

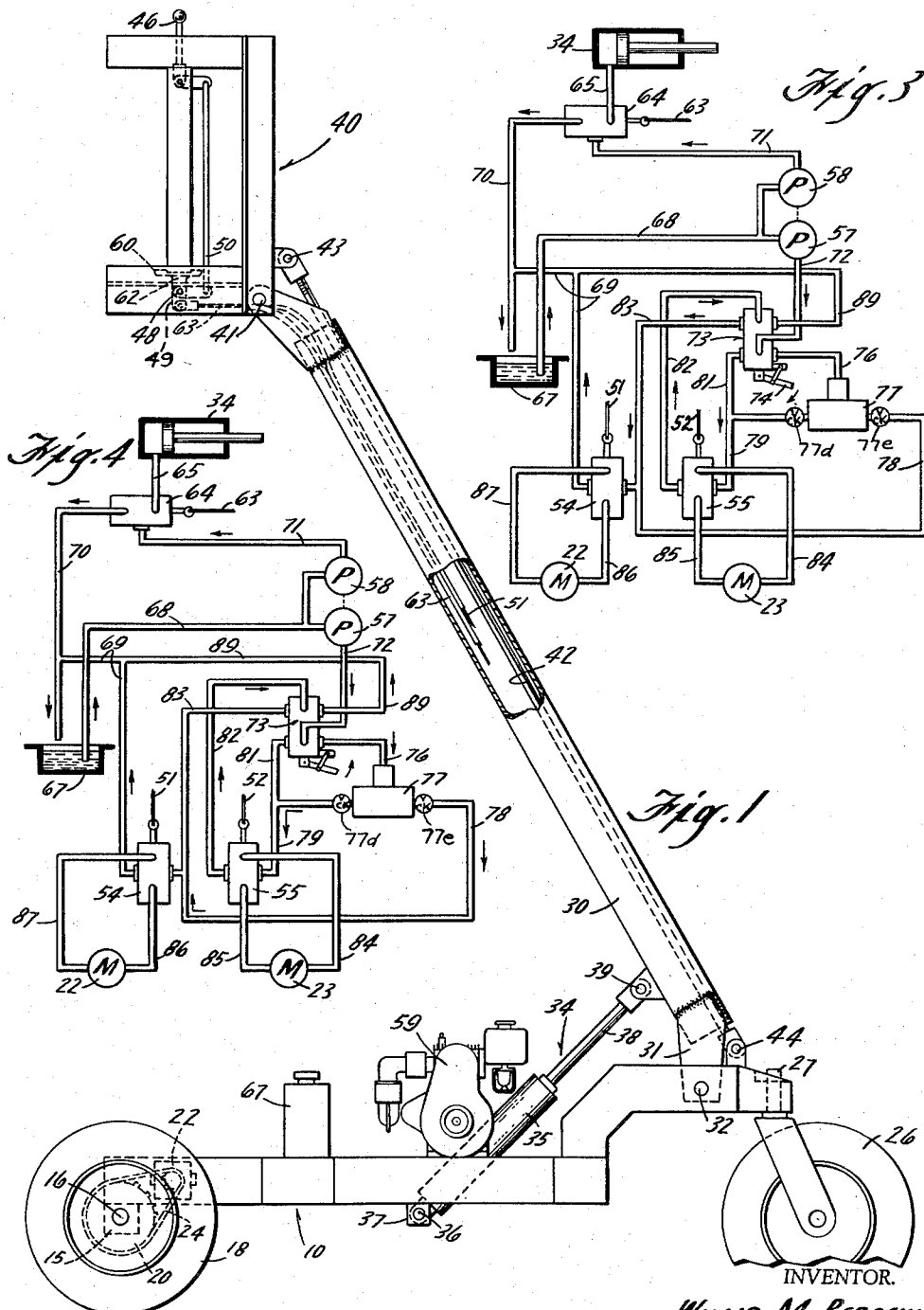
Feb. 7, 1961

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SELF PROPELLED AERIAL PLATFORM AND HYDRAULIC
CONTROL SYSTEM THEREFOR

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Filed June 18, 1958

2 Sheets-Sheet 1



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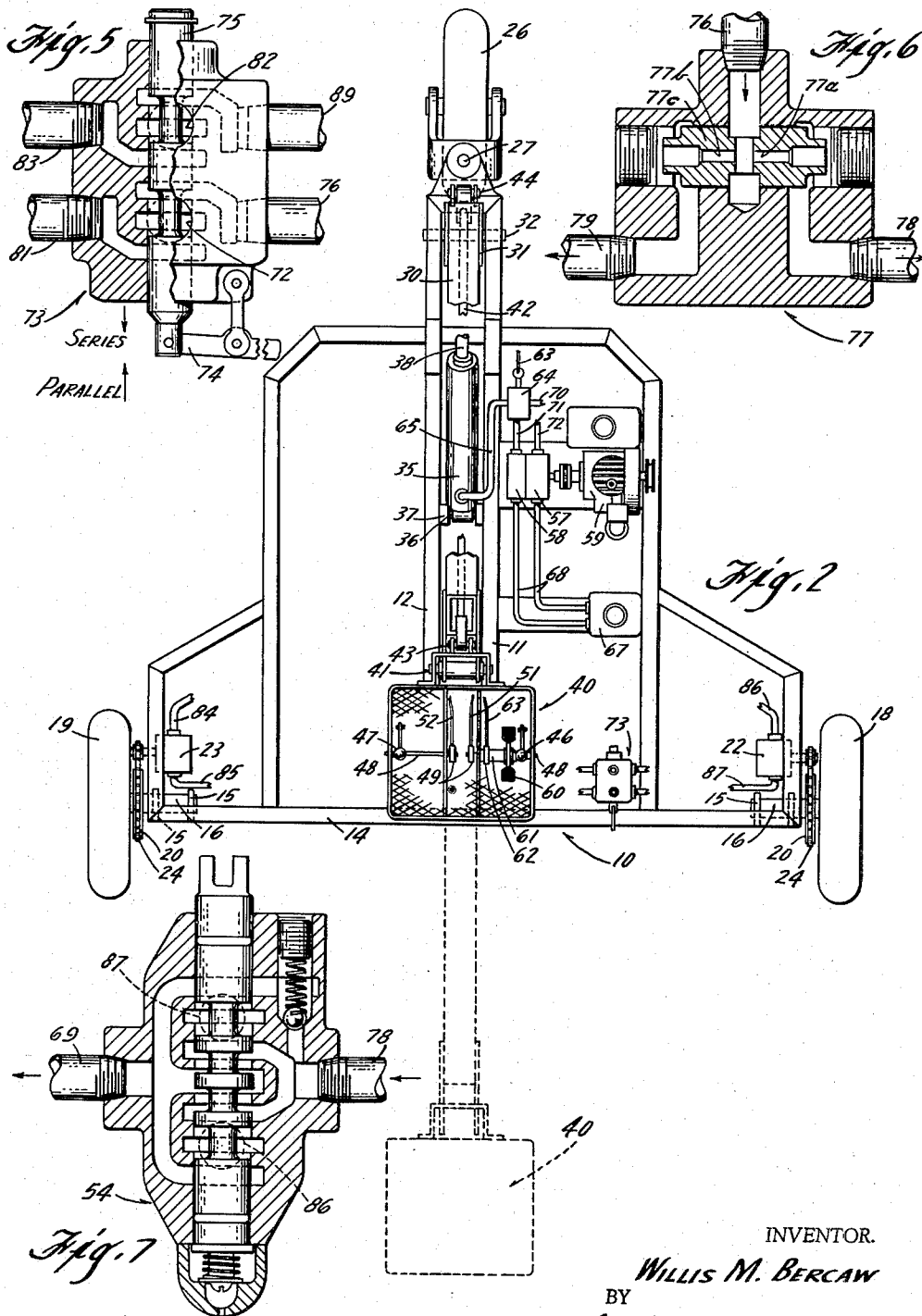
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1 Claim. (Cl. 182—2)

This invention relates generally to a self-propelled aerial platform for supporting a worker while performing orchard work or painting buildings, or the like.

Machines of this general character must be capable of complete maneuverability to enable the worker to move quickly in a vertical direction and also from side to side in order to get over, under and between the branches of a tree, for example, in picking fruit, thinning and pruning branches, or in spraying operations.

The worker himself must operate the controls to cause the machine to move about, and it is important, from the standpoints of safety and ease of operation, that only a minimum number of controls be required to provide this complete flexibility.

Various prior art devices of this general type have been proposed and used with a great deal of success. However, many of these conventional "operator baskets" are rather complicated and consequently costly which has somewhat curtailed their commercial acceptance.

For example, self-propelled and hydraulically or pneumatically operated platform machines have been used in which the platform boom is not only elevationally positionable but also rotates about a vertical axis relative to its supporting vehicle. This horizontal swinging of the platform relative to the vehicle obviously requires special controls, power rams or the like, pivot axis structure and additional framework.

In accordance with the present invention, a self-propelled aerial platform has been provided which has an improved hydraulic control system by means of which the vehicle itself can be turned around about a vertical axis which extends generally through the transverse center line of the vehicle. More specifically, either one of the two traction wheels may be rotated in either direction, one may be held stationary while the other is driven, or both may be driven together in the same direction. For example, driving one traction wheel in reverse while the other is driven forward, the vehicle may be turned around where it stands. As a result, the necessity for providing for horizontal swinging of the platform independently of the vehicle has been eliminated, and yet complete maneuverability of the platform has been maintained. Another advantage of driving the vehicle in this manner is that it permits the use of a wider tread for greater stability without sacrificing the ability to maneuver the vehicle within a small area.

More specifically, the invention contemplates a self-propelled adjustable platform of the above type having a constant output pump and control valve mechanism whereby the fluid motors for the traction wheels are driven selectively either in series or in parallel so as to effect a change in speed without the use of a variable volume pump.

It is generally an object of the present invention to provide a self-propelled aerial platform which is simple in construction and has a minimum number of controls without sacrificing any flexibility or maneuverability of operation. More particularly, drive mechanism and controls therefor are provided which eliminate the necessity for any clutches, steering pedals or controls for the horizontal swinging of the boom.

These and other objects and advantages will appear

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hereinafter as this disclosure progresses, reference being had to the accompanying drawings, in which:

Figure 1 is a side elevational view of a self-propelled aerial platform made in accordance with the present invention;

Figure 2 is a plan view of the apparatus shown in Figure 1;

Figure 3 is a schematic diagram of the hydraulic circuit and shows the pressure fluid flow when the traction wheel fluid motors are operating in series;

Figure 4 is a view similar to Figure 3 but showing the flow for the motors operating in parallel;

Figure 5 is an enlarged view, partially in section, of the selector valve shown in Figures 3 and 4;

Figure 6 is a sectional view, on an enlarged scale, of the flow divider shown in Figures 3 and 4; and

Figure 7 is an enlarged sectional view of a 4-way valve for each of the wheel motors.

Referring in greater detail to the drawings, the main frame 10 of the machine is fabricated from channel iron members or the like which are suitably secured together as by welding and includes a centrally located pair of edge-to-edge channel members 11 and 12 which are arranged longitudinally of the machine. Adjacent each end of the rear transverse channel member 14 are a pair of downwardly extending short plates 15 in which is mounted the axle 16. Traction wheels 18, 19 are suitably journaled on the outer end of their respective stub axles, which wheels each have a large sprocket 20 secured thereto.

Conventional reversible hydraulic motors 22 and 23 are secured to each side of the frame and adjacent, respectively, their wheels 18 and 19, and are drivingly connected to the sprockets thereof by the flexible chains 24. These hydraulic motors act to rotate their respective wheels selectively in either direction and independently of one another, as will appear.

A caster wheel 26 is swivelly mounted by the generally vertical post 27 which is carried by the other end of the main frame.

The platform boom 30 is of rectangular tubular construction and has a pair of plates 31 welded to its lower end by which it is pivotally mounted to the main frame by the pin 32 carried thereby.

A large single acting hydraulic cylinder unit 34 has its cylinder 35 pivotally connected at its lower end on pin 36 rigidly mounted between the brackets 37 welded to the lower side of central channels 11 and 12. The piston 38 extends from the cylinder and is pivotally connected at 39 adjacent the lower end of the boom. This hydraulic unit is effective to swing the boom about its horizontal axis 32 to thereby vertically position the platform 40 carried at the free end of the boom.

Platform 40 is pivoted at 41 to the boom and is of the type that is maintained substantially parallel to the ground regardless of its vertical position. This is accomplished by means of the rod 42 which is pivotally connected at 43 to the platform 40 and at 44 to the main frame. The rod 42 is located within the tubular boom and, because of the location of the pivot points of each end of the rod and boom, the rod and boom are maintained in parallel relationship. Thus a compact and neat-appearing boom structure is provided which will not tend to catch branches and thereby damage them.

The platform has bell-crank levers 46 and 47 pivotally mounted adjacent the upper portion of the platform and on opposite sides thereof. On the platform below each of these levers is rotatably mounted a shaft 48 having a bell-crank 49 secured to their inner ends. A shaft 50 connects the levers 46, 47 to one arm of their respective bell-cranks 49. Push-pull cables 51 and 52 are con-

nected to the other arm of their respective bell-cranks 49 whereby movement of lever 46 moves its cable 51 and movement of lever 47 moves the cable 52.

The cables 51 and 52 extend inside the boom and are connected at their other ends to the control valves 54, 55 (Figures 3 and 4) of the traction wheel hydraulic motors 22, 23. Thus the levers 46, 47 can independently rotate their respective wheels 18, 19 in either direction, as will more fully appear from the description of the hydraulic system to be presently described.

A third control is located on the platform and takes the form of a foot pedal 60 which is secured to the tubular member 61. The member 61 is oscillatably mounted on one of the shafts 48 and has an arm 62 extending downwardly from its inner end. A third cable 63 is attached at one end to this arm and extends along the boom to the conventional spool-type three-way control valve 64 which is in fluid communication via conduit 65 with the head end of the single acting cylinder unit 34 for controlling the latter. Rocking of the foot pedal in one direction acts to admit pressure fluid to the cylinder unit 34 and movement of the foot pedal in the opposite direction acts to shift the valve 64 to release fluid from this unit.

The schematic hydraulic circuits shown in Figures 3 and 4 include the constant output, positive displacement type gear pumps 57, 58 which are driven together by the power plant 59 such as an internal combustion engine of the air cooled type. Instead of the two separate hydraulic pumps, a single larger pump could be utilized, but for purposes of this disclosure, pump 57 has been shown for actuating the vehicle traction drive and pump 58 for furnishing fluid pressure to the platform lift circuit.

The pumps are of conventional design and contain the usual pressure relief valve (not shown), which relief valve serves to dump any excess pressure over a predetermined amount back into the reservoir 67. The conduit 68 places the pumps in fluid communication with the reservoir, conduit 69 is the return line for the traction drive circuit to the reservoir and conduit 70 is the return to the reservoir for the boom lift circuit.

The pump 58 discharges pressure fluid via conduit 71 to the lift control valve 64 and pump 57 discharges via conduit 72 to the selector valve 73.

A selector valve 73 is provided for permitting the wheel motors 22, 23 to be run at either a fast speed, for transport for example, or at a slow speed for maneuvering around the trees. This valve is located on the main frame of the machine and can be reached by the operator when the platform is lowered.

This selector valve 73 (Fig. 5) has a manually operated handle 74 pivoted thereto and also connected to the valve spool 75 for shifting it to a "series" position in which the wheel control valves 54 and 55 are connected in series and the motors 22 and 23 run at the fast speed because all of the flow from pump 57 goes through each of the motors 22, 23. The selector valve is also shiftable to a "parallel" position in which the motors are connected in parallel and each receive only one-half the flow of the pump so as to operate at one-half of the fast speed.

As shown in Figures 4 and 5, when valve 73 is shifted to the "parallel" position, the spool 75 blocks conduits 81 and 83. Fluid is directed via conduit 76 to the flow divider 77 and then via conduits 78 and 79 to the wheel control valves 54, 55, respectively. The flow divider valve 77 is of conventional design and gives two separate and equal supplies of fluid. Flow can pass through passages 77a and 77b of the metering spool 77c only in one direction because of the check valves 77d and 77e, and the valve serves to split the flow evenly between the motor control valves 54 and 55, but not necessarily at equal pressures, and this equal flow is therefore not affected by alternating load variations. Fluid is returned from valve 54 via line 69 to the reservoir and fluid is returned from

valve 55 via line 82, through the valve 73 and out line 89 to the reservoir.

When the selector valve 73 is in the "series" position (Fig. 3), the pressure flow is all via conduit 81 to the motor control valve 55, through conduit 82 back through the selector valve 73 and then out via conduit 83 to the other motor control valve 54. The fluid is returned to the sump via line 69. At this time lines 76 and 89 are blocked by the spool 75. Thus each of the motors 22, 23 receive the full flow of the pump through their respective control valves 54, 55.

Conduits 84, 85 connect the control valve 55 to its motor 23. Conduits 86, 87 connect the control valve 54 to its motor 22. Each of the motors can be driven selectively in either direction and independently of one another.

As shown in Figure 1, when the platform is fully raised, the operator is located substantially directly above the traction wheels in a longitudinal direction in respect to the main frame. When one wheel is driven forward and the other is simultaneously reversed, the pivot point for the machine is substantially directly below the operator. As a result he has good "feel" as to his position when he is maneuvering about.

By means of the present invention, there has been provided a vertically positionable platform which can also be easily positioned in the horizontal plane without the need for horizontally swinging the platform boom relative to the main frame. A self-propelled aerial platform has been provided which is highly maneuverable, can operate at two different speeds, is economical to produce and simple to operate.

Various modes of carrying out the invention are contemplated as being within the scope of the following claim particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

A hydraulic control system for a self-propelled aerial platform having a support frame adapted to travel over the ground, a single boom pivotally mounted on said frame about a generally horizontal axis, said axis being located at one end of said frame and said boom extending from said axis and directly over said frame, a pair of laterally spaced traction wheels on said frame, and a platform at the free end of said boom for vertical adjustment relative to said frame, said platform being substantially directly above said traction wheels in a longitudinal direction when said platform is in a fully raised position, said system comprising, a hydraulic ram connected between said frame and said boom for vertically positioning the latter, a control valve for said ram, a reversible fluid motor drivingly connected to each of said wheels, a control valve for each of said motors for operating said motors selectively and independently of one another in either direction, a flow divider in said system, a pump in said system, a selector valve for selectively directing all of the pressure fluid from said pump through each of said motors to place the latter in series, or for directing said flow through said divider whereby one-half of said flow is directed through each of said motors to place the latter in parallel for a slow speed operation.

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