

United States Patent

[11] 3,584,705

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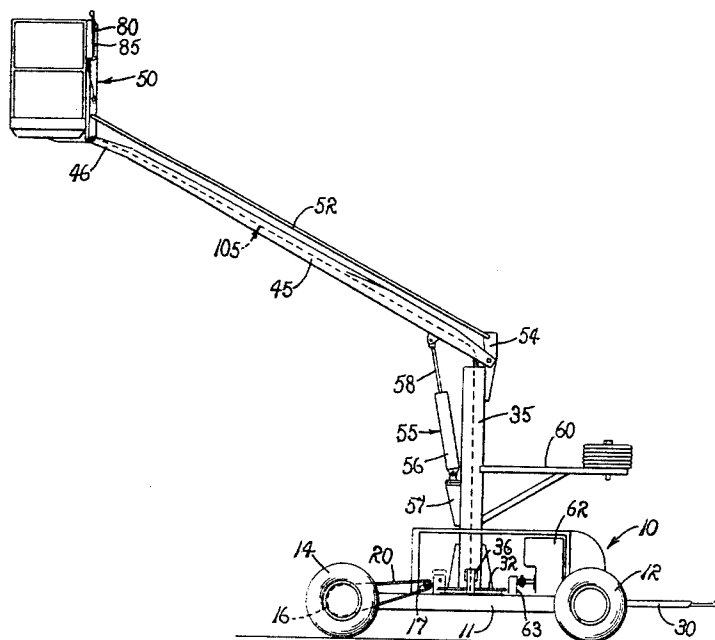
[54] **CONTROL SYSTEM FOR MOBILE WORK
PLATFORMS**
3 Claims, 11 Drawing Figs.

[52] U.S. Cl. **182/13,**
182/2, 74/242.15
[51] Int. Cl. **B66f 11/04**
[50] Field of Search 182/2, 141,
13, 63; 74/217, 242.15; 180/72, 79.2

[56] **References Cited**

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ABSTRACT: A control system for mobile work platforms adapted elevationally to position a worker relative to work-pieces such as trees in an orchard and the like with such a platform being mounted on a mobile chassis for elevational and rotational movement providing a plurality of flexible push-pull control cables extended between control levers on the platform and suitable control valves for the powered members on the chassis with the cables being capable of twisting within their own lengths to accommodate substantially 360° rotation but not continuous rotation of the platform relative to the chassis and a quick-change two-speed drive selector mechanism for the mobile chassis to adapt the mobile platform for operation under a variety of conditions.



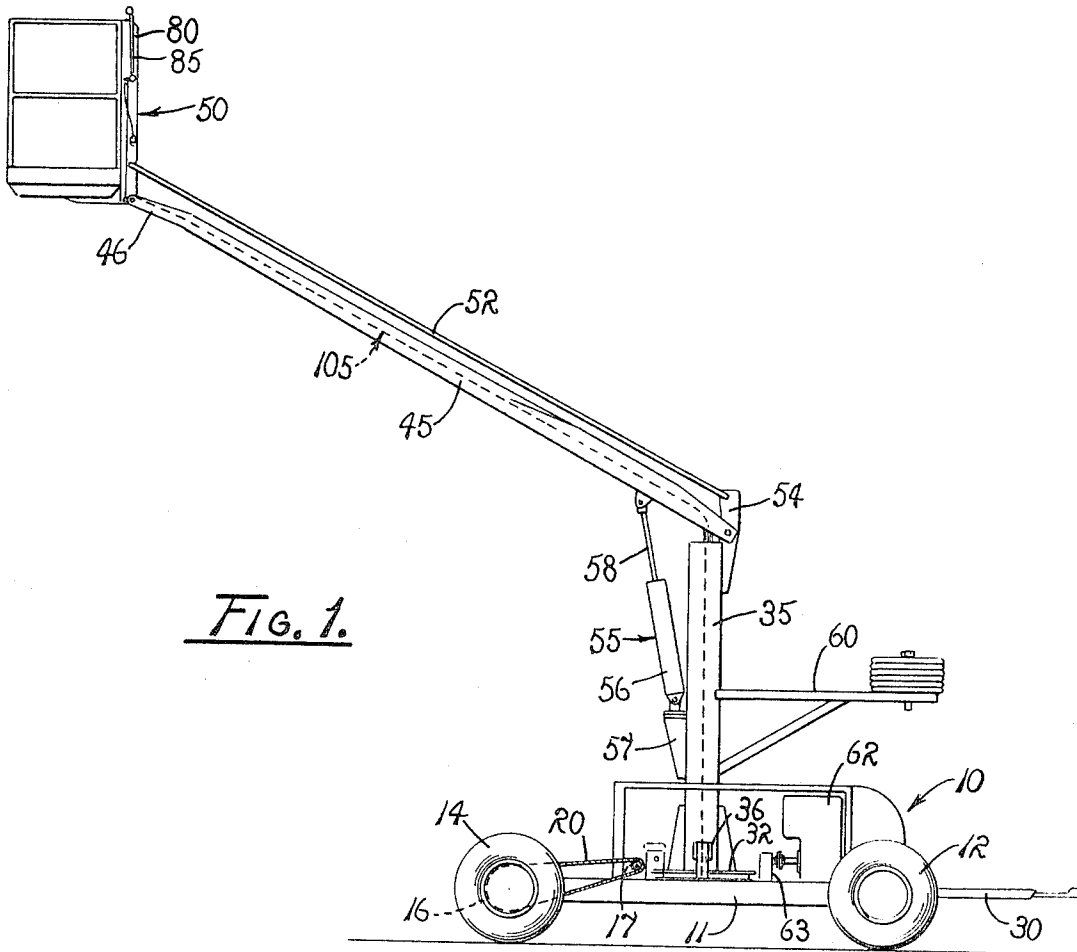


FIG. 1.

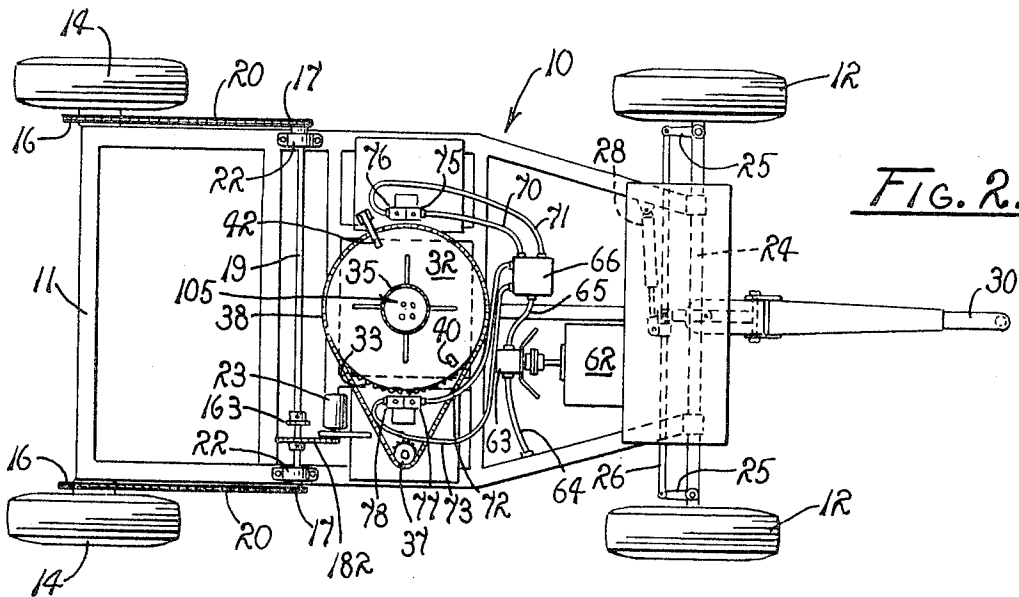


FIG. 2.

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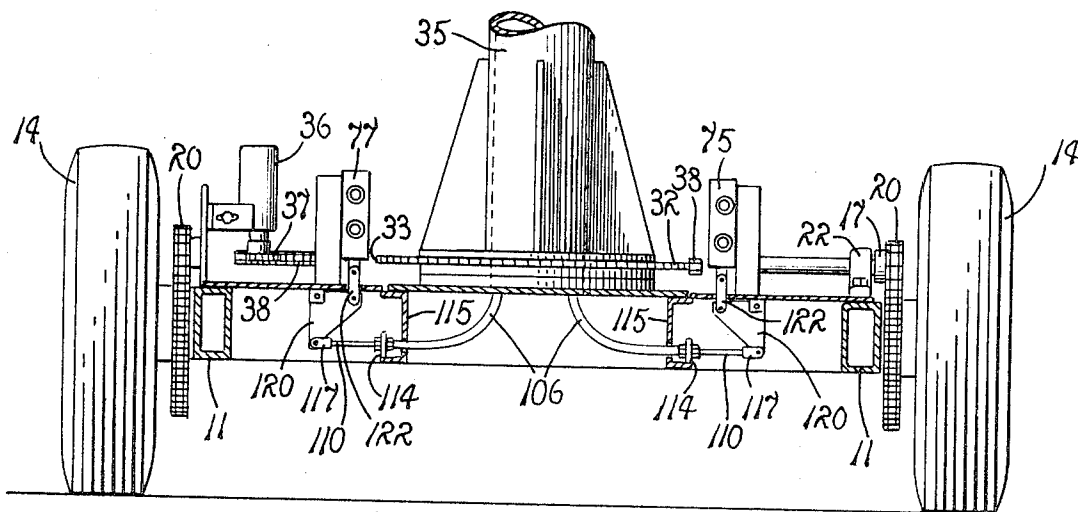
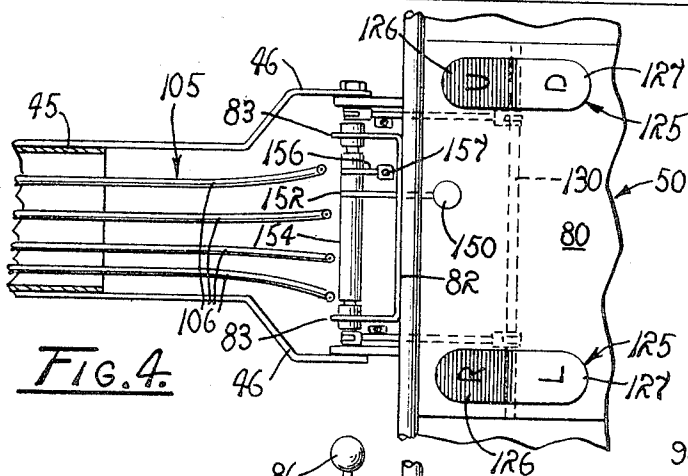


FIG. 3.

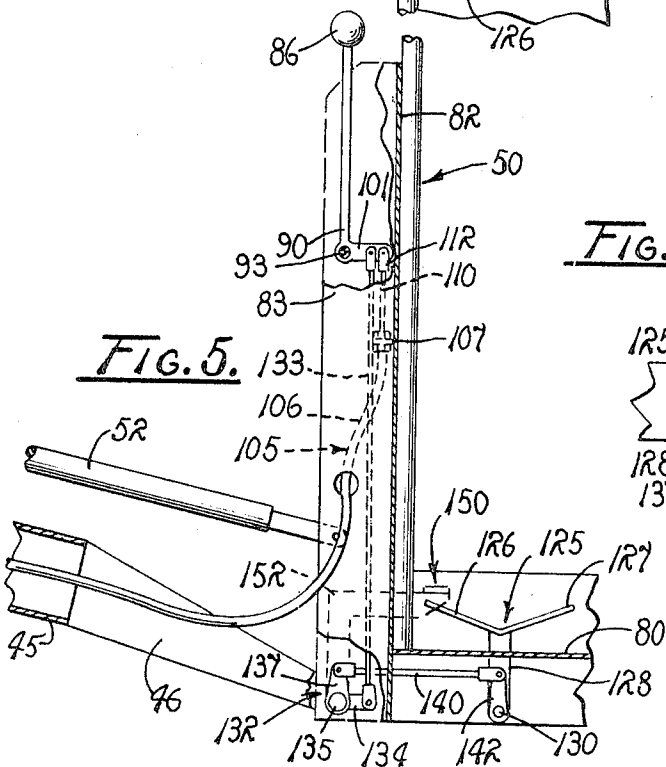


FIG. 4.

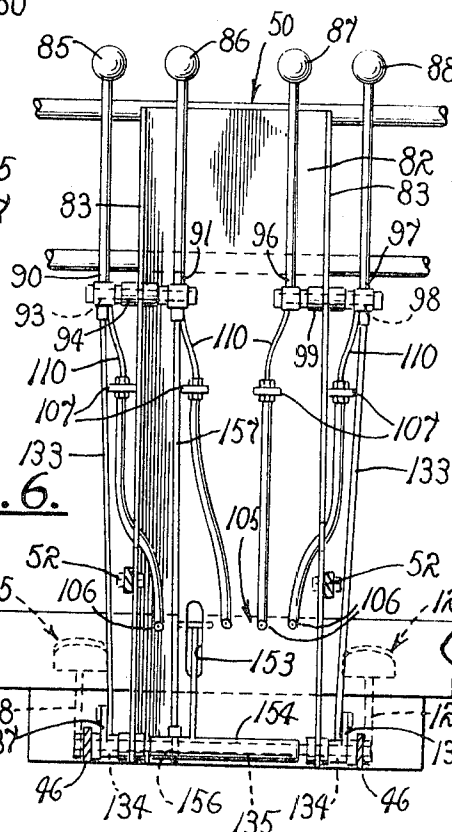
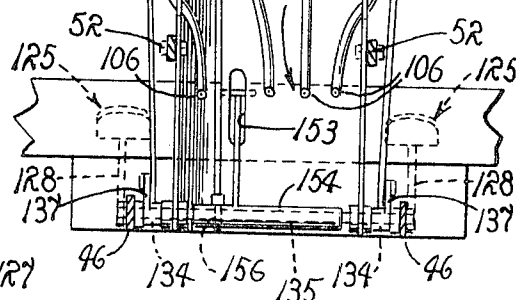


FIG. 5.



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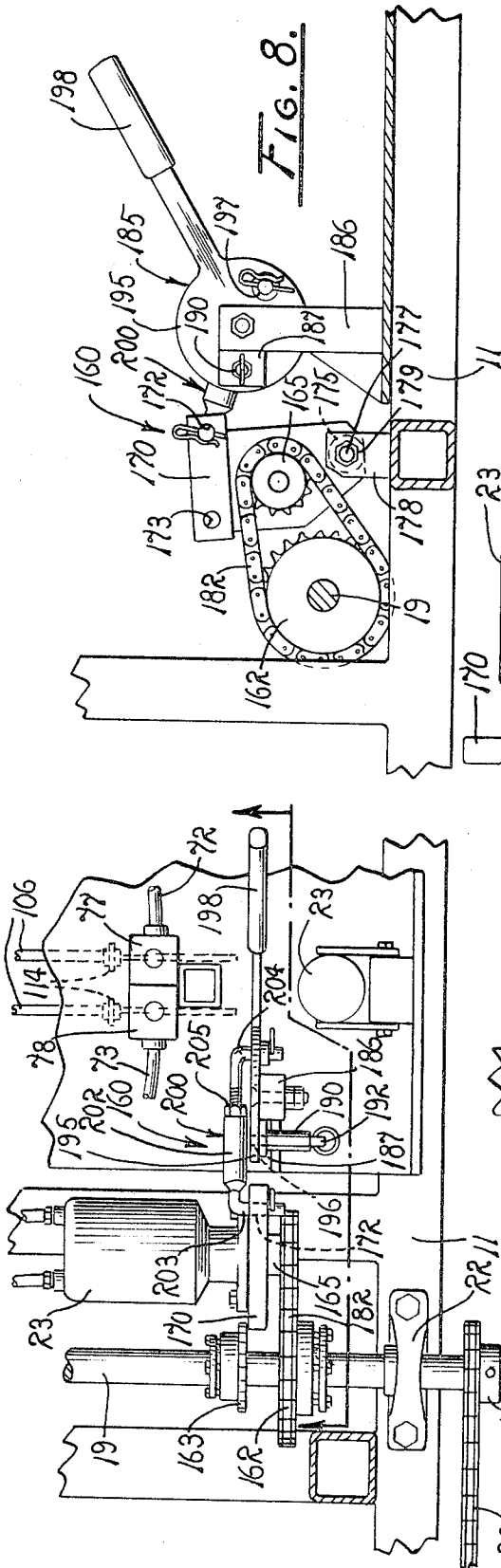
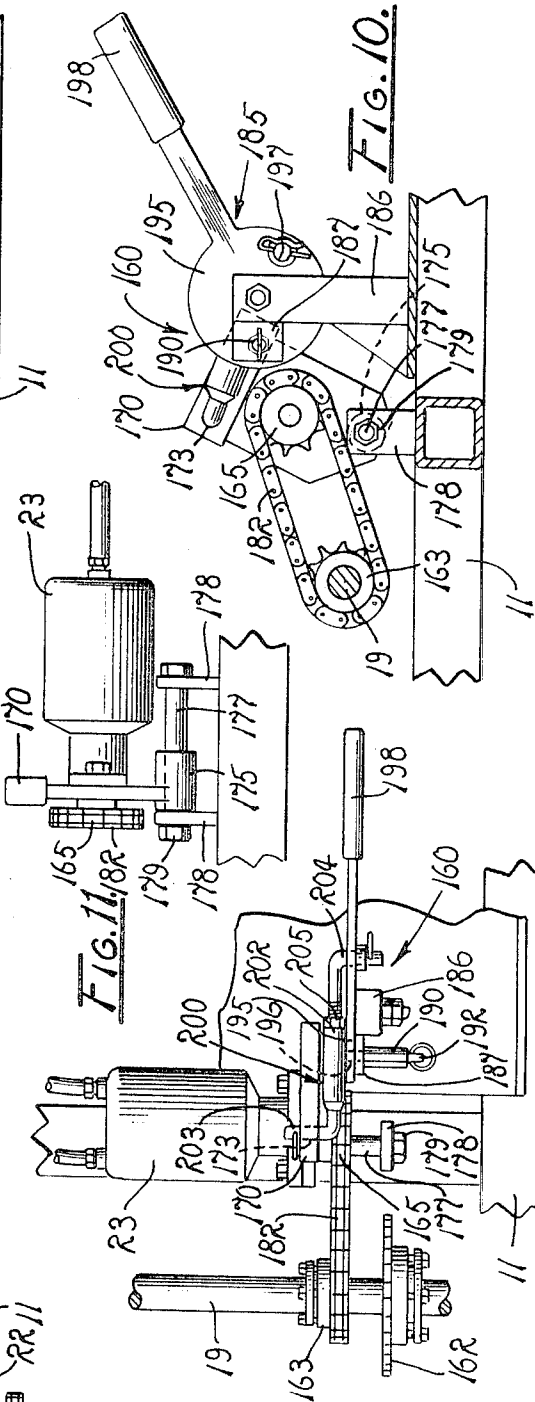


FIG. 9.

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CONTROL SYSTEM FOR MOBILE WORK PLATFORMS

BACKGROUND OF THE INVENTION

The control system of the present invention is particularly adapted for use on mobile work platforms and the like similar to that shown in U.S. Pat. No. 3,127,952. Such a structure provides a mobile chassis having a substantially upright hollow mast rotatably mounted on the chassis in supporting relation to an elongated platform supporting boom which is elevationally positionable relative to the mast and the chassis. Such structure further includes a solid-type control linkage between the control levers on the platform and the hydraulic valves on the chassis for controlling the various powered movements of the platform. While providing precise control of such powered platform movements, it has been found desirable to simplify the control while permitting substantially 360° rotation of the platform and mast relative to the chassis. Further, it is highly desirable to avoid utilizing the unsightly and cumbersome hydraulic hoses which are conventionally employed in similar control systems. It is evident that in order to permit substantially unrestricted movement of the platform, the hydraulic hoses, where employed, need to have sufficient slack to accommodate all such platform movements. Frequently, the hoses become tangled during such platform movements and occasionally are severed by associated mechanism, thus creating a substantial safety hazard to workers on the platform and in the surrounding area. It is also apparent that complicated linkage systems and those employing elongated hydraulic hoses contribute to higher initial manufacturing costs and subsequent maintenance costs which, for the small orchard owners and other small businesses, is economically prohibitive.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved control system for mobile work platforms and the like.

Another object is to provide such an improved control system which eliminates the unsightly and movement-restricting hoses of conventional hydraulic control systems.

Another object is to provide an improved control system for mobile work platforms which completely eliminates the complicated solid control linkages conventionally employed.

Another object is to provide an improved control system of the character described which may be easily, conveniently and economically manufactured and installed on new or existing mobile work platforms and economically maintained.

Another object is to provide an improved control system which permits substantially unrestricted elevational and rotational movement of the worker support platform relative to the mobile chassis.

Another object is to provide an improved control system which utilizes a plurality of flexible push-pull cables which are capable of twisting within their own lengths sufficiently to accommodate substantially 360° rotation but not continuous rotation of the platform.

Another object is to provide a control system for mobile work platforms which incorporates a quick-change, two-speed drive selector mechanism for the mobile chassis in order easily to adapt the platform for operating under a wide variety of conditions.

Another object is to provide an improved control system in which the two-speed drive selector mechanism has an adjustably positionable drive motor and an invertible overcenter locking member which is easily and conveniently manipulated without requiring the removal of any components thereof from the chassis.

Other objects and advantages of the present invention will subsequently become more clearly apparent upon reference to the following description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a mobile work platform showing the worker support platform thereon disposed in an elevated position incorporating the improved control system of the present invention.

FIG. 2 is a somewhat enlarged top plan view of the mobile chassis showing a portion of the improved control system thereon with the boom arm and worker support platform removed.

FIG. 3 is a somewhat enlarged fragmentary front elevation of the mobile chassis and a portion of the control system thereon.

FIG. 4 is a somewhat enlarged fragmentary top plan view of the worker support platform and control lever panel of the control system of the present invention.

FIG. 5 is a somewhat enlarged fragmentary side elevation of the control lever panel of FIG. 4.

FIG. 6 is a somewhat enlarged front elevation of the control lever panel of FIGS. 4 and 5.

FIG. 7 is a somewhat enlarged fragmentary top plan view of a quick-change, two-speed drive selector mechanism for the control system which is diagrammatically shown on FIG. 2.

FIG. 8 is a somewhat enlarged longitudinal vertical section through the chassis, taken generally on line 8-8 of FIG. 7, showing the two-speed drive selector mechanism in front elevation and disposed in a low-speed position.

FIG. 9 is a somewhat fragmentary top plan view of the two-speed drive selector mechanism disposed in a high-speed position.

FIG. 10 is a somewhat enlarged fragmentary front elevation of the two-speed drive selector mechanism disposed in the high-speed position of FIG. 9.

FIG. 11 is a somewhat enlarged, fragmentary side elevation of the two-speed drive selector, showing the drive motor and mounting therefor.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, a mobile work platform, incorporating the improved control system of the present invention, provides a mobile chassis 10 having a box section frame 11 which is supported for ground traversing movement by a pair of steerable wheels 12 and a pair of drive wheels 14. The drive wheels include driven sprockets 16 individually connected to a pair of drive sprockets 17, mounted on the opposite ends of a rotatable jack shaft 19, by endless chains 20. The jack shaft is mounted in transversely disposed relation on the frame 11 of the chassis by a pair of pillow mounted bearing blocks 22 disposed adjacent to the ends of the shaft. The jack shaft is driven by an hydraulic motor 23 on the chassis through a chain and sprocket assembly which will be described in greater detail subsequently.

The steerable wheels 12 are mounted on an axle 24 which is borne by the frame 11 by means of a pair of wheel mounting spindle arms 25 interconnected by a connecting rod 26. An hydraulic steering jack 28 is extendibly retractably mounted between the frame and intermediate the ends of the connecting rod in controlling relation to the steerable wheels 12. An elongated draft tongue 30 is connected to the axle and connecting rod in longitudinally extended relation from the frame for steering the wheels during towing of the mobile chassis behind a truck, tractor, or the like, not shown.

A circular turntable 32, having a toothed periphery 33, is rotatably mounted on the frame 11 of the chassis for supporting an upwardly extended hollow mast 35 in concentric relation thereon. The turntable is driven by an hydraulic motor 36 supported on the frame which has a sprocket 37 engaging an endless chain 38 extended around the toothed periphery 33 of the turntable. A stop dog 40 is formed on the upper surface of the turntable for engagement with a stop arm 42 borne by the frame and disposed in overlying relation to the turntable in the path of movement of the stop dog 40 to limit rotation of the turntable through an arc of travel of approximately 360°.

An elongated hollow platform supporting boom 45 is pivotally mounted at one end of the upper end of the mast 35 and provides a distal end 46 pivotally supporting a work platform 50. An elongated guide rod 52 is extended in parallel-gram relation to the boom arm for connection at one end to the platform and at its other end to an upward extension 54 on the mast 35, in order to maintain the platform in a substantially horizontal position throughout its entire range of elevational swinging movement. Such movement is effected by an hydraulic jack 55 having a cylinder end 56 pivotally mounted on a pedestal 57 on the mast and an opposite rod end 58 pivotally mounted on the boom. An elongated counterweight mounting frame 60 is outwardly extended from the mast intermediate its ends in opposed relation to the boom for counterbalancing the load on the worker support platform 50.

An engine 62 is mounted on the frame 11 of the chassis 10 and has a drive shaft connected to a main hydraulic pump 63. The pump is fed hydraulic fluid from a reservoir disposed within the frame members of the chassis through a line 64 and which discharges fluid under pressure through a line 65 to a flow divider valve 66. A plurality of hydraulic hoses 70, 71, 72 and 73 are extended from the flow divider valve for individual connection to a plurality of control valves 75, 76, 77 and 78, respectively, disposed on the frame. These valves are connected through suitable hydraulic hoses, not shown, respectively to the drive motor 23, the steering jack 28, the turntable drive motor 36, and the boom elevating jack 55.

The worker support platform 50, as best shown in FIGS. 4, 5 and 6, provides a floor 80 having a front control lever mounting panel 82 upwardly extended therefrom and providing oppositely spaced substantially parallel sides 83. A plurality of hand control levers 85, 86, 87 and 88, having respective operational association with the control valves 75, 76, 77 and 78, are pivotally mounted on the control panel 82. The control lever 85 is associated with the control valve 75 for controlling rotational movement of the boom 45 and worker support platform 50. The control lever 86 is associated with the control valve 76 on the chassis which controls the ground traversing movement of the chassis. The control lever 87 is associated with the control valve 77 on the chassis for operation of the hydraulic steering jack 55 for steering the wheels 12 of the chassis. The control lever 88 is associated with the control valve 78 for raising and lowering the boom 45 and the worker support platform 50.

The control levers are grouped in pairs with levers 85 and 86 providing lower ends 90 and 91, respectively, rotatably mounted on a pivot shaft 93 journaled in a sleeve bearing 94 in one of the sides 83 of the control panel 82. The control levers 87 and 88 provide lower ends 96 and 97, respectively, which are mounted on a pivot shaft 98 which is journaled in a sleeve bearing 99 through the opposite side 83 of the control panel 82. As best shown in FIG. 5, each of the lower ends of the control levers has a right-angularly related bellcrank arm 101 for substantially vertical swinging movement about its respective pivot shaft during fore and aft movement of the upper ends of the control levers.

An elongated flexible push-pull cable 105 is connected to each of the bellcrank arms 101 and at its opposite end is connected to one of the control valves on the chassis. Each of the cables provides an outer flexible sheath 106, the upper ends of which are fastened to a bracket 107 secured to the control panel 82. An elongated substantially stiff wire rod 110 is extended in controlling relation through the sheath for connection at its upper end to its respective bellcrank arm 101 by a connector member 112, as shown in FIG. 5. The sheath effectively confines and supports the rod so as to render it capable of transmitting a push-pull force without buckling. Each of the cable sheaths provides an opposite lower end, as best shown in FIG. 3, which is rigidly connected by a bracket 114 secured to a channular frame member 115 of the chassis 10. The control rod 110 includes a lower end outwardly extended from the sheath which is pivotally connected by a bracket 117 to the lower end of a bellcrank lever 120. The bellcrank lever is pivotally mounted intermediate its ends on the frame of the

chassis and provides an opposite end pivotally connected to a rod 122 depending from each of the control valves 75, 76, 77 and 78 on the chassis.

A pair of foot control pedals 125 pivotally are mounted above the floor 80 of the worker support platform 50 which may be utilized by the operator alternatively with the boom swing control lever 75 and the boom elevational control lever 78. As best shown in FIG. 5, each of the foot pedals includes a forward toe portion 126 and a rearward heel portion 127 for respectively simulating fore and aft movement of their corresponding control levers. The pedal includes a downwardly extended support arm 128 which is pivotally mounted on a cross shaft 130 below the floor of the platform. A motion transfer linkage assembly 132 is disposed in interconnecting relation between the foot pedal and the pivot arm 101 of the control levers 75 and 78, respectively. This linkage includes a substantially upright connecting rod 133 pivotally mounted at its upper end on the pivot arm 101 of the control lever and at its lower end to an arm 134 extended from a pivot shaft 135. A substantially upright arm 137 is extended from the pivot shaft in axially spaced relation from the arm 134 for pivotally mounting one end of an elongated connecting rod 140 having its opposite end pivotally connected to an upright arm 142 on the cross-shaft 130 of the foot pedal.

A foot control pedal 150 is also alternatively provided for controlling the chassis drive with the pedal having a substantially L-shaped support arm 152 extended through an opening 153 in the control panel 82 closely adjacent to the floor 80. The arm is upwardly extended from an elongated sleeve 154 rotatably mounted on the pivot shaft 135 which includes a lever arm 156 extended therefrom to provide a pivotal connection for the lower end of a connecting rod 157 connected at its upper end to the pivot arm 101 of the chassis drive control lever 86.

A two-speed drive selector mechanism of the present invention is shown in FIGS. 7 through 11 of the drawings in association with the chassis drive motor 23. Such mechanism includes a driven sprocket 162 disposed on the jack shaft 19 on the chassis and a relatively smaller sprocket 163 mounted on the jack shaft in axially spaced relation to the relatively larger sprocket 162. The drive motor 23 has a drive sprocket 165 of a predetermined size mounted thereon with the motor being adjustably mounted for movement between alternate positions with its drive sprocket aligned in coplanar relation with the sprockets 162 and 163. This is accomplished by mounting the drive motor on a substantially upstanding mounting plate 170 which has a pair of upper connector bores 172 and 173 and a lower elongated bored sleeve 175. The sleeve is axially slidably mounted upon an elongated shaft 177 having opposite screw-threaded ends extended through a pair of spaced substantially upright parallel brackets 178 by a pair of lock nuts 179 screw-threadably received on each end of the shaft. An elongated endless chain 182 is alternately trained about the drive sprocket and the driven sprockets 162 and 163 on the jack shaft 19 for providing the desired two-speed drive to the drive wheels 14 of the chassis 10.

The drive chain 182 is releasably tensioned about the motor drive sprocket 165 and the sprockets 162 and 163 by an over-center locking mechanism 185. This mechanism includes a substantially upright pedestal 186 which is secured to the frame 11 of the chassis adjacent to the drive motor 23. The pedestal has an outwardly extended flange 187 adjacent to its upper end which mounts an elongated spring-loaded detent 190 which has a plunger 192 normally outwardly extended therefrom. A circular disc 195 is rotatably mounted on the upper end of the pedestal in substantially facing sliding relation to the flange 187 and provides an opening 196 therethrough alignable with the detent 190 in receiving relation to the detent plunger 192. The disc further includes a connector bore 197 in substantially diametrically opposed relation to the opening 196 and an elongated handle 198 extended therefrom for manual rotation of the disc upon the pedestal.

An elongated connector rod 200 is disposed between the disc 195 and the mounting plate 170 of the drive motor 23. The connector rod has an intermediate body portion 202 providing a rigid hooked end 203 and an opposite invertible hooked end 204. The invertible end 204 is screw-threadably mounted within the body in axial extension therefrom and has a lock nut 205 for constraining the hooked end in any desired direction from the body. The hooked end 203 of the connector rod is releasably extendible through either of the connector bores 172 of the motor mounting plate 170 and the opposite hooked end 204 is releasably extendible through the connector bore 197 in the disc 195 of the locking mechanism 185 for holding the motor in its chain tensioning position with respect to either of the driven sprockets 162 or 163.

OPERATION

The operation of the described embodiment of the subject invention is believed to be clearly apparent and is briefly summarized at this point. Prior to use, the appropriate drive sprocket 162 or 163 is selected to provide the desired earth traversing speed of the chassis for the particular job involved or for various ground conditions which may be encountered in an orchard or the like. When the mobile work platform is to be used on relatively soft terrain, the driven sprocket 162 is utilized, as shown in FIG. 7 of the drawings. In such position, the connector rod 200 is disposed with the rigid hooked end 203 thereof extended through the connector bore 172 of the motor mounting plate 170 with the control handle 198 and disc 195 rotated to the left from the position shown in FIG. 8 in order to provide sufficient slack in the drive chain 182 to permit its installation about the drive sprocket 165 on the motor and the driven sprocket 162. The invertible hooked end 204 of the connector rod is positioned for extension in the same direction as the rigid hooked rod 203 from the body and the lock nut 205 tightened to hold it in the desired position. The hooked end 204 is extended through the connector bore 197 of the rotatable disc and the handle is returned to the right, as viewed in FIG. 8, to its overcenter locking position dependably to hold the chain in tensioned relation about the sprockets.

If the mobile work platform is to be employed on a substantially hard, smooth surface, the driven sprocket 163 is employed to provide a greater reduction and correspondingly faster speed between the motor and the jack shaft 19. Such speed change is easily and conveniently accomplished by returning the control handle 198 and disc 195 to the left, as viewed in FIG. 8, to provide sufficient slack in the drive chain 182 to permit its removal from the driven sprocket 162 and to permit the removal of the connector rod 200. The lock nut 205 is loosened to permit the invertible end 204 of the rod to be positioned laterally from the connector rod in a direction opposite to the rigid hooked end 203 as shown in FIGS. 9 and 10. The motor mounting sleeve 175 is axially slid along the shaft 177 from the position shown in FIG. 11 to the right in order to align the drive sprocket 165 with the smaller sprocket 163 on the jack shaft 19. In such position, the rigid hooked end 203 of the connector rod is extended through the connector bore 173 of the drive motor of the drive motor mounting plate 170 and the opposite invertible hooked end 204 thereof is again extended through the connector bore 197 in the disc 195. The control handle 198 is again rotated in a clockwise direction to the right, as shown in FIG. 10, to a position rocking the drive motor farther to the right than in its previous drive position of FIG. 8 again to tension the drive chain 182 about the aligned sprockets. The overcenter relationship between the opposite hooked ends 203 and 204 of the connecting rod 200 and the pivot shaft of the disc 195 on the upper end of the pedestal ensures proper tensioning of the drive chain. The detent plunger 192 which is received within the opening 196 in the disc positively precludes return movement of the control handle until the plunger is manually retracted therefrom.

During use, the mobile work platform of the present invention is capable of supporting a workman upon the worker support platform 50 which is elevationally positionable through a wide variety of precisely selectable working positions. The chassis 10 and platform boom 45 are precisely controllable by the operator from the worker support platform 50 by manipulation of the hand control levers 85, 86, 87 and 88 thereon or by alternate manipulation of the foot pedals 125 and 150. As described, during movement of the control levers, the wire rods 110 of the control cables 105 extending between the levers and the control valves 75, 76, 77 and 78 on the chassis for controlling the various powered components on the machine are constrained by their respective outer cable sheaths 106 to axial sliding movement therein to transmit the lever movement precisely to the appropriate control valve. The control cables are conveniently extended downwardly through the hollow boom arm 45 and through the hollow mast 35 so that they are substantially hidden and protected against damage from being struck by foreign objects and from the weather. As described, each of the control cables 105 is rigidly connected at its opposite ends respectively to the control levers and to the control valves on the chassis. However, the cables inherently provide sufficient flexibility between their opposite ends easily to accommodate substantially 360° rotation but not continuous rotation of the boom arm and mast upon the turntable 32 relative to the chassis without impairing the control of the boom arm rotational control valve and lever or any of the other described control levers which are fully operational in any of the various platform positions.

In view of the foregoing, it is readily apparent that the structure of the present invention provides an improved control system for mobile work platforms and the like which may be easily, conveniently and economically manufactured and installed to permit substantially unrestricted elevational and rotational movement of the worker support platform relative to the mobile chassis throughout a predetermined operational range. The plurality of control cables between the control levers on the platform and the control valves on the chassis are capable of twisting within their own lengths substantially to accommodate 360° rotation of the platform with the quick-change two-speed selector mechanism on the chassis permitting the machine to be adapted for operation under a wide variety of operating conditions on various support surfaces.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A control system, for a work platform having a mobile chassis comprising; an alternatively selectable two-speed chassis drive mechanism providing a drive motor; a chassis drive shaft; a pair of different sized driven members disposed in axially spaced relation on said drive shaft; means mounting said drive motor for axial sliding and limited rotational movement between alternate positions respectively aligned with said driven members; means interchangeably drivingly connecting said motor and said driven members; and overcenter locking means for releasably holding said drive motor in said alternate positions providing a pedestal mounted on said chassis in spaced relation to said drive motor; a lever pivotally mounted on said pedestal and an elongated link having rotatably invertible hooked ends releasably interconnecting said drive motor and the lever in said alternate motor positions in tensioning relation to said means drivingly connecting said motor and said driven members.

2. The control system of claim 1 in which said motor mounting means includes a connector plate having a pair of spaced openings for releasably interchangeably receiving said one of said hooked ends of said link, and an opening in said lever for releasably receiving said other hooked end of the link.

3. A multispeed drive mechanism comprising a support, a drive shaft mounted for rotation on said support, a plurality of

driven members of individually distinctive sizes disposed in axially spaced relation on said drive shaft, a drive motor mounted on said support for limited axial sliding and rotational movement between selected positions individually respectively aligned with said driven members, means interchangeably drivingly connecting said drive motor and said

driven members with which it is aligned, lock means mounted on the support releasably holding said drive motor in said selected positions, and reversible link means releasably interconnecting said drive motor and said lock means in each of said selected positions.

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