

July 10, 1962

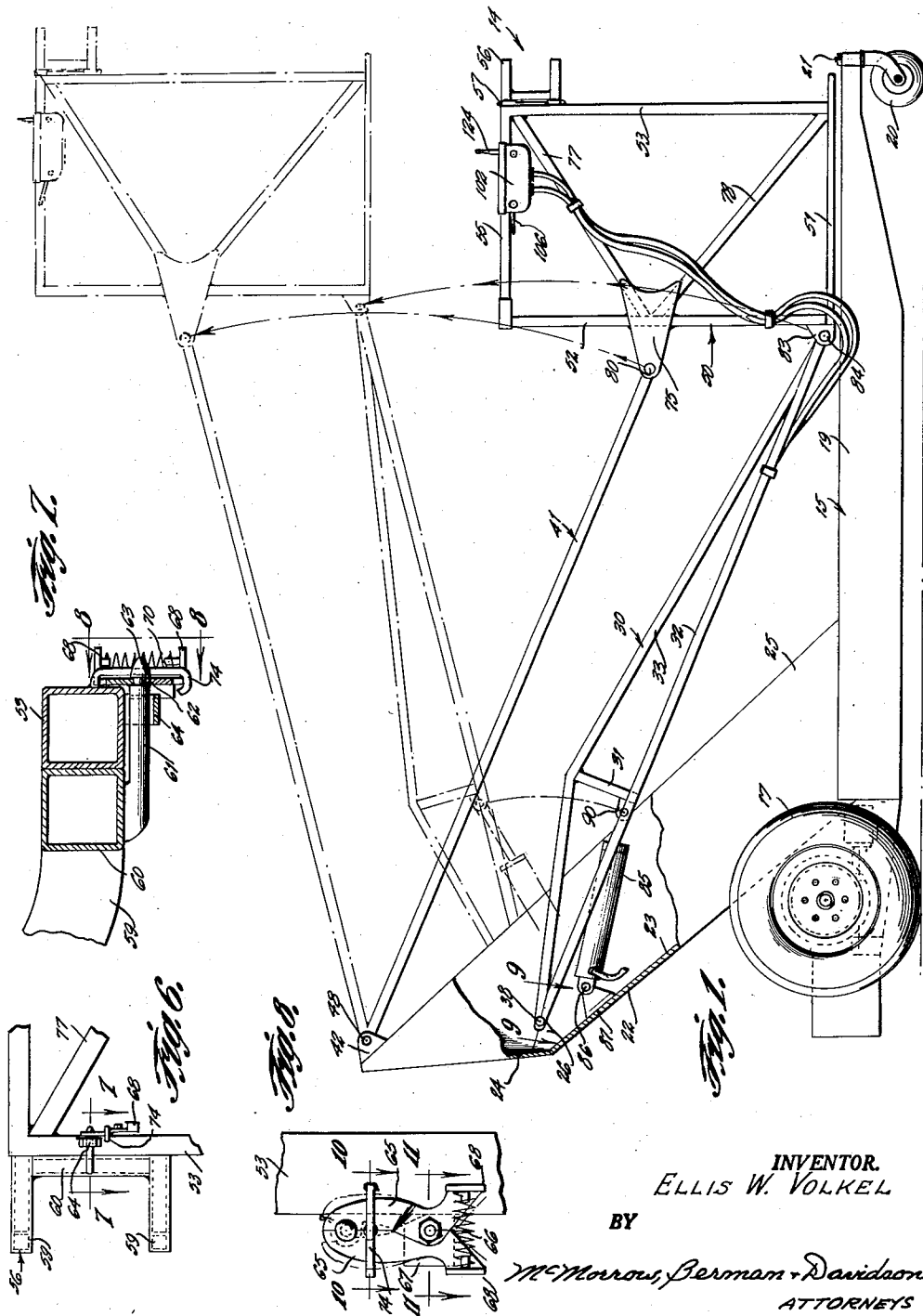
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MECHANIZED LADDER DEVICE

Filed June 2, 1961

3 Sheets-Sheet 1



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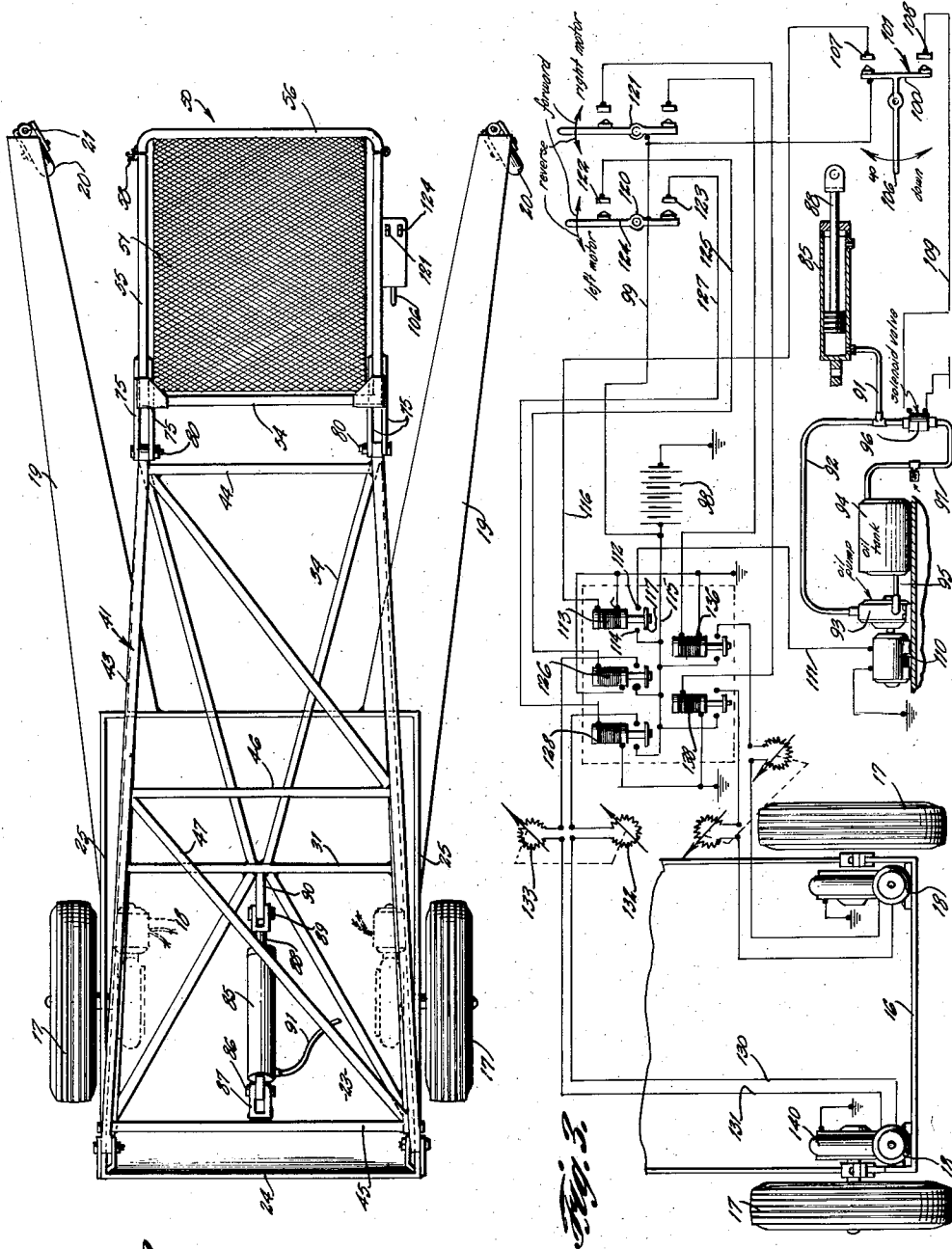


Fig. 1

Fig. 2

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MECHANIZED LADDER DEVICE

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Filed June 2, 1961, Ser. No. 121,289

4 Claims. (Cl. 182-2)

This invention relates to mechanical ladder devices, and more particularly to a mechanically adjustable platform structure for supporting a worker in an elevated position.

A main object of the invention is to provide a novel and improved adjustable mechanical ladder device including a worker-supporting platform, the device being relatively simple in construction, being highly maneuverable, and being easy to operate.

A further object of the invention is to provide an improved self-propelled mechanized ladder device which involves relatively inexpensive components, which is durable in construction, and which is safe to use.

A still further object of the invention is to provide an improved self-propelled aerial platform device which is relatively compact in size, which is completely portable, and which may be easily and safely maneuvered by a worker using same, even with the supporting platform element thereof in an elevated position.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a side elevational view, partly in vertical cross section, of an improved mechanized ladder device constructed in accordance with the present invention.

FIGURE 2 is a top plan view of the device of FIGURE 1.

FIGURE 3 is an electrical wiring diagram showing the circuit connections of the various electrical elements employed in the mechanized ladder device of FIGURES 1 and 2.

FIGURE 4 is a perspective view of the upper tension link frame forming a part of the ladder device of FIGURES 1 to 3.

FIGURE 5 is a perspective view of the main lifting frame employed as the lower linkage component of the ladder device.

FIGURE 6 is an enlarged fragmentary elevational view showing the latch mechanism employed to fasten the hinged gate element of the worker-supporting platform forming part of the mechanized ladder structure of FIGURES 1 to 5.

FIGURE 7 is an enlarged horizontal cross sectional view taken substantially on the line 7-7 of FIGURE 6.

FIGURE 8 is a fragmentary elevational view taken substantially on the line 8-8 of FIGURE 7.

FIGURE 9 is an enlarged cross sectional view taken substantially on the line 9-9 of FIGURE 1.

FIGURE 10 is a cross sectional view taken substantially on the line 10-10 of FIGURE 8.

FIGURE 11 is a cross sectional view taken substantially on the line 11-11 of FIGURE 8.

FIGURE 12 is an enlarged perspective view of one of the pivoted latch jaws employed in the latch assembly shown in FIGURE 6.

FIGURE 13 is a vertical cross sectional view taken through the solenoid release valve employed in the hydraulic system of the mechanized ladder device of FIGURES 1 to 12.

Referring to the drawings, 14 generally designates an improved mechanized ladder device constructed in accordance with the present invention. The device 14 comprises a supporting base 15 consisting of a bed 16 provided at its opposite sides with the respective supporting wheels 17, 17 journaled thereto and independently driven by respective reversible electric motors 18, 18. Rigidly secured to the supporting bed 16 are the forwardly di-

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verging elongated side bars 19, 19 provided at their ends with the casters 20, 20 depending therefrom and freely swiveled thereto. As is clearly shown in FIGURE 1, the casters 20 are freely rotatable around the axes of their vertical swivel shafts 21.

Rigidly secured to the bed 16 is an upwardly and rearwardly inclined upstanding trough-like supporting member 22 having the upwardly and rearwardly inclined bottom wall 23, the upstanding transverse wall 24 and the respective side walls 25, 25. A pair of upstanding pivot lugs 26, 26 are provided adjacent the opposite ends of the top marginal portion of the main wall 23 of member 22, said lugs being spaced from the side walls 25 in the manner clearly illustrated in FIGURE 9. Designated at 30 is a first frame structure which is employed as a bottom link element of the aerial platform mechanism, presently to be described.

The frame structure 30 comprises a transversely extending intermediate rectangular frame 31 rigidly connected at its ends to straight bottom side bars 32 and bent top side bars 33, as shown in FIGURE 5. Respective pairs of diagonally extending inwardly divergent brace bars 34, 34 and 35, 35 connect the joined ends of the bars 32 and 33 to the intermediate portion of the transversely extending frame panel 31, as is clearly shown in FIGURE 5, to provide a rigidly braced frame of substantial strength.

The rear ends of the joined frame bars are provided at their junctions with apertured pivot lugs 36, 36 which are received between the lugs 26 and the walls 25, as illustrated in FIGURE 9, and are pivotally connected thereto. Thus, respective bearing sleeves 37, 37 are provided in the apertured lugs 36, 36 and transversely extending fastening bolts 38 are engaged through the bearing sleeves 37, the heads 39 of the bolts bearing against the walls 25 and the bolts being fastened by nuts 40 threadedly engaged thereon and clamped against the lugs 26 and the inner ends of the sleeves 37, as shown in FIGURE 9.

Designated at 41 is a generally rectangular top link frame which is pivotally connected to respective upstanding pivot lugs 42 provided at the top ends of the walls 25, the frame 41 comprising the longitudinal side bars 43, 43 connected at their forward and rear ends by transverse bars 44 and 45 and at their intermediate portions by a transverse bar 46, and further braced by diagonal brace bars 47, as shown in FIGURE 4. The rear ends of the side bars 43, 43 are pivotally connected to the lugs 42 by pivot bolts 48, the pivot bolts 48 being transversely aligned so that the frame 41 is pivotally connected for rotation on a transverse axis spaced above the transverse axis defined by the pivot sleeves 37 and fastening bolts 38 employed to provide the pivotal connection of the lower link frame 30.

Designated at 50 is a platform member comprising a generally rectangular platform floor 51 provided with upstanding corner posts 52 at its rear corners and upstanding front posts 53, the top ends of the rear corner posts 52 being connected by a transverse rail 54 and the top ends of the corner posts 52 and the front posts 53 being connected by side rails 55. A swingable gate member 56 is hinged at 57 to the top portion of one of the front posts 53 and is releasably latched to the top portion of the opposite front posts 53 by a latch mechanism designated generally at 58.

As shown in FIGURE 6, the gate 56 comprises spaced top and bottom rail bars 59, 59, rigidly connected at their ends by vertical bars 60. The latch structure 58 comprises a horizontally extending locking bolt 61 rigidly secured to the vertical bar 60 at the free end of the gate 56, as shown in FIGURE 7, the bolt 61 being formed with an annular groove 62 at its forward end and with the tapered smoothly curved head portion 63. The bolt 61 extends transverse to the member 60 and is receivable

in a sleeve bracket 64 secured to the adjacent upstanding member 53, the bolt 61 being of sufficient length so that the groove 62 is engageable between a pair of pivoted locking jaws 65, 65, the jaws 65, 65 being pivotally mounted on a pivot bolt 66 extending through a lug 67 rigidly secured to the adjacent vertical post member 53, as shown in FIGURE 11. The jaws 65, 65 are provided with opposing vertical flanges 68, 68 having inwardly projecting guide pins 69, 69 engaging in the ends of a coiled spring 70 disposed between the flanges 68, 68 and biasing the lower ends of the jaws apart. The inner edges of the jaws 65 are formed above the pivot bolt 66 with opposing locking notches 71 adapted to engage in the annular locking groove 62 of the bolt member 61 in the manner illustrated in FIGURES 7 and 8. The inner edges of the upper portions of the jaws 65 are formed with further notches 72 adapted to receive an inwardly projecting stop pin 73 formed on a transversely extending, generally U-shaped stop bracket 74 secured at one end to the member 53, as shown in FIGURE 10, and engaging around the upper portions of the jaws 65 to limit the separation of said jaws. Thus, the end arms of the generally U-shaped bracket member 74 limit the separation of the upper portions of the jaws 65 whereas the inwardly projecting intermediate stop pins 73 limit the inward movement of the jaws towards each other by engaging in the lower notches 72 provided in the inner edges of the upper portions of the jaws.

As will be readily apparent, when the bolt 61 is engaged through the sleeve 64, it is guided between the opposing notches 71, 71 of the jaws 65, 65 and snaps into locking position with the groove 62 received in said notches and the head 63 projecting beyond the mating jaws 65, 65 in the manner illustrated in FIGURE 7.

The gate member 56 may be released by exerting manual squeezing force on the lower flanges 68, 68 of the jaws 65, 65, causing the upper portions of the jaws to be separated sufficiently to allow the bolt 61 to be retracted from the jaws, whereby the gate 56 may be swung open. The gate 56 cannot be opened unless the flanges 68, 68 are manually squeezed together to release the bolt member 61.

Respective pairs of parallel pivot lugs 75, 75 are secured to the intermediate portions of the upstanding corner post members 52 of platform 50, the inner corners of the lugs being rigidly secured on opposite sides of respective top and bottom brace bars 77 and 78 connected to the upper and lower corners of the side panels of the platform frame, as shown in FIGURE 1. The forward ends of the side bars 43, 43 of the upper link frame 41 are received between and pivotally connected to respective pairs of pivot lugs 75, 75, as shown at 80, 80. Respective apertured pivot lugs 81, 81 are provided at the forward ends of the joined frame elements of the lower link frame 30, said apertured lugs 81 being received between respective pairs of pivot lugs 83 provided at the bottom end portions of the post member 52 of the platform frame and pivotally connected thereto, as shown at 84. Thus, it will be seen that the link frames 30 and 41 are connected between the supporting member 22 and the aerial platform 50 to define a parallelogram linkage such that the aerial platform member 50 remains vertical at all times during the rotation of the link frames 30 and 41.

Designated at 85 is a fluid pressure cylinder which is pivotally connected at 85 to a U-shaped pivot bracket 87 secured to the upper intermediate portion of wall 22, but spaced below the link frame 30. Cylinder 85 is provided with the extensible piston element 88 pivotally connected at 89 to a lug 90 rigidly secured to and projecting rearwardly from the intermediate portion of the lower margin of the transverse frame 31 associated with the lower link frame 30. As shown in FIGURE 3, the rear end of the fluid pressure cylinder 85 is connected by a conduit 91 to the outlet conduit 92 of a hydraulic pump 93, so that

when the pump 93 is actuated, hydraulic fluid, such as oil, or the like, will be admitted into the rear end portion of the cylinder 85 to cause the piston rod 88 thereof to be extended. This rotates the lower link frame 30 upwardly, namely, in a counter-clockwise direction, as viewed in FIGURE 1, causing the platform 50 to be elevated. The platform 50 will be allowed to descend when the hydraulic fluid in cylinder 85 is allowed to discharge therefrom. As shown in FIGURE 3, the hydraulic fluid is supplied from a tank 94 whose lower portion is connected by a conduit 95 to the inlet port of the pump 93. Conduit 92 is connected to the upper portion of tank 94 through a normally closed solenoid valve 96. When the valve 96 is energized, the conduit 91 is connected to the return conduit 97 leading to the tank 94, which is at substantially atmospheric pressure, so that the weight of the platform 50 is sufficient to cause the platform to descend, since the hydraulic fluid will be forced out of the cylinder 85 and return to the supply tank 94. The valve 96 may be energized from a storage battery 98 suitably mounted on the main support 15 of the device, one terminal of the battery being grounded and the other terminal of the battery being connected to a wire 99 leading to the pole 100 of a control switch 101 mounted on the platform 50. Control switch 101 is housed in a suitable control box 102 secured to one of the side rails 55 of the platform. The switch 101 is provided with an operating lever 106 which projects out of the box 102 and is readily accessible to the person using the device. As shown in FIGURE 3, the wire 99 is connected to the pole 100 and the pole 100 is selectively engageable with a pair of contacts 107 or 108 responsive either to the upward or the downward rotation of the operating lever 106. The lower contact 108 is connected by a wire 109 to one terminal of the solenoid valve 96, the other terminal of the valve being grounded, as shown, so that when the lever 106 is rotated downwardly, the pole 100 engages the lower contact 108, energizing the solenoid valve 96 through a circuit comprising the ungrounded terminal of battery 98, the wire 99, the pole 100, the contact 108, the wire 109, the winding of the solenoid 96, and ground. As previously mentioned, this opens the solenoid 96 and allows the hydraulic fluid to discharge from the cylinder 85.

Pump 93 is driven by a motor 110 having one grounded terminal. The remaining terminal of the motor is connected by a wire 111 to one contact 112 of a relay 113, the remaining terminal 114 of the relay being connected to a wire 115 connected to the ungrounded terminal of battery 98. One terminal of the winding of relay 113 is grounded. The opposite terminal of said winding is connected by a wire 116 to the contact 107. Thus, when the operating lever 106 is moved upwardly, the contact 107 is engaged by the pole 100, connecting the winding of the relay 113 to the battery 98 by a circuit comprising the ungrounded terminal of battery 98, wire 99, pole 100, contact 107, wire 116, the winding of relay 113 and ground. Energization of the relay 113 energizes the motor 110 by a circuit comprising the ungrounded terminal of battery 98, wire 115, contact 112, the armature 117 of the relay, contact 112, wire 111, the winding of the motor 110 and ground. Thus, upward movement of the lever 106 energizes the motor 110, causing the pump 93 to become operative and to force hydraulic fluid into the cylinder 85, causing the piston rod 88 to be extended and elevating the platform 50.

The wheel motors 18 are likewise controlled from the platform 50, by the provision of a pair of control switches 120 and 121 in the control box 102. The motors 18, 18 are controlled by similar independently operated circuits, each circuit being controlled by one of the switches 120 or 121. Thus, the motor 18 associated with the left wheel 17 of FIGURE 3 is controlled by the switch 120. Switch 120 is provided with the upper contact 122 and the lower contact 123 and with a pole 124 selectively engageable with the contacts 122 or 123. The pole 124

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is connected to the wire 99, as is the pole of the switch 121, which is identical in construction to the switch 120. The upper contact 122 is connected by a wire 125 to one terminal of the winding of a relay 126, the remaining terminal of said winding being connected to ground. The lower contact 123 is connected by a wire 127 to one terminal of the winding of a relay 128, the remaining terminal of said relay winding being connected to ground. The motor 18 is of conventional construction and has a pair of windings having a common grounded terminal, and having remaining terminals connected to respective lead wires 130 and 131. The wire 130 is connected through a rheostat 132 and the contacts of relay 128 to the ungrounded battery wire 115. Similarly, the wire 131 is connected through a rheostat 133 and the contacts of the relay 126 to said ungrounded battery wire 115. Thus, the left motor 18 may be energized to operate in one direction by rotating the pole 124 in one direction, and the motor may be caused to operate in the opposite direction by rotating the pole 124 in the corresponding opposite direction. Thus, when the pole 124 is rotated to the right, namely, in a clockwise direction, as viewed in FIGURE 3, pole 124 engages contact 122 and energizes relay 126 through a circuit comprising the ungrounded terminal of battery 98, wire 99, the pole 124, contact 122, wire 125, the winding of relay 126 and ground. This closes the contacts of relay 126 and energizes the winding portion of motor 18 connected to the lead wire 131 through a circuit comprising the ungrounded terminal of battery 98, wire 115, the contacts of relay 126, the rheostat 133, the wire 131, the winding of the motor 18 and ground. In a similar manner, the opposite winding of the motor may be energized by rotating the pole 124 to cause said pole to engage lower contact 123.

The right hand motor 18 is controlled in the same manner through corresponding control relays 136 and 138, similar to the relays 126 and 128, but controlled by the switch 121.

It will thus be seen that the occupant of the aerial platform 50 may maneuver the apparatus to move same in any direction or to rotate the same, by independently operating the wheel motors 18, 18. At the same time, the occupants of the platform 50 may vertically adjust the position of the platform by controlling the energization of the pump 93 and the release of hydraulic fluid from the cylinder 85 by means of the control lever 106.

As previously mentioned, the control circuits for the right hand wheel motor 18 are identical to the control circuits for the left hand wheel motor 18, so that a detail discussion of the circuits associated with the right hand motor 18 is believed to be unnecessary. Suitable rheostats are provided in the motor winding circuits, for example the rheostats 132 and 133, to adjust the speed of operation of the wheel motors. As clearly shown in FIGURE 3, each of the wheel motors is provided with a suitable gear reduction unit 140.

As shown in FIGURE 13, the solenoid valve 96 comprises a core 141 containing a movable valve element 142 which is of magnetic material and which is thus located within the winding 143 of the valve. The movable element 142 carries a sealing member 144 which is biased into sealing engagement against the top end of a valve port 145 by a coiled spring 146 bearing between the upper stationary conduit element 147 and the movable element 142. Conduit 92 is connected to the upper element 147 and the return conduit 97 is connected to the bottom end of the main valve body 141 in communication with the port 145. When the winding 143 of the valve is energized, the magnetic element 142 is elevated against the force of the biasing spring 146, lifting the sealing member 144 off the top end of the bottom wall of member 141, exposing port 145 to the interior of the hollow body 141. The movable member 142 is formed with a passage 148 which provides communication between the lower portion of the cavity in member 141 and the upper

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portion thereof. When the member 142 is elevated as a result of the energization of winding 143, the port 145 is exposed to the lower portion of the cavity in member 141, and is thus placed in communication with the conduit 147 through the passage 148. As previously mentioned, this allows the hydraulic fluid in the cylinder 85 to return to the fluid reservoir 94 and allows the aerial platform 50 to descend.

While a specific embodiment of an improved mechanized ladder device has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefor, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. An aerial platform device comprising a support, a platform member, an upwardly and rearwardly inclined trough-line supporting member secured on said support and having an upstanding rear wall, an upwardly and rearwardly inclined bottom wall, and respective side walls, a main link structure comprising a transversely extending intermediate rectangular frame of substantial height and width, respective longitudinally extending side frames of substantial height rigidly connected to the ends of said intermediate frame and rigidly braced to said intermediate frame, extending forwardly and rearwardly therefrom, means pivotally connecting the rear ends of the side frames to said side walls adjacent the bottom edge of said rear wall, means pivotally connecting the forward ends of said side frames to the platform member, an auxiliary longitudinally extending rigid frame structure of substantial transverse width spaced above said main link structure, said auxiliary frame structure having transversely spaced rear and front corner portions, means pivotally connecting said rear corner portions to the top ends of said walls, means pivotally connecting said front corner portions to the platform member, and fluid pressure means disposed in said trough-like supporting member and connected between the upper intermediate portion of said bottom wall and the bottom intermediate portion of said transversely extending intermediate frame to rotate said main link structure upwardly and elevate said platform member responsive to operation thereof.

2. An aerial platform device comprising a support, a platform member, an upwardly and rearwardly inclined trough-like supporting member secured on said support and having an upstanding rear wall, an upwardly and rearwardly inclined bottom wall, and respective side walls, a main link structure comprising a transversely extending intermediate rectangular frame of substantial height and width, respective longitudinally extending side frames of substantial height rigidly connected to the ends of said intermediate frame and rigidly braced to said intermediate frame, extending forwardly and rearwardly therefrom, means pivotally connecting the rear ends of the side frames to said side walls adjacent the bottom edge of said rear wall, means pivotally connecting the forward ends of said side frames to the platform member, an auxiliary longitudinally extending rigid frame structure of substantial transverse width spaced above said main link structure, said auxiliary frame structure having transversely spaced rear and front corner portions, means pivotally connecting said rear corner portions to the top ends of said side walls, means pivotally connecting said front corner portions to the platform member, and a fluid pressure cylinder disposed in said trough-like supporting member and pivotally connected to the upper intermediate portion of said bottom wall and being provided with an extensible piston rod pivotally connected to the bottom intermediate portion of said transversely extending intermediate frame to rotate said main link structure upwardly and elevate said platform member responsive to extension of said piston rod.

3. An aerial platform device comprising a platform

member, a supporting base provided with supporting wheels, respective motors drivingly coupled to said supporting wheels, means to independently energize said motors, an upwardly and rearwardly inclined trough-like supporting member secured on said supporting base and having an upstanding rear wall, an upwardly and rearwardly inclined bottom wall, and respective side walls, a main link structure comprising a transversely extending intermediate rectangular frame of substantial height and width, respective longitudinally extending side frames of substantial height rigidly connected to the ends of said intermediate frame and rigidly braced to said intermediate frame, extending forwardly and rearwardly therefrom, means pivotally connecting the rear ends of the side frames to said side walls adjacent the bottom edge of said rear wall, means pivotally connecting the forward ends of said side frames to the platform member, an auxiliary longitudinally extending rigid frame structure of substantial transverse width spaced above said main link structure, said auxiliary frame structure having transversely spaced rear and front corner portions, means pivotally connecting said rear corner portions to the top ends of said walls, means pivotally connecting said front corner portions to the platform member, and a fluid pressure cylinder disposed in said trough-like supporting member and pivotally connected to the upper intermediate portion of said bottom wall and being provided with an extensible piston rod pivotally connected to the bottom intermediate portion of said transversely extending intermediate frame to rotate said main link structure upwardly and elevate said platform member responsive to extension of said piston rod.

4. An aerial platform device comprising a platform member, a supporting base provided with supporting wheels, respective motors drivingly coupled to said supporting wheels, means to independently energize said motors comprising a source of current, a pair of control switches mounted on said platform member, and circuit means connecting said source of current to said motors through the respective control switches, whereby to in-

dependently control the motors from the platform member, an upwardly and rearwardly inclined trough-like supporting member secured on said supporting base and having an upstanding rear wall, an upwardly and rearwardly inclined bottom wall, and respective side walls, a main link structure comprising a transversely extending intermediate rectangular frame of substantial height and width, respective longitudinally extending side frames of substantial height rigidly connected to the ends of said intermediate frame and rigidly braced to said intermediate frame, extending forwardly and rearwardly therefrom, means pivotally connecting the rear ends of the side frames to said side walls adjacent the bottom edge of said rear wall, means pivotally connecting the forward ends of said side frames to the platform member, an auxiliary longitudinally extending rigid frame structure of substantial transverse width spaced above said main link structure, said auxiliary frame structure having transversely spaced rear and front corner portions, means pivotally connecting said rear corner portions to the top ends of said side walls, means pivotally connecting said front corner portions to the platform member, a fluid pressure cylinder disposed in said trough-like supporting member and pivotally connected to the upper intermediate portion of said bottom wall and being provided with an extensible piston rod pivotally connected to the bottom intermediate portion of said transversely extending intermediate frame to rotate said main link structure upwardly and elevate said platform member responsive to extension of said piston rod, and means on the platform member to control the extension of said piston rod.

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