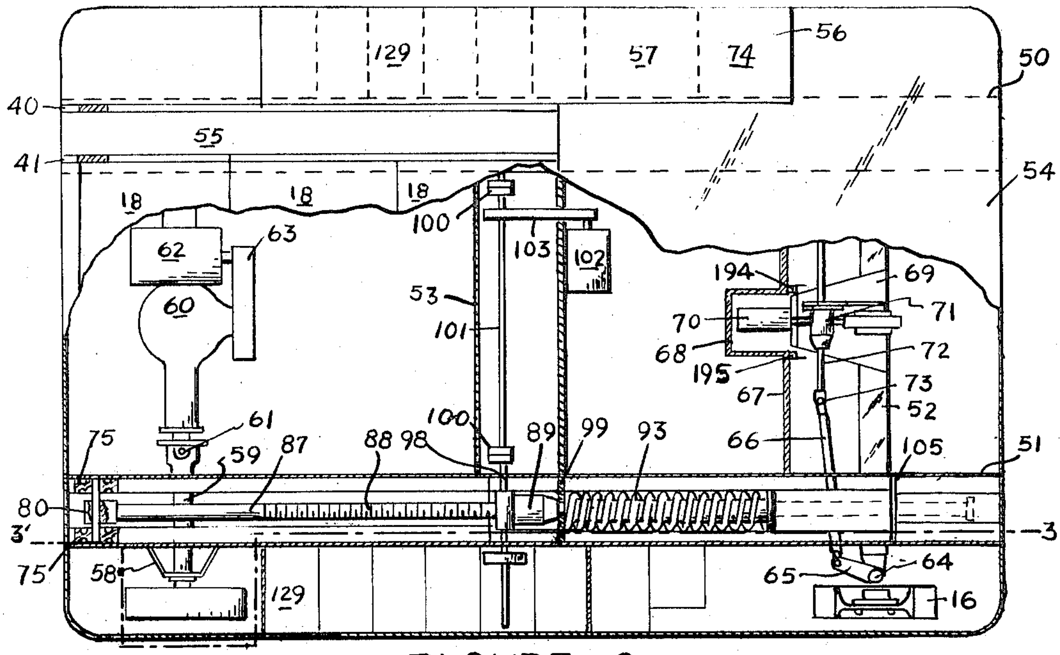


FIGURE 2

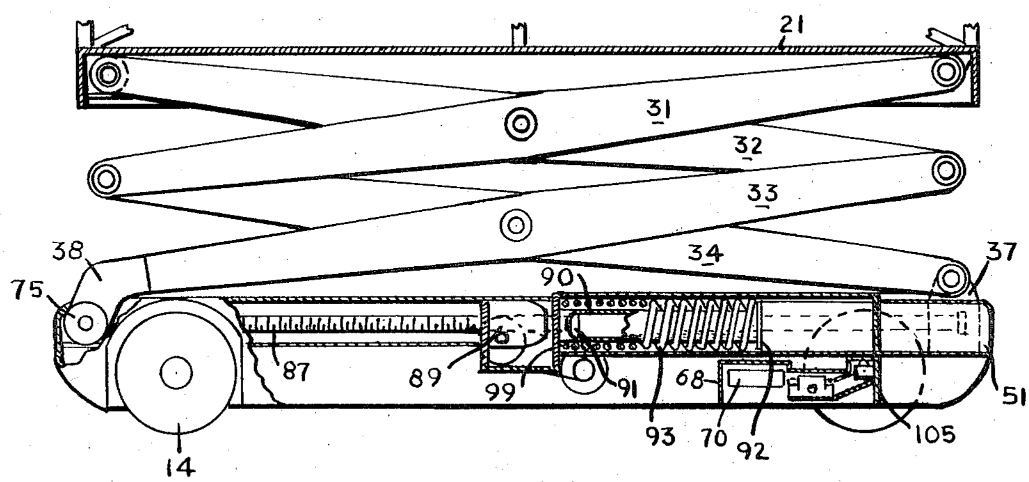
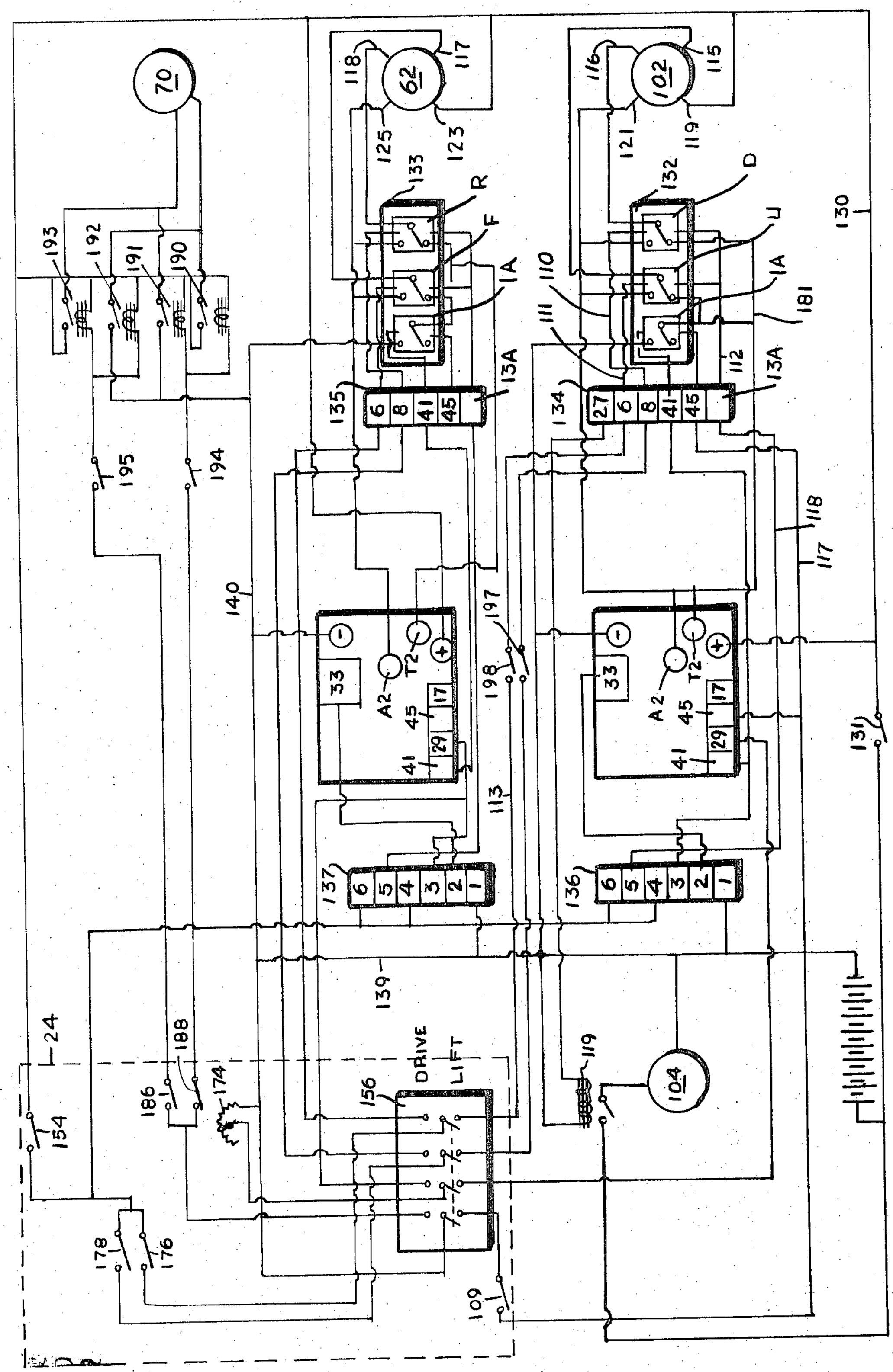


FIGURE 3


DRIVE
LIFT

MOBILE SCAFFOLDING

DESCRIPTION OF THE INVENTION

This invention relates to mobile scaffolding and, in particular, to a mobile unit having an electric drive and a mechanical lift mechanism.

The construction industry, particularly that of tilt up wall construction employs scaffolding to a large extent for installation of ceilings and overhead utility facilities. This construction is used largely for warehouse and industrial building construction. The foundation and floor are generally poured concrete and the walls are formed as concrete panels which are cast on the floor and are then tilted upright and secured in place. These walls can be from about 8 to 30 feet in height. Generally, all the utility facilities, electrical wiring or water or gas plumbing, etc., are installed overhead, directly beneath the roof.

Fixed or immobile scaffolding has been used to support workmen near the roof, however, workmen are needed at many different locations under the roof and the construction of fixed scaffolding at each of these locations is time consuming and costly.. Mobile scaffolding which can be moved about the building without dismantling has been used. This scaffolding comprises a mobile base with a work platform that can be elevated by jacks carried by the unit. These jacks have, without exception, been hydraulically actuated and generally have been powered by a gasoline engine that is mounted on the unit. Gasoline engines are objectionable for indoor work and require a substantial ventilation of the building when in use. While electric motors would be more desirable as a power source, their use has been limited by the inefficiency of the hydraulic mechanism used with the conventional mobile scaffolding.

Mechanical lifting mechanisms, however, have not been used for this service because of the large lifting force that is required during the initial actuation of the lift when the lift mechanism provides the least favorable lever arm for the lifting force. Consequently, the direct use of a mechanical drive lift mechansim has necessitated a compromise in lift design, e.g., either the scaffolding must be too high in the collapsed position or it fails to extend as high as desirable.

An extremely efficient mechanical drive means for use in the lift unit is a screw with mating screw engagement means having rolling contact with the screw. The screw means can be combined with electric motive power means in a highly efficient, portable or mobile scaffolding unit having a minimum collapsed height and maximum extended height. I have found that such a mechanical drive mechansim can be used with a portable scaffolding device provided that compact resilient means are provided to bias against the platform or any of the members of the extendible assembly linking the platform to the base when the platform is in its retracted position. The compact resilient means comprises at least one massive compression spring which is coaxially placed about the lift screw so that it is compressed when the platform is collapsed and is operative to release its stored force to supplement the lift power means when the platform is extended.

The mobile scaffolding of this invention comprises: a base, wheels carried thereon, electric power means linked to at least one of the wheels to provide mobility to the base, directional control means to pivot at least one of the wheels and provide steering of the base, a platform, an extendible assembly mechanically interconnecting said platform and base and comprising at least one pair of arm members joined together in a pivotable connection at an intermediate point of their length, platform attachment means securing a pair of free ends of the extendible assembly to the platform and base attachment means securing the free ends of the opposite end of the assembly to the base, while permitting the sliding engagement of at least one of either or both of said pairs of free ends with its respective platform or base, lift means operatively attached to at least one end of the extendible assembly comprising screw means transversely positioned to the direction of extension of the assembly, screw engagement means cooperative therewith, electrical lift motor means, interconnecting means linking said motor in rotational driving connection to one of said screw and screw engaging means to one of said pair of free ends whereby rotational movement of said motor effects extension and retraction of the assembly, and resilient means coaxial with the screw means and operative to engage the extendible assembly in its retracted position and to resiliently urge movement of said assembly from its retracted position whereby the force stored in the resilient means by retraction of the assembly is available for supplementing the force of said electric lift motor means to extend the assembly through the positions having the most disadvantageous lever moments. In its preferred embodiments, the scaffolding has remote control means carried on the platform to control the actuation of the lift mechanism and the movement of the unit about the building. The entire operation of the unit can be controlled by a single hand control that actuates switches in the respective circuits for the drive power means, the directional control power means or the lift motor means.

The invention will now be described with reference to the FIGURES, of which:

FIG. **1** illustrates the mobile scaffolding unit in its most extended position;

FIG. **2** is a plan view of the base of the unit;

FIG. **3** is a sectional view along the line **3—3'** of FIG. **2**;

FIG. **4** illustrates the slidable connection of the extendible assembly;

FIG. **5** illustrates the electrical circuit of the unit; and

FIGS. **6** and **7** illustrate the hand control of the unit.

Referring now to FIG. **1**, the mobile scaffolding unit comprises a base **10**, a platform **20** and an extendible assembly **30** mechanically interlinking the platform and the base.

Base **10** has a protective cover **12** with sidewalls. The unit has a pair of rear wheels **14** and a pair of forward wheels **16**. The rear of base **10** is covered by a plurality of cover plates **18**. The forward pair of wheels **16** are steerable and are mounted on base **10** with means permitting their axes to be turned to the right or left of the base.

The platform **20** has a floor **21** with a protective railing **22** about its periphery and an open section for access at its rear end. If desired, the railing can fold away from the platform or a gate can be furnished for the open section. At its front end, the platform preferably carries a control console or pedestal **9** which supports an instrument and control box **24** for operation of the unit.

The extendible assembly **30** comprises at least one and, preferably, two pairs of arm members **31, 32, 33** and **34** which are pivotably interconnected at points intermediate their lengths, at hubs **35** and **36.** For maximum stability, these pairs of arm members are duplicated at each side of the scaffolding unit and are identified by common numbers. Each assembly has one pair of its free ends, e.g., the upper ends of arm members **31** and **32,** attached to the platform and, at its opposite end, has the free ends of its arm members, e.g., the lower ends of arm members **33** and **34** attached to the base **10.** The attachment means at the front of the base can be bracket members **37** which are supported on the frame of the base. A similar pair of bracket members can be provided on the forward edge of the undersurface of platform **20.**

The extendible assemblies **30** are vertically extendible and, accordingly, at least one of each pair of free ends of the assemblies is attached to either the base or platform by means permitting its sliding engagement therewith. While the free ends of both arm members **31** and **32** can slidably attach to the platform and the free ends of both arm members **33** and **34** can slidably attach to the base, it is preferred that only one of each of these pairs be slidably attached to its respective base or platform. This is shown in FIG. **1** where the lower end of the arm members **33** of each of the assemblies is slidably attached to the base **10.** The ends of these members are secured to curved flange plates **38** and **37** which extend through grooves **40** and **41** and into the housing of base **10.** The upper ends of members **32** bear rollers which are free to move in channels on the underside of the platform. The remaining member of each pair of free ends is secured to its respective platform or base by brackets.

All the power and drive mechanisms for the unit can be contained within the housing of base **10,** including the electrical energy storage means, motive power means for propulsion of the unit, its directional control and extension of the platform.

FIGS. **2** and **3** illustrate the construction and assembly of base **10.** The base is formed by a pair of longitudinal beams **50** and **51** that run the length of the base. These can be formed of sheet metal welded to provide an upright, open channel. Two transverse beams are provided; **52** at the front of and **53** intermediate the lengths of the longitudinal beams. A sheet **67** also extends transversely across the base a short distance behind beam **52** and has an offset pocket **68** at the midline of base **10.** The front of base **10** is covered by plate **54** while the rear portion is covered by plates **18** which extend between beams **50** and **51.** The plates have a short lip that overhangs the inside wall of these beams to hold them in place. A narrow plate, **55,** is secured over the channel and provides open slots **40** and **41** along each beam.

Cover plate **54** extends to about 12 inches of both edges of the unit. The remainder of the top comprises a hinged cover **56** at each side of the unit as shown in FIG. **1.** Beneath the hinged cover are compartments for the control circuit components **57,** battery charger **74** and the electrical batteries **129** which are placed six at each side.

The longitudinal beams have apertures near their rear ends and support outboard brackets **58** in line with the apertures. The rear axles **59** extend through the apertures and through a bearing support carried by bracket **58.** A conventional differential **60** is supported on the midline of the base **10** with its axles extending to universal joints **61** that connect to axles **59.** Other means such as flexible couplings can also be used in lieu of the universal joints. The power drive to the differential comprises electric motor **62,** a conventional direct current motor of suitable voltage, e.g., 6 to 42 volts, that is linked by sprockets and chain **63** to the differential input shaft.

The forward wheels **16** are mounted on axles having upright spindles that are journaled at **64** by a sleeve carried at the outboard end of beam **52.** A trailing arm **65** projects from the wheel spindle and is pivotably secured to a tie rod **66.** The inboard end of rod **66** is secured to shaft **72** by a ball joint coupling **73.** The steering motor and its mechanical linkage are mounted at the front center of base **10.** The motor **10** fits into the pocket or housing **68** in transverse sheet **67** and is supported by bracket **69** that is carried by beam **52.** The shaft of motor **70** is connected to gear box **71.** Shaft **72** projects through gear box **71** and has a mid section bearing screw threads which engage a mating nut in gear box **71.** The nut is secured to a pinion gear that is meshed with a worm gear which is connected to the motor shaft so that rotation of the motor effects side to side movement of rod **66.**

The lift assembly, as previously described, comprises two pairs of interconnected arms at each side of the unit. The arms are preferably formed by welding together the edges of two channels to form a hollow beam having the illustrated shape. The lower ends of arms **34** are pivotably secured on base **10** by brackets **37** which are secured to the forward ends of the longitudinal beams **50** and **51.** The lower end of arm **33** is secured to plates **38** and **39** which project into base **10** and are mounted therein in sliding engagement with wheels such as **75** that are contained within channel beams **50** and **51** and that roll on the inside bottom of these channel beams.

FIG. **4** illustrates the construction of the lower end of the arms **33.** Plates **38** and **39** are secured, preferably by welding to the opposite sides of the arms **33.** The plates are bored at **76** and collar **77** is fitted into each bore. The collar has an annular flange **78** which fits against the outer side of the plate and can be secured thereto by welding or other suitable means. A bronze bushing **79** is placed within collar **77.** Mounted between the plates **38** and **39** is cylindrical block **80.** This block has trunions **81** at each end and a central bore **82** to accomodate shaft **83.** The bosses **81** fit in bearing relationship to bushing **79.** Bore **85** is tapped transversely through block **80** and set screw **84** is provided to lock shaft **83** in the block after assembly of the elements. The wheels **75** are similarly carried on shaft **83** with a bushing. Block **80** is bored at **86** and and the end of shaft **87** is threaded into one end of clevis **64** which is free to pivot with its opposite end having a bore for shaft **83.**

Each of the shafts **87** bears screw means, threads **88,** as shown in FIGS. **2** and **3** for the right side shaft. These shafts lie within the channel beams **50** or **51.** Each shaft **87** projects through a gear housing **89** and a flange plate **99** which extends across the channel directly forward of gear housing **88.** The end of shaft **87** which is opposite block **80** projects into tubular member **90** and bears a collar **91** that is secured thereto by threads, welding or the like. Tubular member **90** has an end plate which is bored to receive shaft **87** in a sliding fit and which serves as a stop to collar **91.** The opposite end of member **90** is open and bears annular collar **92** about its outer periphery.

Resilient means comprising compression spring **93** is mounted about member **90** and is biased between flange **99** and collar **92.** The retraction of the extendible assembly into the position shown in FIG. **3** compresses resilient springs **93.** The springs are selected so that the dead weight of the platform and extendible assembly is sufficient to compress the springs, thereby insuring that in the event of failure of the lift motor, the unit can still be retracted.

The gear housings **89** comprise conventional units wherein screw threads **88** engage in rolling contact at a nut that is driven by a worm gear on shaft **98.** While other gear drives could be used, the drive with rolling contact is preferred for its high efficiency. A commercially available gear drive that can be used for this is a ball screw "Jactuator" described in U.S. Pat. No. 3,178,958 and manufactured by the Duff-Norton Company, North Carolina. The nut of this unit, which is driven by screw threads on shaft **98** has a helical race for ball bearings to provide a recirculating, rolling contact with the threads on shaft **98.** This gear drive is preferred for its high efficiency. Other gear drives, e.g., a direct worm gear be used, if desired. The shafts **98** are coupled through flexible couplings **100** to shaft **101** that is mechanically linked by chain **103** to electric motor **102.** The outboard end of shaft **98** extends through gear housing **89** and bears brake means **104.** Any conventional brake means can be used, preferably the brake has a solenoid which is biased to lock the brake and is unlocked by the application of a direct current voltage to the solenoid coil. The brake should also have manual means for its release and at least one of shafts **98** is extended, as shown, so that a crank can be attached to the shaft to permit manual lowering of the lift platform.

Resilient spring means **93** are effective throughout the initial movement of the arms of the extendible assemblies from their positions shown in FIG. **3.** The springs should be compressed against the assembly during translation of the arms through an arc from their compressed position, shown in FIG. **3.** to an angle of about 45°, preferably about 40° to the axis of the screw shaft **87.** The arms in the embodiment shown in FIG. **3** have an angle to this axis when in the compressed position of about 7°. Consequently, the springs are under compression when the arms are at an inclined angle to the axis of shafts **87** of from 7° to 40°. Other embodiments can have varied minimum angles of inclination from 2° to about 15°, however, with most embodiments, the maximum angle of about 45°, for compression of the springs would be applicable.

During the initial movement of the assemblies from their retracted position, the vertical component of force applied to the assemblies from the motor **102** and through gear housings **89** is at a minimum value. In the absence of the springs, a considerable force would need to be exerted to lift even the unloaded platform because of the unfavorable lever moment provided to the lift motor. Springs **93,** however, elastically release their stored force to supplement the force of motor **102** and permit substantially the entire force of motor **102** to be applied to lifting of any load on platform **20.**

The resilient spring means are coaxial with the screw means to form a very compact power unit. Placement of these compression springs in the indicated position avoids expanding the structure to any significant degree and insures a minimum collapsed height to the unit.

As the extendible assemblies are advanced to full extension, shafts **87** are moved forward in their channels **50** and **51.** The position of the forward end of these shafts is shown by the broken lines in FIGS. **2** and **3.** The forward ends project past flanges **105** which are transversely positioned in the channels and which have a central bore through which the shafts project.

In a typical embodiment of the portable scaffolding as illustrated herein, the unit has a lift capacity of 2,000 pounds with a lift motor of 3.25 horsepower, a drive motor of 2.25 horsepower and a steering motor of 0.5 horsepower, all at 36 volts. The unit has twelve six volt batteries and has a useful work period of 10 hours continuous use between recharging cycles. This is sufficient for about 5 days of normal use. The extendible height of the scaffolding platform **20** above the floor surface is 20 feet and the collapsed or retracted height is 4.5 feet. The unit has a maximum ground speed of 7 miles per hour and a minimum lift time of from 30 to 40 seconds at the rated capacity load of 2,000 pounds.

The entire unit can be controlled with a single hand lever which is mounted in a control box **24.** The control box is illustrated in FIG. **6** and the control circuit for the unit, including that of the control box, is shown by FIG. **5.** The circuit of the control box is shown at the left of FIG. **5** within the box defined by the broken lines.

The control box **24** has a hinged cover panel **152** that supports a key switch **154** and a manual four pole, double throw selector switch **156.** The two throw positions of this switch are identified as Lift and Drive on FIG. **5.** The cover is slotted at **158** and a T-bar handle **160** protrudes through this slot. The handle has a threaded shaft **162** that is turned into a tapped bore of tube **164.** The latter tube is slidably mounted in a larger diameter tube **166,** the base of which bears journal **168** that is mounted on and secured to shaft **170.** Shaft **170** is the shaft extension from the accelerator master switch, not shown. The shaft has a segment gear mounted on it that drives a pinion gear which in turn rotates the wiper of potentiometer **174,** shown in FIG. **5.** The shaft also bears cams which move the levers of each of switches **176** and **178** also shown in FIG. **5.** When the handle is pushed forward in slot **158** and pivots shaft **170,** the cams of switch **176** are actuated. Depending upon the position of selector switch **156,** this will close the contacts to the up relay of the contactor panel **132** or the forward relay of contactor panel **133.** When the handle is pulled back in slot **158,** it pivots shaft **170** and actuates the cam of switch **178.** Again, depending upon the position of selector switch **156,** this either closes the contacts of the down relay of panel **132** or the contacts of the reverse relay of panel **133.** The operation of these relays will be described in greater deail hereinafter.

A compression spring, not shown, is in tube **166** and seats against journal **168.** The spring is biased against the lower end of tube **164** and this tube is retained in tube **166** by pin **180** that extends from a transverse bore in tube **164** outwardly and into an inverted T-groove **182.** The spring urges the handle assembly of tube **164** and handle **160** upwardly so that pin **180** seats in the upright leg of groove **182,** thereby locking the handle assembly against rotation about its axis. When the handle is depressed against the tension of the spring, it can then be rotated left or right, the pin **180** following the horizontal legs of the groove **182.**

The upper end of tube **164** bears a bracket **184** to which are secured two normally open microswitches **186** and **188.** These switches have spring arms which support rollers **190** and **192** that bear against the side of the control box **150.** A view of the bracket and switches appears in FIG. **7.** As the handle **160** is rotated clockwise about its axis, the switch lever of switch **188** is moved into contact with its spring arm and is depressed against this arm sufficiently to close its contacts. Switch **188** actuates the relays of the steering motor **124** to cause the motor to turn the forward wheels towards the right. Switch **186** actuates other relays to reverse the current through motor **124** and turn the wheels to the left.

The steering motor **70** and its normally open relays **190, 191, 192** and **193** are shown at the upper right of FIG. **5.** The positive lead **130** is connected to the coils of the relays and to the contacts of relay **193** and **190** while negative lead **140** is connected to the contacts of relays **191** and **192.** When switch **186** is closed by clockwise rotation of handle **160** and when selector switch **156** is in the Drive position, the coils of relays **192** and **193** are grounded to the negative lead **140** through normally closed left limit switch **194.** The limit switch is mounted on the unit near gear box **71** so that when the wheels have turned the maximum degree the contacts of this switch are opened by engagement with the left end of shaft **72** or by left tie rod **66.** Closing of the contacts of relays **192** and **193** permits current to flow from lead **130** through the relay contacts, the windings of motor **70** to negative lead **140.** When the wheels have turned the maximum degree to the left, the contacts of limit switch **194** will be forced open, breaking the circuit to the relay coils. Closing of the contacts of microswitch **188** by counterclockwise movement of handle **160** will close the contacts of relays **190** and **191** and cause current to flow through relay **190,** the windings of motor **70** in an opposite direction than previously described, the contacts of relay **191** and through limit switch **195** whichch will open when the wheels have turned the maximum degree to the right. which

The control circuits for the lift and drive motors are based on commercially available circuit components which have silicon controlled rectifiers, SCRs. Each motor control circuit employs a silicon controlled rectifier panel, a contactor panel and a pulse monitoring trip card. Both motors are controlled with a single accelerator master switch, which as previously mentioned is actuated by handle **160.**

The silicon controlled rectifier circuit employs a SCR to provide a pulsed input to the motor contacts at a frequency of 50 to 300 times per second. The duration of the closed motor contact period is a fixed value determined by the rate of charge of a fixed capacitor in the silicon controlled rectifier panel while the duration of the open motor contact period is variable and is determined by the rate of charge of a capacitor which is in series with a potentiometer in the accelerator master control circuit. The wiper of the potentiometer is mechanically linked to the accelerator control so that the resistance can be varied; high resistance limiting the current flow to charge the turn-on capacitor and thereby limiting the frequency of on cycles to the motor and low resistance, conversely, increasing the number of on cycles and increasing the duration of the on time to the motor. The potentiometer, previously mentioned, is shown at **174** in FIG. **5.**

The motors operate on the average voltage supplied to them. A low frequency of on cycles is the same as a steady state low voltage so that the motors turn slowly and their speed increase with increasing frequency of on cycles, i.e., increasing average voltage. Some refinements of the circuit, as it is commercially available, include placing a diode across the motor terminals so that induced current can flow through the motor windings during the off cycles, greatly increasing the efficiency of the motor operation.

The components for the lift and drive motor control circuits are available from the General Electric Company and are described in detail in the General Electric publication **RKE-151,** Static Control for Electric Vehicles. These components are illustrated in FIG. **5** in the integrated circuit for the scaffolding unit.

The lift motor is shown at **102** and the drive motor at **62.** The armature contacts of these motors are shown at **119** and **121** and **123** and **125** for motors **102** and **62** respectively. The field or stator contacts are **115** and **116** and **117** and **118.** The terminals of the armatures and fields of the motors are connected through magnetic contactor panels **132** and **133.** These panels each have three relays, two of which are opposite acting double throw relays and are identified as D and U on panel **132** and R and F on panel **133.** The connections to the switch contacts of these relays are shown while the relay actuating coils are omitted to simplify the drawing.

The positive lead **130** from batteries **129** is connected, through circuit breaker **131,** to an armature contact of each motor, **119** and **123.** The other armature contact of the lift motor **102** is connected to the normally open switch terminals of down relay D and up relay U in the magnetic contactor panel **132.** The armature contact **125** of motor **62** is similarly connected to the normally open terminals of the reverse relay R and the forward relay F of the magnetic contactor panel **133.** One of the stator contacts of each motor, **115** and **117,** is connected to the switch pole terminal of the up relay U and the forward relay F of its respective panel **132** or **133.** The opposite stator contacts **116** and **118** are connected to the switch pole terminal of the down relay D and reverse relay R of their respective panels **132** and **133.** The normally closed terminals of the relays are commonly connected to terminal **T2** of their respective SCR control circuit.

The circuit through the motor and its contactor panel is described herein with regard to lift motor **102.** The current flows from positive lead **130** through the armature of the motor, the closed contacts of the up relay U, to stator contacts **115,** through the field of the motor **102** to line **181** through the normally closed contacts of the down relay D to contact T2 of the SCR panel and, in a controlled pulsing, through SCR panel to the negative contact of the panel. When the up and down relay switches are reversed, the current flows through the armature, through the down relay D to stator contact **116,** through the field of motor **102** in an opposite direction to that previously described to line **181** through the normally closed contacts of the up relay U.

The actuating coils for the relays of the magnetic contactor panels are not shown, however, the connecting leads to these coils are shown in FIG. **5** as line **110** from terminal **8** and line **111** from terminal **6** of terminal connector strip **134** which lead to the coils of the down relay D and up relay U, respectively. The opposite terminals of the relay coils have a common lead **112** which extends to terminal **13**A of the terminal connector strip **134.**

The selector switch **156** connects switches **176** and **178** into the control circuit for the drive motor **62.** With the selector switch in the lift position, closing of switch **176** by moving lever **160** forward will permit current to flow from the positive lead **130,** through lead **113** and the lift up limit switch **198** to contact **6** of the terminal connector strip **134.** This contact is connected to the coil of the up relay U, the opposite terminal of which is connected to terminal **13A** of terminal connector strip **134.** Lead **115** connects 13A to contact **5** of the safety card **136.** Contact **5** of this card is internally connected to the negative terminal **1** by a safety circuit which disconnects the internal connection in the event that excessive voltage appears across terminals **2** and **3** of the card. Terminals **4** and **6** of the card are connected to the positive lead and are connected to an internal circuit which requires that the external circuit to terminal **5** be opened to reset the card in the event that the internal connection is opened by an overload condition.

When the hand control lever **160** is moved fully forward, the cam on shaft **170** closes switch **109** and current flows to the coil of relay **1**A of the magnetic contactor panel through lead **117** and terminal **45** of the terminal connector strip **134.** The common connector on the normally closed terminals of the down and up relays is connected through relay **1A** to negative lead **139,** bypassing lead **181** and the SCR control circuit and permitting full voltage operation of the motor.

Whenever the lift motor circuit is actuated, current flows from terminal **27** of terminal connector strip **134,** through the coil **119** of the solenoid of brake **104,** releasing this brake.

The limit switches for the lift motor **102** are located on the unit so that the up limit switch **198** is opened when the assembly is fully extended and the down limit switch **197** is opened when the assembly is fully retracted.

While the preceding discussion has been directed to actuation and operation of the lift motor in the up mode, the operation of the closely related circuit to actuate the down mode and the related circuits to actuate the drive motor in forward and reverse are substantially identical. The actuating switch for the drive motor comparable to **109** is not illustrated; its employment, as well as switch **109** and the **1**A relay bypass circuit for the lift motor, is optional.

The invention has been described with regard to the illustrated and presently preferred mode of practice. It is not intended that this specific illustration be unduly limiting of the invention. Instead, it is intended that the invention be defined by the means and their obvious equivalents set forth in the following claims.

What is claimed is:

1. A mobile scaffolding machine having:

a platform;

a base, axle means carried thereon, wheels on said axle means whereby said scaffolding is mobile;

an extendible assembly mechanically interlinking said platform and base and comprising at least one pair of arm members joined together in a pivotable connection at an intermediate point of their length;

platform attachment means securing a pair of free ends of said extendible assembly to said platform;

base attachment means securing the opposite pair of free ends of said extendible assembly to said base;

said attachment means including longitudinal channel means carried on each of said platform and base and wheeled means engaged therein and carried by at least one of each of the pairs of free ends of said assembly to permit its sliding engagement with its respective platform or base;

lift means operatively attached to at least one end of said extendible assembly comprising screw means positioned transversely to the direction of extension of said assembly, screw engagement means cooperative therewith, electric lift motor means, interconnecting means linking said motor in rotational driving relationship to one of said screw and screw engagement means and means securing at least one of said pair of free ends at said one end of said extendible assembly to at least one of said screw and screw engagement means whereby rotational movement of said motor effects the extension and retraction of said assembly;

resilient means comprising compression coil spring means carried on said scaffolding coaxially with said screw means to engage said extendible assembly between its retracted position and a partially extended position having said arm members at an angle no greater than about **45** degrees to the horizontal and to urge extension of said assembly from said retracted position to said partially extended position whereby the force stored in said resilient means by retraction of said assembly is available for supplementing the force of said motor means through the positions of said assembly having the most disadvantageous lever moments to said screw means.

2. The scaffolding machine of claim **1** wherein said base carries: electric power means, means linking said power means to at least one of said wheels to drive said scaffolding, directional control power means, means linking said control power means to at leat one of said wheels to steer said scaffolding, and a source of electrical energy with connector means to said electric power means.

3. The scaffolding machine of claim **1** wherein said extendible assembly comprises two assemblies of arms located at each side thereof.

4. The scaffolding machine of claim **3** wherein each of the extendible assemblies of arms comprises four arms pivotably interconnected.

5. The scaffolding machine of claim **4** wherein each of said platform and base attachment means includes a set of fixed brackets at one end of said scaffolding.

6. The scaffolding machine of claim 5 wherein screw and screw engagement means are positioned at each side of the scaffolding base.

7. The mobile scaffolding machine of claim 1 wherein said screw means comprises at least one screw rod longitudinally carried by said base with one end thereof secured to said one end of said extendible assembly and the opposite end thereof extending to said interconnecting means, the latter comprising a rotating nut drive member engaged by said screw rod in a thread drive housing.

8. The mobile scaffolding machine of claim 7 wherein said free end of said screw rod extends past said threaded drive housing and into sliding engagement with a tubular member having a flanged abutment and coxially supporting said compression coil spring means between said abutment and said threaded drive housing.

9. A mobile scaffolding machine comprising:

a rectangular mobile base with dirigible wheels;

a pair of spaced-apart parallel channel means located on opposite sides of said base, each of said channel means having a pivot fixture located at one end thereof;

a separate dolly means reciprocally confined in each of said channel means;

a first screw rod having one end connected to one of said dolly means and extending coasially therefrom in its associated channel means toward its pivot fixture;

a second screw rod having one end connected to the other of said dolly means and extending coaxially therefrom in its associated channel means toward its pivot fixture;

a first thread drive housing fixedly mounted intermediately of one of said channel means and having a rotating nut drive member engaging the threads of said first screw rod;

a second thread drive housing fixedly mounted intermediately of the other of said channel means and having a rotating nut drive member engaging the threads of said second screw rod;

drive means in each of said housing for rotating its drive nut member;

a rigid cross shaft interconnecting said drive means of said housings for simultaneous rotation thereof;

an electric drive motor drivingly connected to said cross shaft where said dolly means can be simultaneously advanced and retracted relative to their respective pivot fixtures;

a pair of vertically oriented scissor-type lift arms, one of said pair connected between one of said dolly means and its pivot fixture and the other of said pair connected between the other of said dolly means and its pivot fixture whereby a work platform connected to said pair of vertically oriented lift arms is raised and lowered as said dolly means are simultaneously reciprocated in their associated channel means.

10. The mobile scaffolding machine as defined in claim 9 wherein a compression spring is coaxially mounted between each threaded drive housing and the end of its screw rod extending therefrom toward its associated pivot fixture whereby said compression spring will be compressed as its associated dolly moves away from its pivot fixture.

11. The mobile scaffolding machine of claim 10 wherein said compression springs are operative only to bias their associated screw rods when said scissor-type lift arms are between their most retracted position and a partially extended position having said arms at an angle no greater than about 45 degrees to the horizontal and to urge extension of said lift arms from their retracted position to said partially extended position whereby the force stored in said compression springs by retraction of said lift arms is available for supplementing the force of said motor through the positions of said lift arms having the most disadvantageous lever moments to said screw rods.

12. The mobile scaffolding machine as defined in claim 9 wherein the electric drive motor is a variable speed drive motor so the speed of simultaneous movement of said dolly means in their associated channels can be controlled.

13. The mobile scaffolding machine defined in claim 12 wherein the electric drive motor is a DC drive motor and its speed is controlled with a control circuit employing a SCR operable to pulse the drive motor at different frequencies to selectively change its speed.

14. The mobile scaffolding machine defined in claim 13 wherein a control circuit is provided to change the pulse rate of the SCR, said control circuit having a manually operated device for changing the pulse rate of the SCR circuit.

15. The mobile scaffolding machine defined in claim 14 wherein the manually controlled device includes a lever means which includes a reversing switch and a potentiometer whereby advancing the lever from a neutral position in one direction will cause the motor to drive clockwise at a rate proportional to the displacement of said lever from a neutral position and the advance of said lever from said neutral position in the other direction will cause said motor to rotate in a counter-clockwise manner proportional to the distance said lever is moved from said neutral position.

16. The mobile scaffolding machine as defined in claim 15 wherein the lever means is mounted on the work platform whereby the ascent and descent of the platform can be controlled directly therefrom.

17. The mobile scaffolding machine as defined in claim 15 wherein the rectangular mobile base with dirigible wheels includes an electric drive motor and the control circuit can be switched so the lever means can be utilized to control the movement of said mobile base in speed and direction.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,817,346 Dated June 18, 1974

Inventor(s) DONALD T. WEHMEYER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Change Inventor's address from "276 Mountain Cir., Fountain Valley, Calif. 94517" to --276 Mountaire Cir., Clayton, Calif. 94517--.

Signed and sealed this 7th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents