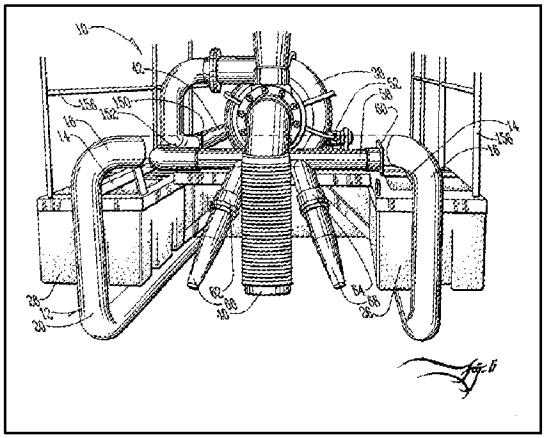
Ground II – Carrier in view of Puck		
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
		
6. The vehicle according to claim 1, wherein the location of the ground engaging propulsion structure, power source and fluid pump are selected to provide a desired location for a center of gravity of the vehicle.	**Col. 4:14-32:** As is described herein, a plurality of platform mounting surface 24 can be formed on the frame system inside the hull 12 which can include a plurality of open surfaces and holes through which quick release connectors (pivot locks 26) can be inserted to attach and secure all functional mechanical components, weapons armaments, communications, fire-fighting equipment and pumps, pump engines, foam systems, dry chemical systems, split cell foam tanks, water hoses, nozzles, water tanks, special operations, laser, electrified water and or slippery slime tanks, microwave impulse equipment, water cannon, hazardous materials decontamination, search, rescue, medical, surveillance, cargo, transport, fuel tank, vehicle engine, transmission, wiring connectors, wire harnesses, instrument panels, access panels, computer, doors, windows, hatches, sensors, imaging equipment, etc, all of which can be equipped with mounting flanges 22 and pivot or shaft (single or double action) push button ball bearing positive locking pin system as used in the engine/transmission mounting platform described herein. **Col. 9:43-53:** A first compartment preferably contains about 150 to 350 gallons of water, while a second compartment preferably contains about approximately 15 to 25 gallons of a foaming agent like that described above. The tank 34' can also preferably be divided by a plurality of sections 72, 74 having a number of	**[0041]** As shown, the fuel reservoir (164) is provided at least partially below the deck (34) of the vessel (12) to allow access to the fuel reservoir (164), while still providing the agitator (10) with a low center of gravity to increase the stability of the agitator (10).

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	holes dispersed therein which permit fluid to flow within tank 34', but prevents the fluid from shifting or "sloshing" from one side to the other. Again, it is important for the fluid not to shift, since the center of gravity of vehicle 10' would shift with the fluid, which would in tum increase the chance of vehicle 10' overturning.	
7. The vehicle according to claim 1, wherein the amount of fluid flow from the at least one fluid nozzle and/or the direction of the at least one fluid nozzle are remotely controllable by the operator remote from the vehicle when the vehicle is floating.	**Col. 10: 2-5:** An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses. **Col. 11:47-53:** All pertinent data transmissions can be sent back and forth allowing for all systems monitoring such as vehicle speed, rpm, water temperature, oil pressure, gear transmission, electrical input and output, weapons diagnostics to include arming and disarming as well as include weapons selection if equipped with multiple weapon systems, water tank level, foam tank level, pump water pressure, etc.	**[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port. The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) star-board. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the agi-tator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward. **[0033]** If desired, the remote control system (84) may be provided with a first gate close button (114) that closes a valve (115) on the transport pipe (42) positioned between the fluid intake pipe (40) and forward nozzle (48). A gate open button (116) is also provided to open the valve (150). Similarly, a close gate button (118) and open gate button (120) are pro-vided to open and close a valve (152) provided between the fluid intake pipe (40) and the nozzles (66) and (68). The gate buttons (114), (116), (118) and (120) allow a user to selec-tively supply fluid through one, two or three of the nozzles (48), (66) and (68) as is desired to appropriately agitate the fluid (128) within which the agitator (10) is floating. The remote control system (84) is also provided with a button(122) to actuate lights (154) provided on the agitator (10)

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		if it is desired to use the agitator (10) in circumstances where additional lighting is desired. The remote control system (84) may be configured to receive feedback from the control panel (74), such as system status, latitude, longitude and height coordinates. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130).

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8. An amphibious vehicle comprising:	**Col. 1:10-16:** The present invention relates to a multi-purpose all-terrain vehicle. More specifically, the present invention is directed to an all-terrain hostile environment vehicle equipped with various aid units such as quick exchange medical, hazardous material, search, rescue, communications, fire fighting, and weapon units which can be deployed in remote areas or areas not accessible by paved roads. **Col. 1:37-41:** The terrain may be sandy, mountainous, muddy, swampy, jungle, or covered with snow, ice, mines, obstructions, vegetation, trees and in cities the roads may be to narrow to traverse. **Col. 8:16-18:** The vehicle 10 is designed to be drivable on uneven ground, on mud, through deep water, or on other surfaces a regular automobile or truck cannot be driven on.	
a floatable vehicle body;	**Col. 2:8-10:** The vehicle is lightweight and stable when traveling over rough ground and includes a fame having a sealed hull to provide the vehicle with buoyancy. **Col. 3:26-28:** The hull 12 can be substantially sealably molded for providing buoyancy for water crossings and provide way for necessary functional attachment of units. **Col. 5:61-65:** Alternatively, in another embodiment the drive train housing 53 can be pivotally mounted to the platform 14, for example so that the same can be actuated between two modes, i.e., a land and a water use, as seen in FIGS. 4A and 4B. **Figs. 4A, 4B:**	**Abstract:** A floating manure agitator that floats on the surface of a manure lagoon and that may be remotely controlled to agitate manure supernatant into a slurry with sludge settling on the bottom of the lagoon. The agitator is provided with a plurality of fluid outputs, the direction of which may be controlled to motivate and steer the agitator. The outputs are angled to develop vortices of supernatant into the sludge to further mix the materials into a slurry. **[0001]** The present invention relates in general to a manure agitator and, more particularly, to a floating manure agitator for use in association with a manure lagoon. **[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore.

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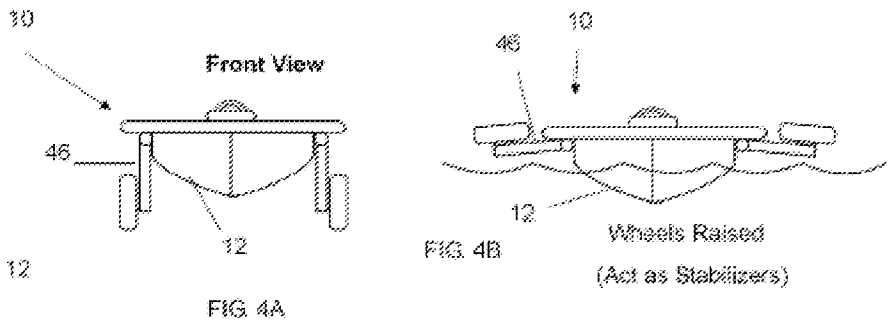
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		**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0022]:** A floating fluid agitator is shown generally as (10) in FIG. 1. A vessel (12) is provided having a frame (14) preferably constructed of welded tubular steel pipes (16). The vessel (12) may alternatively be constructed of any suitable material or may be constructed with a more standard hull, such as those known in the art. The frame (14) is constructed with an angled bow (18) and a vertical stern (20). The angled bow (18) facilitates the launch

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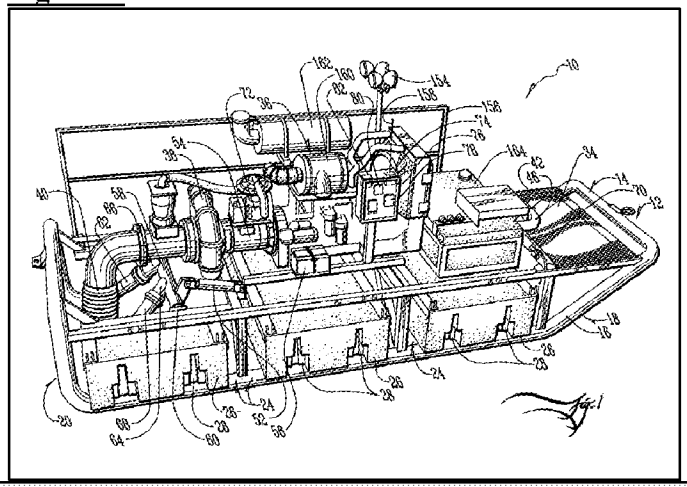
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		and retrieval of the agitator (10) from a manure lagoon (22). (FIGS. 1-2). The frame (14) defines a plurality of receiver slots (24) into which are provided modular dock sections (26), such as those known in the art. In the preferred embodiment, the dock sections (26) are 1000 series dock components manufactured by Connect-A-Dock, Inc. of Atlantic, Iowa. **Figure 1:** 
four hydraulically powered ground engaging wheels;	**Col. 3:25-38:** The hull 12 can be substantially sealably molded for providing buoyancy for water crossings and provide way for necessary functional attachment of units. For example, the hull 12 can optionally be molded with axle holes therethrough to provide for axle shafts to be passed therethrough and connect with one or more each wheels to provide a direct drive. The vehicle 10 can be direct all wheeled drive (8, 10, or 12 wheeled drive). All axles can be in a split splined design configuration (one splined axle shaft along with a splined female mating coupling) can be permanently attached inside the vehicle hull 12 on a sub frame assembly, with the other splined axle shaft end being capable of being inserted into the splined female mating coupling enabling the splined axle shafts to be separated. **Col. 6:41-46:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke	

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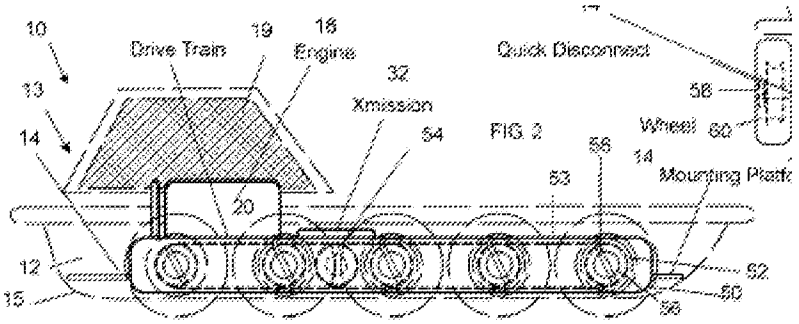
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	connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. **Fig. 2:**  	
four hydraulic motors, one hydraulic motor per wheel, for powering the four hydraulically powered ground engaging wheels;	**Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt, hydro-static over chain, hydro-static over belt, belt over chain. This can be accomplished by using a variety of mechanical components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley	

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	to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations.	
a fluid pump for pumping liquid manure;	**Col. 4:14-32:** As is described herein, a plurality of platform mounting surface 24 can be formed on the frame system inside the hull 12 which can include a plurality of open surfaces and holes through which quick release connectors (pivot locks 26) can be inserted to attach and secure all functional mechanical components, weapons armaments, communications, fire-fighting equipment and pumps, pump engines, foam systems, dry chemical systems, split cell foam tanks, water hoses, nozzles, water tanks, special operations, laser, electrified water and or slippery slime tanks, microwave impulse equipment, water cannon, hazardous materials decontamination, search, rescue, medical, surveillance, cargo, transport, fuel tank, vehicle engine, transmission, wiring connectors, wire harnesses, instrument panels, access panels, computer, doors, windows, hatches, sensors, imaging equipment, etc, all of which can be equipped with mounting flanges 22 and pivot or shaft (single or double action) push button ball bearing positive locking pin system as used in the engine/transmission mounting platform described herein. **Col. 10:51-56:** The use of a pump mounted to the all terrain vehicle which is capable of pumping water from a lake or stream onto a fire is another feature of the present invention. This feature reduces the need to transport water to the site of the fire or, in the alternative, makes it easier to transport water pumping equipment to the body of water to be used in fighting the fire.	**[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible

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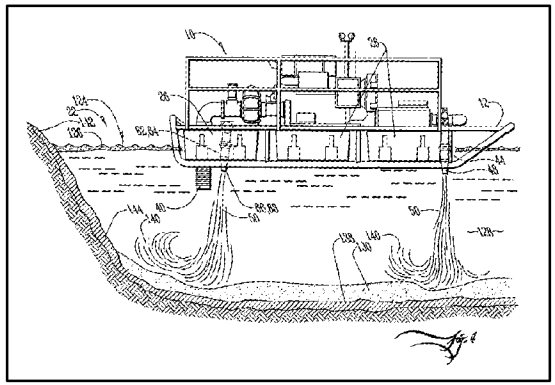
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		to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **Figure 4:**  **Figure 5:**

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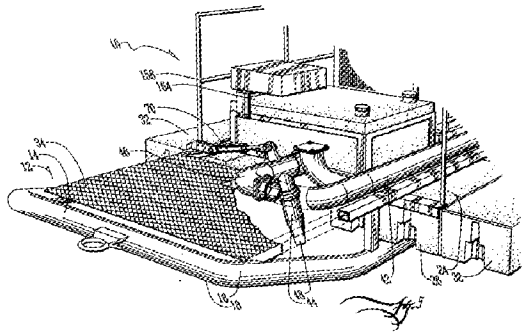
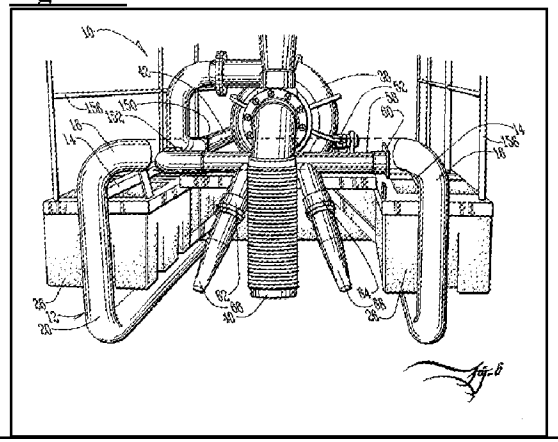
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		 **Figure 6:** 
at least one directionally adjustable nozzle through which the liquid manure is pumped;	**Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low Volume, to Pressure/High Volume in 'joint" work together or independent	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of

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	pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an opposing enemy or terrorist cell. Hose and attachment therewith can preferably be equipped to have quick release couplings. **Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end.	unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the

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		angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees star-board, more preferably between ten and sixty degrees star-board and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably posi-tioned between the first slurry output (44) and the second slurry output (62). **[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port. The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) star-board. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the

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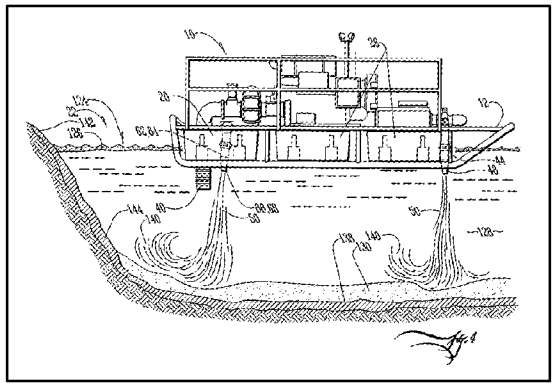
Ground II – Carrier in view of Puck		
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
		agi-tator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **Figure 4:** 

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an internal combustion engine configured to provide power to both the four variable speed hydraulic motors and the fluid pump;	**Col. 5:47-65:** The engine unit 18 can be operably connected to the transmission unit 32 by a quick connect clamp 44. In one embodiment, a drive train 46 can be operably connected to the side of the vehicle 10.A quick connect drive linkage 48 connects the transmission unit 32 to the transmission unit 32. The drive train 46 can be chain or belt driven in this embodiment. Chain or belt 50 operably connects to wheels 52 within a housing 53 which are configured to be complementary with the chosen drive, for example, a chain system would utilize a suitable sprocket on each wheel 52 for engagement therewith. The drive train 46 includes a drive wheel 54 to drive the belt/chain 50. Each wheel 52 can include a drive shaft 56 which extends outward from the housing 53 and includes an end configured with means 58, such lock pin through a hole in shaft 56, for quick connection of a wheel 60. Alternatively, in another embodiment the drive train housing 53 can be pivotally mounted to the platform 14, for example so that the same can be actuated between two modes, i.e., a land and a water use, as seen in FIGS. 4A and 4B. **Col. 5:40-43:** The unit 34 can be self powered (e.g., 40 independent engine) or can be powered by the vehicle engine unit 18 through stacked hydrostatic or hybrid electrical drive systems. **Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt, hydro-static over chain, hydro-static over belt, belt over chain. This can be accomplished by using a variety of mechanical	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower. **[0025]** Coupled to the power source (36) is a liquid manure pump such as a slurry pump (38). In the preferred embodi-ment, the slurry pump (38) is a Cornell Redi-Prime centrifu-gal pump capable of handling both solid and liquid material. The slurry pump (38) is preferably designed to move between one thousand and twenty-four thousand liters of material per minute, more preferably between eight thousand and twenty thousand liters of material per minute, and most preferably about sixteen thousand liters of material per minute. **Claim 13:** The floating slurry agitator of clam 1, wherein the power source is a diesel engine.

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	components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations. **Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low Volume, to Pressure/High Volume in 'joint" work together or independent pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an opposing enemy or terrorist cell. Hose and attachment therewith can preferably be equipped to have quick release couplings. **Col. 5:40-46:** The unit 34 can be self powered (e.g., independent engine) or can be powered by the vehicle engine unit 18 through stacked hydrostatic or hybrid electrical drive systems. Vehicle and secondary engines of the combustion type	

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	can be electrically started and all engine horse powers can be predetermined to be capable to give the necessary power to drive the intended function(s) of the engine. **Col. 8:4-8:** Electric powertrain technologies can also be incorporated using hybridelectric drive transformation designs and technologies that have no mechanical links between the internal combustion engine and the wheels. **Col. 8:54-58:** Engine unit 18 can be fueled by any number of fuels such as gasoline, diesel, propane, electric, hybrid electric, or natural gas and can be used to power the vehicle 10 as well as any other unites descried herein by using a suitable coupling.	
the location of the four hydraulically powered ground engaging wheels, the internal combustion engine and the fluid pump selected to provide a desired location for a center of gravity of the vehicle; and,	**Col. 4:14-32:** As described herein, a plurality of platform mounting surface 24 can be formed on the frame system inside the hull 12 which can include a plurality of open surfaces and holes through which quick release connectors (pivot locks 26) can be inserted to attach and secure all functional mechanical components, weapons armaments, communications, fire-fighting equipment and pumps, pump engines, foam systems, dry chemical systems, split cell foam tanks, water hoses, nozzles, water tanks, special operations, laser, electrified water and or slippery slime tanks, microwave impulse equipment, water cannon, hazardous materials decontamination, search, rescue, medical, surveillance, cargo, transport, fuel tank, vehicle engine, transmission, wiring connectors, wire harnesses, instrument panels, access panels, computer, doors, windows, hatches, sensors, imaging equipment, etc, all of which can be equipped with mounting flanges 22 and pivot or shaft (single or double action) push button ball bearing positive locking pin system as used in the engine/transmission mounting platform described herein. **Col. 9:43-53:** A first compartment preferably contains about 150 to 350 gallons of water, while a second compartment preferably contains about approximately 15 to 25 gallons of a foaming agent like that described above. The tank 34' can also preferably be divided by a plurality of sections 72, 74 having a number of holes dispersed therein which permit fluid to flow within tank 34', but prevents the fluid from shifting or "sloshing" from one side to the other. Again, it is important for the fluid not to shift, since the center of gravity of vehicle 10' would shift with the fluid, which would in tum increase the chance of vehicle 10' overturning.	**[0041]** As shown, the fuel reservoir (164) is provided at least partially below the deck (34) of the vessel (12) to allow access to the fuel reservoir (164), while still providing the agitator (10) with a low center of gravity to increase the stability of the agitator (10).

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remote control structure configured to control the four variable speed hydraulic motors and the fluid pump, wherein the speed and/or direction of the vehicle is remotely controllable by an operator remote from the vehicle when the vehicle is ground engaging and when the vehicle is floating.	**Col. 11:5-16:** The operations of each unit described herein can be performed by remote control unit 42 which is operably quick connectable to each unit on the vehicle 10 having suitable connections therewith. The remote control unit 42 is also equipped with manual controls thereon to provide for operation of the vehicle 10 manually as well as a transceiver equipment enabling it to be reprogrammed on a need to need basis, as well as enabling the vehicle 10 to be remotely controlled via line of sight, gps, or by air via aircraft such as the Preditor. Remote control mechanics, servos, hardware, wiring harnesses can be quick releasable to facilitate easy replacement of any faulty components in case of damage or failure. **Col. 11:47-53:** All pertinent data transmissions can be sent back and forth allowing for all systems monitoring such as vehicle speed, rpm, water temperature, oil pressure, gear transmission, electrical input and output, weapons diagnostics to include arming and disarming as well as including weapons selection if equipped with multiple weapons systems, water tank level, foam tank level, pump water pressure etc.	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the stan-dard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the superna-tant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the

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		angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust

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		(126) and supernatant (128) is adequately mixed with the sludge (130).
9. The vehicle according to claim 8, wherein the power source is configured to provide hydraulic fluid power to the four hydraulic motors and the fluid pump.	**Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt, hydro-static over chain, hydro-static over belt, belt over chain. This can be accomplished by using a variety of mechanical components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations **Col. 9:61 – Col. 10:13:** The hose can be fluidly attached to the pump. A Suction hose can be provided in the second storage area and connected to the pump	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.

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	connected to the tank with a sensor installed within the tank that sends a signal Pressure or Electric or both to a valve connected at the suction input on the pump automatically manipulating the valve system to automatically begin the refilling of the water tank when a determined loss of water level is reached. An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses. A valve system consisting of electronic, air over hydraulic, electronic over air, air, hydraulic, automatic, automatic over manual can control fluid flows between the first compartment and pump, a tank fill valve to which the suction hose may be attached for refilling first compartment when the pump is activated; a water cannon valve that permits fluid to flow therethrough; and a master valve which controls the flow of fluid through fire hose.	
10. The vehicle according to claim 9, wherein the four hydraulic motors are variable speed hydraulic motors and wherein the four hydraulically powered ground engaging wheels are each operable at variable speed.	**Col. 7:12-27:** In an embodiment, the vehicle 10 is equipped with steering and braking components adjacent the wheels 60 and can be steered via a conventional wheel turning mechanism or via a skid steer method whereby one or more wheels 60 are braked to effect a turn of the vehicle 10. This will give the vehicle 10 the ability to switch back and forth from the turn steer mode to the skid steer mode through the flip of a switch. The vehicle 10 forward and reverse motion can be achieved by the drive train 46. The multi steering capability enables the vehicle 10 to be placed into a highway mode of steering like that of an automobile on standard paved and unpaved road networks and then changed to skid steer type steering for greater steering mobility when needed as in combat escape and evade or weapons set up and deploy maneuvers, rough terrain or congested areas such as city streets enabling all vehicles to turn within the length of its own radius. **Col. 7:46-49:** The transmission contemplated by the invention can be of a type configured using a torque converter drive, 3, 6 or more speed power-shift transmission.	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.

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11. The vehicle according to claim 8, wherein the at least one directionally adjustable nozzle is connected to a fluid conduit connected to the fluid pump.	**Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end.	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface

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		of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry

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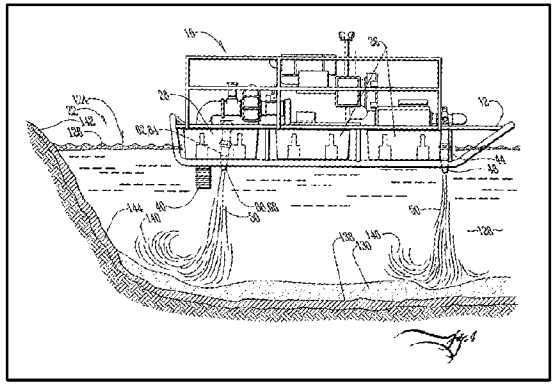
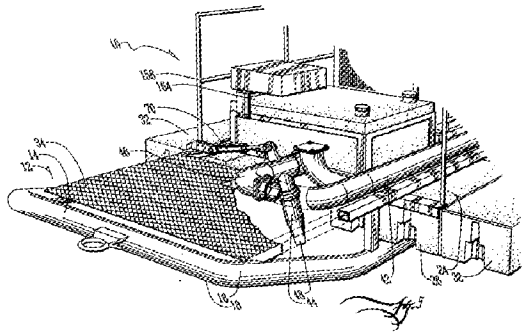
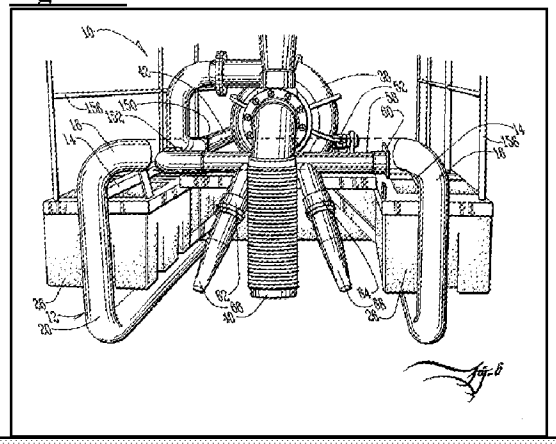
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		outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**  **Figure 5:**

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		 **Figure 6:** 
12. The vehicle according to claim 11, wherein a plurality of nozzles comprising the at least one directionally	**Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of

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U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
adjustable nozzle is connected to the fluid conduit.	Volume, to Pressure/High Volume in 'joint" work together or independent pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an opposing enemy or terrorist cell. Hose and attachment therewith can preferably be equipped to have quick release couplings. **Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end. **Col. 10:2-5:** An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses.	unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the stan-dard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the superna-tant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry.

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		(FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon.

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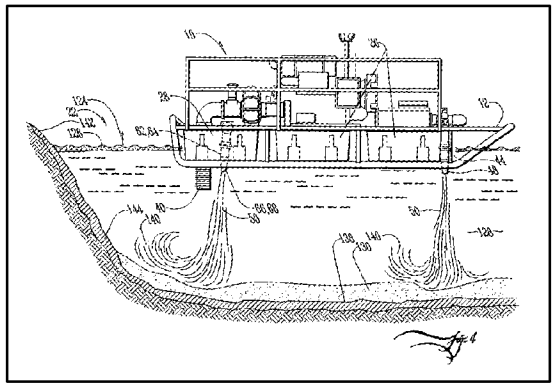
Ground II – Carrier in view of Puck		
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
		[0037] The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**  **Figure 5:**

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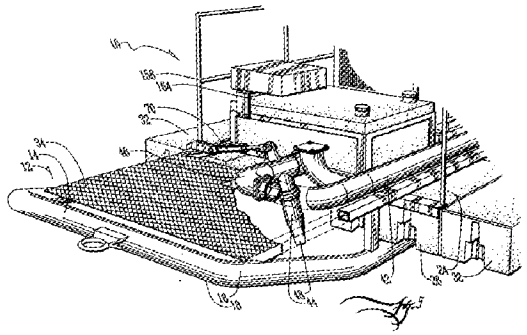
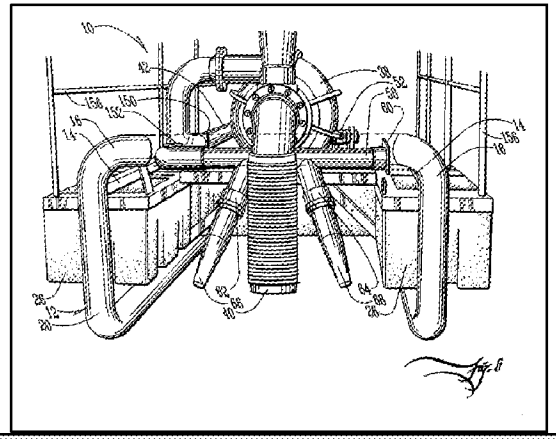
Ground II – Carrier in view of Puck		
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
		 **Figure 6:** 
13. The vehicle according to claim 8, wherein the amount of fluid flow from the directionally adjustable	**Col. 10:2-5:** An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses. **Col. 11:5-16:** The operations of each unit described herein can be performed by remote control unit 42 which is operably quick connectable to each unit on the vehicle 10 having suitable connections therewith. The remote control unit 42 is also equipped with manual controls thereon to provide for operation of the vehicle 10 manually as well as a transceiver equipment enabling it to be	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the stan-dard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle

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nozzle and/or the direction of the directionally adjustable nozzle are remotely controllable by the operator remote from the vehicle when the vehicle is floating.	reprogrammed on a need to need basis, as well as enabling the vehicle 10 to be remotely controlled via line of sight, gps, or by air via aircraft such as the Preditor. Remote control mechanics, servos, hardware, wiring harnesses can be quick releasable to facilitate easy replacement of any faulty components in case of damage or failure. **Col. 11:47-53:** All pertinent data transmissions can be sent back and forth allowing for all systems monitoring such as vehicle speed, rpm, water temperature, oil pressure, gear transmission, electrical input and output, weapons diagnostics to include arming and disarming as well as including weapons selection if equipped with multiple weapons systems, water tank level, foam tank level, pump water pressure etc.	that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the superna-tant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0033]** If desired, the remote control system (84) may be provided with a first gate close button (114) that closes a valve (115)on the

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		transport pipe (42) positioned between the fluid intake pipe (40) and forward nozzle (48). A gate open button (116) is also provided to open the valve (150). Similarly, a close gate button (118) and open gate button (120) are pro-vided to open and close a valve (152) provided between the fluid intake pipe (40) and the nozzles (66) and (68). The gate buttons (114), (116), (118) and (120) allow a user to selec-tively supply fluid through one, two or three of the nozzles (48), (66) and (68) as is desired to appropriately agitate the fluid (128) within which the agitator (10) is floating. The remote control system (84) is also provided with a button (122) to actuate lights (154) provided on the agitator (10) if it is desired to use the agitator (10) in circumstances where additional lighting is desired. The remote control system (84) may be configured to receive feedback from the control panel (74), such as system status, latitude, longitude and height coordinates. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydrau-lic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of super-natant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry

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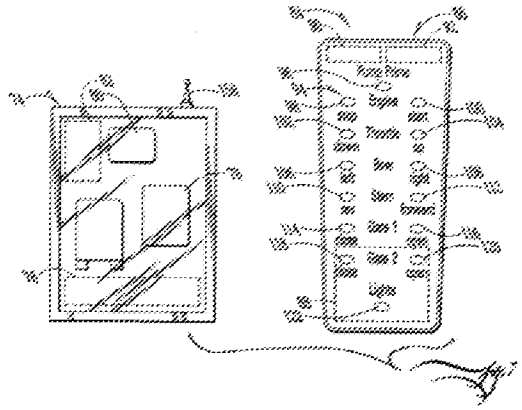
Ground II – Carrier in view of Puck		
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**
		outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 7:** 

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EXHIBIT I

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U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
8. An amphibious vehicle comprising:	**Col. 1:10-16:** The present invention relates to a multi-purpose all-terrain vehicle. More specifically, the present invention is directed to an all-terrain hostile environment vehicle equipped with various aid units such as quick exchange medical, hazardous material, search, rescue, communications, fire fighting, and weapon units which can be deployed in remote areas or areas not accessible by paved roads. **Col. 1:37-41:** The terrain may be sandy, mountainous, muddy, swampy, jungle, or covered with snow, ice, mines, obstructions, vegetation, trees and in cities the roads may be to narrow to traverse. **Col. 8:16-18:** The vehicle 10 is designed to be drivable on uneven ground, on mud, through deep water, or on other surfaces a regular automobile or truck cannot be driven on.		
a floatable vehicle body;	**Col. 2:8-10:** The vehicle is lightweight and stable when traveling over rough ground and includes a fame having a sealed hull to provide the vehicle with buoyancy. **Col. 3:26-28:** The hull 12 can be substantially sealably molded for providing buoyancy for water crossings and provide way for necessary functional attachment of units. **Col. 5:61-65:** Alternatively, in another embodiment the drive train housing 53 can be pivotally mounted to the platform 14, for example so that the same can be actuated between two modes, i.e., a land and a water use, as seen in FIGS. 4A and 4B. **Figs. 4A, 4B:**	**Abstract:** A floating manure agitator that floats on the surface of a manure lagoon and that may be remotely controlled to agitate manure supernatant into a slurry with sludge settling on the bottom of the lagoon. The agitator is provided with a plurality of fluid outputs, the direction of which may be controlled to motivate and steer the agitator. The outputs are angled to develop vortices of supernatant into the sludge to further mix the materials into a slurry. **[0001]** The present invention relates in general to a manure agitator and, more particularly, to a floating manure agitator for use in association with a manure lagoon.	

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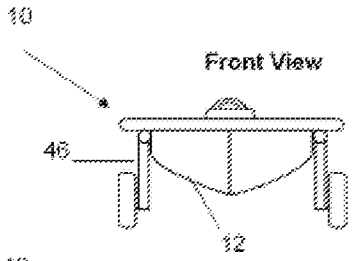
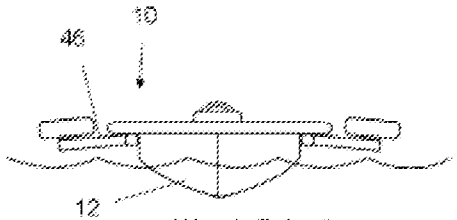
Ground III – Carrier in view of Puck and in further view of Gaither			
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
	 FIG. 4A  FIG. 4B	**[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel	

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		and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0022]:** A floating fluid agitator is shown generally as (10) in FIG. 1. A vessel (12) is provided having a frame (14) preferably constructed of welded tubular steel pipes (16). The vessel (12) may alternatively be constructed of any suitable material or may be constructed with a more standard hull, such as those known in the art. The frame (14) is constructed with an angled bow (18) and a vertical stern (20). The angled bow (18) facilitates the launch and retrieval of the agitator (10) from a manure lagoon (22). (FIGS. 1-2). The frame (14) defines a plurality of receiver slots (24) into which are provided modular dock sections (26), such as those known in the art. In the preferred embodiment, the dock sections (26) are 1000 series dock components manufactured by Connect-A-Dock, Inc. of Atlantic, Iowa. **Figure 1:**	

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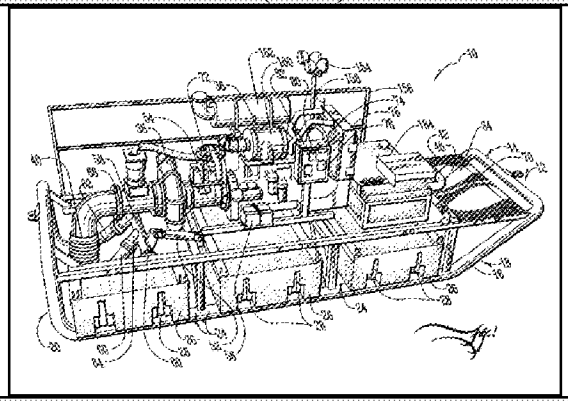
Ground III – Carrier in view of Puck and in further view of Gaither			
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
			
four hydraulically powered ground engaging wheels;	**Col. 3:25-38:** The hull 12 can be substantially sealably molded for providing buoyancy for water crossings and provide way for necessary functional attachment of units. For example, the hull 12 can optionally be molded with axle holes therethrough to provide for axle shafts to be passed therethrough and connect with one or more each wheels to provide a direct drive. The vehicle 10 can be direct all wheeled drive (8, 10, or 12 wheeled drive). All axles can be in a split splined design configuration (one splined axle shaft along with a splined female mating coupling) can be permanently attached inside the vehicle hull 12 on a sub frame assembly, with the other splined axle shaft end being capable of being inserted into the splined female mating coupling enabling the splined axle shafts to be separated. **Col. 6:41-46:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive		**Col. 1:22-25:** The present invention generally relates to amphibious motor vehicles. More specifically, the invention is an amphibious vehicle that utilizes four, six, or eight independent, hydraulically driven wheels when the wheels are in contact with the ground and a pair of propellers when the vehicle is in water. Further, a single pair of levers controls the speed and direction of the vehicle both on land and in water. **Col. 3:21-24:** A fourth problem is that the utilization of a single hydraulic system to drive wheel motors and a propeller motor can result subjecting the propeller motor to high pressure when the vehicle is operated in wheels only mode.

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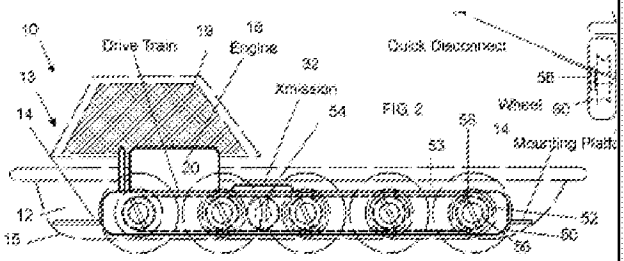
Ground III – Carrier in view of Puck and in further view of Gaither			
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
	systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. **Fig. 2:**  		**Col. 7:1-3:** Undercarriage assembly 200r is comprised of channel assembly 210, access cover 202, wheel motors 504, and tires 203. **Col. 7:15-18:** Channel 220 further defines a plurality of wheel motor 15 apertures 232 through which the shaft of each wheel motor 504 passes. One tire 503 is mounted to the shaft of each wheel motor 504.
four hydraulic motors, one hydraulic motor per wheel, for powering the four hydraulically powered ground engaging wheels;	**Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt, hydro-static over chain, hydro-static over belt, belt over		**Col. 1:22-25:** The present invention generally relates to amphibious motor vehicles. More specifically, the invention is an amphibious vehicle that utilizes four, six, or eight independent, hydraulically driven wheels when the wheels are in contact with the ground and a pair of propellers when the vehicle is in water. Further, a single pair of levers controls the speed and direction of the vehicle both on land and in water. **Col. 3:21-24:** A fourth problem is that the utilization of a single hydraulic system to drive wheel motors and a propeller motor can result subjecting the propeller motor to high pressure when the

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U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
	chain. This can be accomplished by using a variety of mechanical components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations.		vehicle is operated in wheels only mode. **Col. 7:1-3:** Undercarriage assembly 200r is comprised of channel assembly 210, access cover 202, wheel motors 504, and tires 203. **Col. 7:15-18:** Channel 220 further defines a plurality of wheel motor 15 apertures 232 through which the shaft of each wheel motor 504 passes. One tire 503 is mounted to the shaft of each wheel motor 504.
a fluid pump for pumping liquid manure;	**Col. 4:14-32:** As is described herein, a plurality of platform mounting surface 24 can be formed on the frame system inside the hull 12 which can include a plurality of open surfaces and holes through which quick release connectors (pivot locks 26) can be inserted to attach and secure all functional mechanical components, weapons armaments, communications, fire-fighting equipment and pumps, pump engines, foam systems, dry chemical systems, split cell foam tanks, water hoses, nozzles, water tanks, special operations, laser, electrified water and or slippery slime tanks, microwave impulse equipment, water cannon, hazardous materials decontamination, search, rescue, medical, surveillance, cargo, transport, fuel tank,	**[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a	

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	vehicle engine, transmission, wiring connectors, wire harnesses, instrument panels, access panels, computer, doors, windows, hatches, sensors, imaging equipment, etc, all of which can be equipped with mounting flanges 22 and pivot or shaft (single or double action) push button ball bearing positive locking pin system as used in the engine/transmission mounting platform described herein. **Col. 10:51-56:** The use of a pump mounted to the all terrain vehicle which is capable of pumping water from a lake or stream onto a fire is another feature of the present invention. This feature reduces the need to transport water to the site of the fire or, in the alternative, makes it easier to transport water pumping equipment to the body of water to be used in fighting the fire.	sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first	

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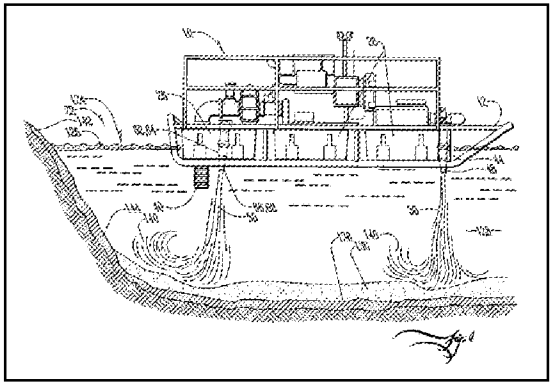
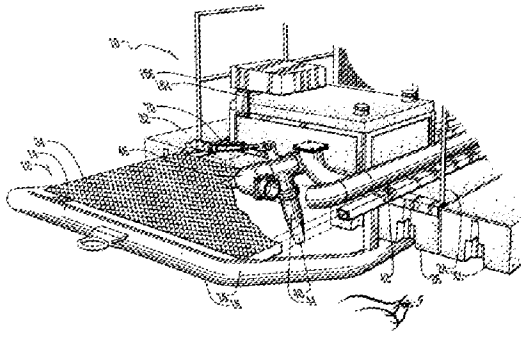
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		slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **Figure 4:**  **Figure 5:**  **Figure 6:**	

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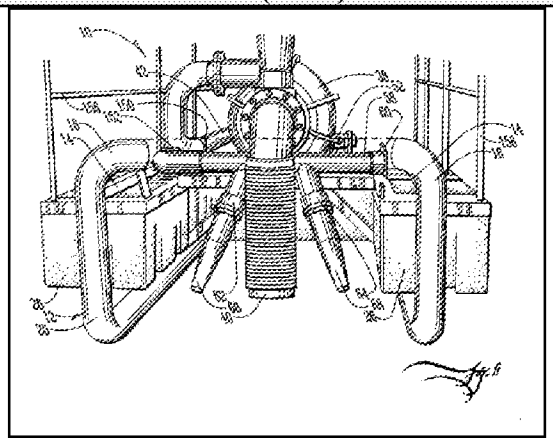
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at least one directionally adjustable nozzle through which the liquid manure is pumped;	**Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low Volume, to Pressure/High Volume in 'joint" work together or independent pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an opposing enemy or terrorist cell. Hose and attachment	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are	

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	therewith can preferably be equipped to have quick release couplings. **Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end.	directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (	

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		48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote	

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		control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port. The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) starboard. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the agitator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the	

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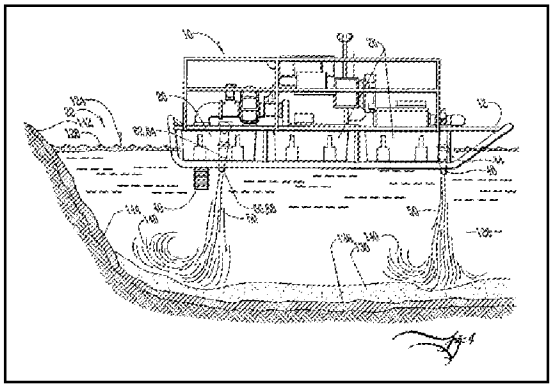
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		direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **Figure 4:** 	
an internal combustion engine configured to provide power to both the four variable speed hydraulic motors and the fluid pump;	**Col. 5:47-65:** The engine unit 18 can be operably connected to the transmission unit 32 by a quick connect clamp 44. In one embodiment, a drive train 46 can be operably connected to the side of the vehicle 10. A quick connect drive linkage 48 connects the transmission unit 32 to the transmission unit 32. The drive train 46 can be chain or belt driven in this embodiment. Chain or belt 50 operably connects to wheels 52 within a housing 53 which are configured to be complementary with the chosen drive, for example, a chain system would utilize a suitable sprocket on each wheel 52 for engagement therewith. The drive train 46 includes a drive wheel 54 to drive the belt/chain 50. Each wheel 52 can include a drive shaft 56 which	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower. **[0025]** Coupled to the power source (36) is a liquid manure pump such as a slurry pump (38). In the	**Col. 1:21-25:** The present invention generally relates to amphibious motor vehicles. More specifically, the invention is an amphibious vehicle that utilizes four, six, or eight independent, hydraulically driven wheels when the wheels are in contact with the ground and a pair of propellers when the vehicle is in water. Further, a single pair of levers controls the speed and direction of the vehicle both on land and in water.

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	extends outward from the housing 53 and includes an end configured with means 58, such lock pin through a hole in shaft 56, for quick connection of a wheel 60. Alternatively, in another embodiment the drive train housing 53 can be pivotally mounted to the platform 14, for example so that the same can be actuated between two modes, i.e., a land and a water use, as seen in FIGS. 4A and 4B. **Col. 5:40-43:** The unit 34 can be self powered (e.g., 40 independent engine) or can be powered by the vehicle engine unit 18 through stacked hydrostatic or hybrid electrical drive systems. **Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt,	preferred embodiment, the slurry pump (38) is a Cornell Redi-Prime centrifugal pump capable of handling both solid and liquid material. The slurry pump (38) is preferably designed to move between one thousand and twenty-four thousand liters of material per minute, more preferably between eight thousand and twenty thousand liters of material per minute, and most preferably about sixteen thousand liters of material per minute. **Claim 13:** The floating slurry agitator of clam 1, wherein the power source is a diesel engine.	**Col. 3:21-24:** A fourth problem is that the utilization of a single hydraulic system to drive wheel motors and a propeller motor can result subjecting the propeller motor to high pressure when the vehicle is operated in wheels only mode. **Col. 7:1-3:** Undercarriage assembly 200r is comprised of channel assembly 210, access cover 202, wheel motors 504, and tires 203. **Col. 7:15-18:** Channel 220 further defines a plurality of wheel motor 15 apertures 232 through which the shaft of each wheel motor 504 passes. One tire 503 is mounted to the shaft of each wheel motor 504.

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	hydro-static over chain, hydro-static over belt, belt over chain. This can be accomplished by using a variety of mechanical components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations. **Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change		

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	from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low Volume, to Pressure/High Volume in 'joint" work together or independent pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an opposing enemy or terrorist cell. Hose and attachment therewith can preferably be equipped to have quick release couplings. **Col. 5:40-46:** The unit 34 can be self powered (e.g., independent engine) or can be powered by the vehicle engine unit 18 through stacked hydrostatic or hybrid electrical drive systems. Vehicle and secondary engines of the combustion type can be electrically started and all engine horse powers can be predetermined to be capable to give the necessary power to drive the intended function(s) of the engine. **Col. 8:4-8:** Electric powertrain technologies can also be incorporated using hybridelectric drive transformation designs and technologies that have no mechanical links between the internal combustion engine and the wheels. **Col. 8:54-58:** Engine unit 18 can be fueled by any number of fuels such as gasoline, diesel, propane, electric, hybrid electric, or natural gas and can be used to power the vehicle 10 as well as any other unites descried herein by using a suitable coupling.		
the location of the four hydraulically	**Col. 4:14-32:** As described herein, a plurality of platform mounting surface 24 can be formed on the frame system inside the hull 12 which can include a	**[0041]** As shown, the fuel reservoir (164) is provided at least partially below the deck (34) of the vessel (12) to allow access to the fuel reservoir	**Col. 1:22-25:** The present invention generally relates to amphibious motor vehicles. More

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powered ground engaging wheels, the internal combustion engine and the fluid pump selected to provide a desired location for a center of gravity of the vehicle; and,	plurality of open surfaces and holes through which quick release connectors (pivot locks 26) can be inserted to attach and secure all functional mechanical components, weapons armaments, communications, fire-fighting equipment and pumps, pump engines, foam systems, dry chemical systems, split cell foam tanks, water hoses, nozzles, water tanks, special operations, laser, electrified water and or slippery slime tanks, microwave impulse equipment, water cannon, hazardous materials decontamination, search, rescue, medical, surveillance, cargo, transport, fuel tank, vehicle engine, transmission, wiring connectors, wire harnesses, instrument panels, access panels, computer, doors, windows, hatches, sensors, imaging equipment, etc, all of which can be equipped with mounting flanges 22 and pivot or shaft (single or double action) push button ball bearing positive locking pin system as used in the engine/transmission mounting platform described herein. **Col. 9:43-53:** A first compartment preferably contains about 150 to 350 gallons of water, while a second compartment preferably contains about approximately 15 to 25 gallons of a foaming agent like that described above. The tank 34' can also preferably be divided by a plurality of sections 72, 74 having a number of holes dispersed therein which permit fluid to flow within tank 34', but prevents the fluid from shifting or "sloshing" from one side to the other. Again, it is important for the fluid not to shift, since the center of gravity of vehicle 10' would shift with the fluid, which would in tum increase the chance of vehicle 10' overturning.	(164), while still providing the agitator (10) with a low center of gravity to increase the stability of the agitator (10).	specifically, the invention is an amphibious vehicle that utilizes four, six, or eight independent, hydraulically driven wheels when the wheels are in contact with the ground and a pair of propellers when the vehicle is in water. Further, a single pair of levers controls the speed and direction of the vehicle both on land and in water. **Col. 3:21-24:** A fourth problem is that the utilization of a single hydraulic system to drive wheel motors and a propeller motor can result subjecting the propeller motor to high pressure when the vehicle is operated in wheels only mode. **Col. 7:1-3:** Undercarriage assembly 200r is comprised of channel assembly 210, access cover 202, wheel motors 504, and tires 203. **Col. 7:15-18:** Channel 220 further defines a plurality of wheel motor 15 apertures 232 through which the shaft of each wheel motor 504 passes. One tire 503 is mounted to the shaft of each wheel motor 504.
remote control structure	**Col. 11:5-16:** The operations of each unit described herein can be performed by remote control unit 42	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into	

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configured to control the four variable speed hydraulic motors and the fluid pump, wherein the speed and/or direction of the vehicle is remotely controllable by an operator remote from the vehicle when the vehicle is ground engaging and when the vehicle is floating.	which is operably quick connectable to each unit on the vehicle 10 having suitable connections therewith. The remote control unit 42 is also equipped with manual controls thereon to provide for operation of the vehicle 10 manually as well as a transceiver equipment enabling it to be reprogrammed on a need to need basis, as well as enabling the vehicle 10 to be remotely controlled via line of sight, gps, or by air via aircraft such as the Preditor. Remote control mechanics, servos, hardware, wiring harnesses can be quick releasable to facilitate easy replacement of any faulty components in case of damage or failure. **Col. 11:47-53:** All pertinent data transmissions can be sent back and forth allowing for all systems monitoring such as vehicle speed, rpm, water temperature, oil pressure, gear transmission, electrical input and output, weapons diagnostics to include arming and disarming as well as including weapons selection if equipped with multiple weapons systems, water tank level, foam tank level, pump water pressure etc.	suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore.	

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		[0027] Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the	

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		direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130).	
9. The vehicle according to claim 8, wherein the power source is configured to provide hydraulic fluid power to the four hydraulic motors and	**Col. 6:41 – Col. 7:11:** It is contemplated that a direct drive system can be employed wherein one or more wheels is driven by a drive shaft with suitable yoke connections, a hydrostatic drive transmission or via a hydraulic system as is known in the art. One or more drive systems can be employed on the vehicle 10 providing the user with multiple drive mechanism options. The drive train connection can be either/or a combination of/direct drive shaft utilizing a suitable yoke system, hydrostatic, belt or chain. The direct shaft, hydro-static, belt or chain drive or drives or a combination thereof can connect to the driven axles	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	

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the fluid pump.	within a housing which can be configured to be universally complementary with the chosen drive or drives, i.e., a chain system would utilize a suitable sprocket on each axle as the drive engagement mechanism. n objective achieved here is to incorporate a back up drive train for an "emergency switch-over" in the event one drive train becomes inoperable. This can be accomplished by using one or more methods: shaft over hydro-static, shaft over chain, shaft over belt, hydro-static over chain, hydro-static over belt, belt over chain. This can be accomplished by using a variety of mechanical components such as electromagnetic spring plates, electromagnetic clutches (such as the same used on simple automotive air conditioning systems), or air/hydraulic positive pressure clamps, centrifugal clutches using drive pulley to driven pulley (belt, chain, hydro-static actuated), power take off, (pto), back up configured separately from the transmission, located on the engine to be connected to the drive train, to independently stacked hydro-static drives that can be mechanically driven by either the engine, electronically or the transmission or both using a combination of manual over electronic solenoid valves in the event the solenoid valve falls to open it can be opened manually. The drive train can also be configured in such a manner where as one or more wheels can be driven by one or more drive component systems. In example, the front two wheels can be belt driven, the next two wheels being hydro-statically driven, the next two wheels can be chain or direct drive shaft driven or electronically driven in a multitude of various configurations **Col. 9:61 – Col. 10:13:** The hose can be fluidly attached to the pump. A Suction hose can be provided in the second storage area and connected to the pump		

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	connected to the tank with a sensor installed within the tank that sends a signal Pressure or Electric or both to a valve connected at the suction input on the pump automatically manipulating the valve system to automatically begin the refilling of the water tank when a determined loss of water level is reached. An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses. A valve system consisting of electronic, air over hydraulic, electronic over air, air, hydraulic, automatic, automatic over manual can control fluid flows between the first compartment and pump, a tank fill valve to which the suction hose may be attached for refilling first compartment when the pump is activated; a water cannon valve that permits fluid to flow therethrough; and a master valve which controls the flow of fluid through fire hose.		
10. The vehicle according to claim 9, wherein the four hydraulic motors are variable speed hydraulic motors and wherein the four hydraulically powered	**Col. 7:12-27:** In an embodiment, the vehicle 10 is equipped with steering and braking components adjacent the wheels 60 and can be steered via a conventional wheel turning mechanism or via a skid steer method whereby one or more wheels 60 are braked to effect a turn of the vehicle 10. This will give the vehicle 10 the ability to switch back and forth from the turn steer mode to the skid steer mode through the flip of a switch. The vehicle 10 forward and reverse motion can be achieved by the drive train 46. The multi steering capability enables the vehicle 10 to be placed into a highway mode of steering like that of an automobile on standard paved and unpaved road networks and then changed to skid steer type steering for greater steering mobility when needed as in combat	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**Col. 10:19-26:** The speed of vehicle 10 is controlled by a combination of vehicle control levers 602! and 602r and throttle 630. The further away from their central positions levers 602*l* and 602*r* are moved, the greater the output from hydrostatic pump 502 and the faster the propulsion motors will rotate. Throttle 630 is mounted in dashboard 168 and is mechanically linked to power source 182 and preferably provides four different throttle settings: idle, low, medium, and high.

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ground engaging wheels are each operable at variable speed.	escape and evade or weapons set up and deploy maneuvers, rough terrain or congested areas such as city streets enabling all vehicles to turn within the length of its own radius. **Col. 7:46-49:** The transmission contemplated by the invention can be of a type configured using a torque converter drive, 3, 6 or more speed power-shift transmission.		**Col. 10: 34-39:** To execute a gradual tum to the right, lever 602*l* is moved farther forward from its central position than lever 602*r*, as shown in FIG. 6C, resulting in the engaged propul-sion motors on the left side of vehicle 10 rotating at a higher rate than the engaged propulsion motors on the rights side of vehicle 10 causing vehicle 10 to turn. **Col. 10:18-50:** The speed of vehicle 10 is controlled by a combination of vehicle control levers 602 l and 602 r and throttle 630. The further away from their central positions levers 602 l and 602 r are moved, the greater the output from hydrostatic pump 502 and the faster the propulsion motors will rotate. Throttle 630 is mounted in dashboard 168 and is mechanically linked to power source 182 and preferably provides four different throttle settings: idle, low, medium, and high. Throttle 630 controls the range of speed that can be achieved by the operation of levers 602 l and 602 r. The higher the throttle setting, the faster vehicle 10 can travel. 4. Turning Vehicle 10

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			Vehicle 10 is turned by creating a differential in the location of levers 602 l and 602 r relative to the levers' central positions—the greater the differential the smaller the radius of the turn. To execute a gradual turn to the right, lever 602 l is moved farther forward from its central position than lever 602 r, as shown in FIG. 6C, resulting in the engaged propulsion motors on the left side of vehicle 10 rotating at a higher rate than the engaged propulsion motors on the rights side of vehicle 10 causing vehicle 10 to turn. The larger the differential between the positions of levers 602 l and 602 r, the smaller the radius of the turn. To execute a very sharp turn to the right, lever 602 l is moved forward from its central position, causing the engaged propulsion motors on the left side of vehicle 10 to rotate in a forward direction, while lever 602 r is simultaneously moved backward from its central position, causing the engaged propulsion motors on the right side of vehicle 10 to rotate in a reverse direction, as shown in FIG. 6D. Finally, as would be evident to one of ordinary skill in the art, turns to the left are accomplished by reversing the positions of levers 602 l and 602 r discussed above.

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11. The vehicle according to claim 8, wherein the at least one directionally adjustable nozzle is connected to a fluid conduit connected to the fluid pump.	**Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end.	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry	

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		control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5).	

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		[0035] Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the	

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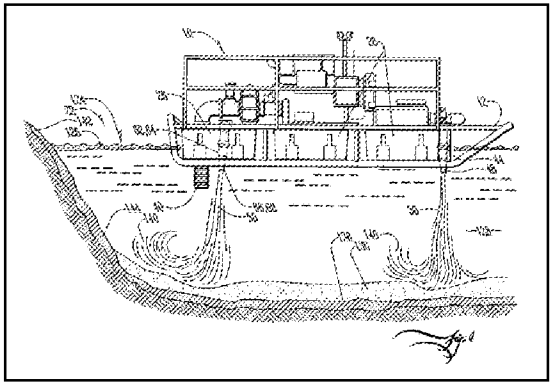
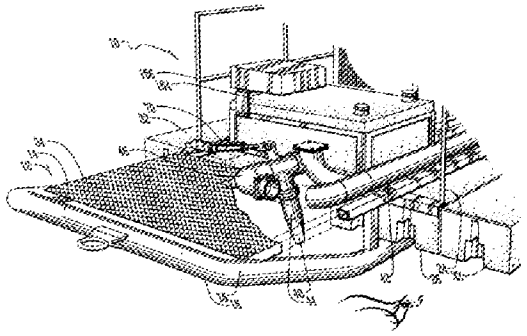
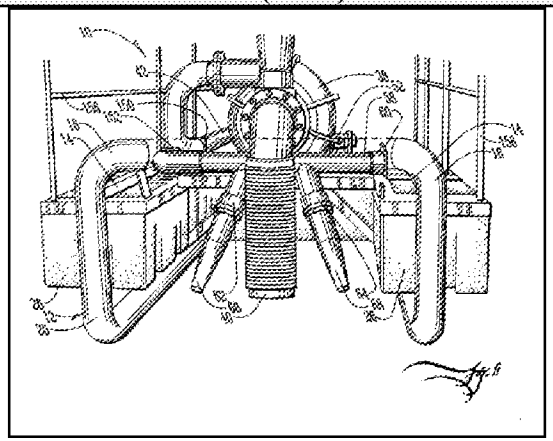
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		lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**  **Figure 5:**  **Figure 6:**	

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12. The vehicle according to claim 11, wherein a plurality of nozzles comprising the at least one directionally adjustable nozzle is connected to the fluid conduit.	**Col. 5:19-40:** The unit 34 can be equipped with quick release pump systems that can provide various pressure and volume outputs to flow sufficient volumes of water and or foam and or dry chemicals in a fire and or hazardous materials decontamination mission from a distance that can not endanger the operator or crew members of the vehicle 10 and enable one to quickly change from one flow rate and pressure to another as the mission dictates such as from fire to hazmat to weapons to DEW (Directed Energy Weapons) to crowd control in seconds. The unit 34 can include pump systems which have the capabilities to quickly change from flow rates and pressures of High 30 Pressure/Low Volume, to Low Pressure/High Volume, to Low Pressure/Low Volume, to Pressure/High Volume in 'joint" work together or independent pump systems and all pump systems can be draft capable, such as gross decontamination of men and equipment to include vehicles, downed aircraft, buildings, civilians, ect; in remote area's of the world during or after a chemical agent and or gas agent (Dirty Bomb), release by an	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge	

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	opposing enemy or terrorist cell. Hose and attachment therewith can preferably be equipped to have quick release couplings. **Col. 9:13-30:** For controlling the flow of water in the case where a series of valves and hoses are used, a first valve controls the flow of water through a first hose from tank 34 to a pump; a second valve controls the flow of the water from a second hose through the tank filter; and a third valve prevents water from flowing from master drain. If there is a convenient nearby source of water, such as a lake or stream, the water from the available source can be pumped directly by pump into the fire hoses, or the tank at the same time refilling the tanks water supply and continuing to supply water to the hoses, water tank and cannon thereby providing a continuous uninterrupted supply or flow of water by removing an end cap from pump and simple valve manipulations feeding water therethrough. The water cannon is capable of flowing water, and or foamed water and or dry chemicals at the same time or independently through a dual chambered water cannon with the appropriate corresponding nozzle affixed to each independent chambers output end. **Col. 10:2-5:** An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses.	solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the	

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		preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and	

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U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
		(64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**	

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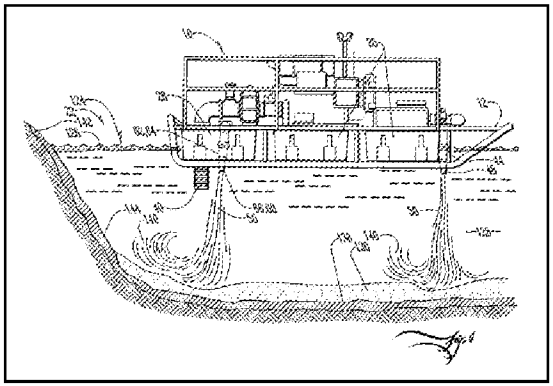
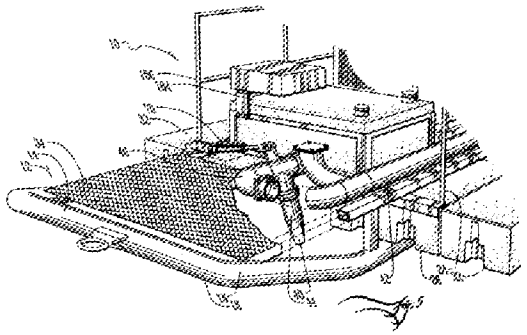
Ground III – Carrier in view of Puck and in further view of Gaither			
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
		 **Figure 5:**  **Figure 6:**	

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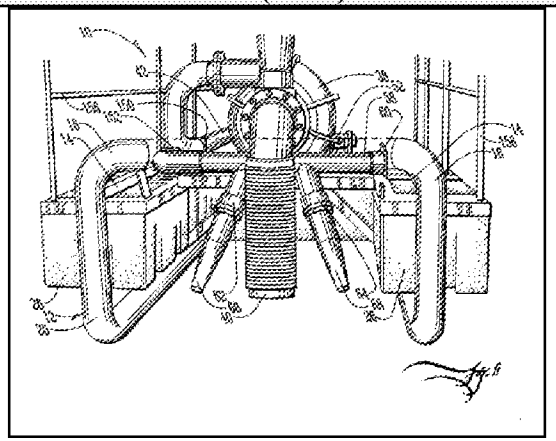
Ground III – Carrier in view of Puck and in further view of Gaither			
U.S. Patent No. 10,974,557	**U.S. Patent No. 7,478,817 (Carrier)**	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent No. 7,833,071 (Gaither)**
			
13. The vehicle according to claim 8, wherein the amount of fluid flow from the directionally adjustable nozzle and/or the direction of the directionally adjustable nozzle are remotely controllable by the operator remote from the vehicle	**Col. 10:2-5:** An adjustable electronic, electronic over air, air over hydraulic, air, hydraulic, automatic, automatic over manual valve system is provided to control the direction of flow of water, foam and dry chemicals through hoses. **Col. 11:5-16:** The operations of each unit described herein can be performed by remote control unit 42 which is operably quick connectable to each unit on the vehicle 10 having suitable connections therewith. The remote control unit 42 is also equipped with manual controls thereon to provide for operation of the vehicle 10 manually as well as a transceiver equipment enabling it to be reprogrammed on a need to need basis, as well as enabling the vehicle 10 to be remotely controlled via line of sight, gps, or by air via aircraft such as the Preditor. Remote control mechanics, servos, hardware, wiring harnesses can be quick releasable to facilitate easy replacement of any faulty components in case of damage or failure.	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to	

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when the vehicle is floating.	**Col. 11:47-53:** All pertinent data transmissions can be sent back and forth allowing for all systems monitoring such as vehicle speed, rpm, water temperature, oil pressure, gear transmission, electrical input and output, weapons diagnostics to include arming and disarming as well as including weapons selection if equipped with multiple weapons systems, water tank level, foam tank level, pump water pressure etc.	the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5).	

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		[0033] If desired, the remote control system (84) may be provided with a first gate close button (114) that closes a valve (115)on the transport pipe (42) positioned between the fluid intake pipe (40) and forward nozzle (48). A gate open button (116) is also provided to open the valve (150). Similarly, a close gate button (118) and open gate button (120) are provided to open and close a valve (152) provided between the fluid intake pipe (40) and the nozzles (66) and (68). The gate buttons (114), (116), (118) and (120) allow a user to selectively supply fluid through one, two or three of the nozzles (48), (66) and (68) as is desired to appropriately agitate the fluid (128) within which the agitator (10) is floating. The remote control system (84) is also provided with a button (122) to actuate lights (154) provided on the agitator (10) if it is desired to use the agitator (10) in circumstances where additional lighting is desired. The remote control system (84) may be configured to receive feedback from the control panel (74), such as system status, latitude, longitude and height coordinates. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the	

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		agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 7:**	

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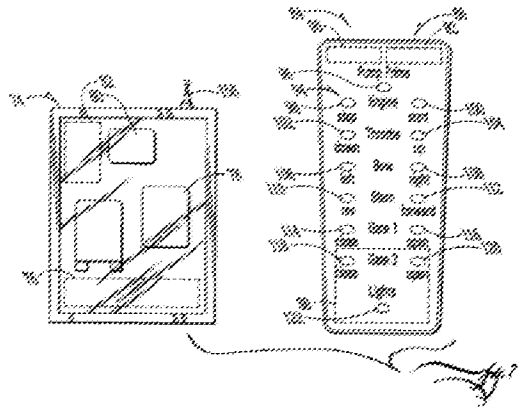
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EXHIBIT J

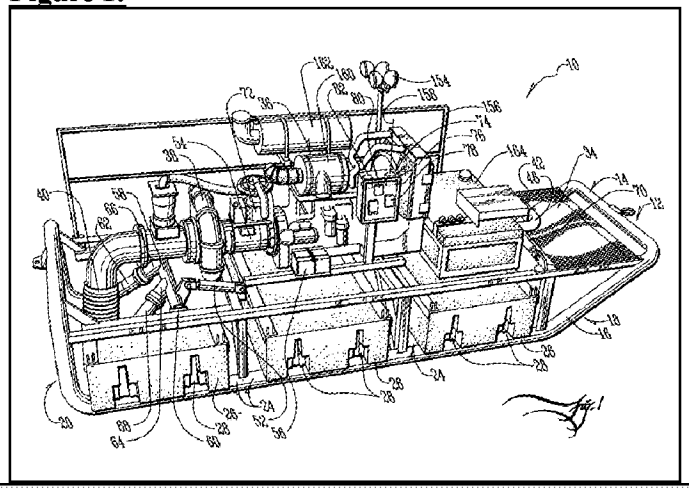
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1. An amphibious vehicle comprising:		**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation.
a floatable vehicle body;	**Abstract:** A floating manure agitator that floats on the surface of a manure lagoon and that may be remotely controlled to agitate manure supernatant into a slurry with sludge settling on the bottom of the lagoon. The agitator is provided with a plurality of fluid outputs, the direction of which may be controlled to motivate and steer the agitator. The outputs are angled to develop vortices of supernatant into the sludge to further mix the materials into a slurry. **[0001]** The present invention relates in general to a manure agitator and, more particularly, to a floating manure agitator for use in association with a manure lagoon. **[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore.	**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation. **[0051]:** Longitudinal frame members 32, 33 and cross frame members 34 may be comprised of a metallic or polymeric material. Frame assembly 30 of FIGS. 7A-7C may be com-prised of an aluminum material, for example 6061-T6 Alu-minum. Similarly, tub 40 may be comprised of an aluminum material, for example 5052-H32 Aluminum. Alternatively, at least a portion of frame assembly 30 and/or tub 40 may include ultra-high molecular weight polyethylene. Addition-ally, frame assembly 30 and/or tub 40 may include a marine-grade pourable urethane coating and/or foam material inserts in order to fill volume voids and resist water ingestion during amphibious operation. As such, frame assembly 30 and tub 40 are

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	[0008] It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0022]:** A floating fluid agitator is shown generally as (10) in FIG. 1. A vessel (12) is provided having a frame (14) preferably constructed of welded tubular steel pipes (16). The vessel (12) may alternatively be constructed of any	configured to minimize water accumulation within vehicle 10. Flotation devices, such as inflatable units, may also be included and secured to vehicle 10 to further increase the buoyancy of vehicle 10 during amphibious operation. In one embodiment, vehicle 10 is configured to float at approxi-mately 1,600 kg without any urethane materials, however, urethane materials may increase the buoyancy of vehicle 10 during amphibious operation.

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	suitable material or may be constructed with a more standard hull, such as those known in the art. The frame (14) is constructed with an angled bow (18) and a vertical stern (20). The angled bow (18) facilitates the launch and retrieval of the agitator (10) from a manure lagoon (22). (FIGS. 1-2). The frame (14) defines a plurality of receiver slots (24) into which are provided modular dock sections (26), such as those known in the art. In the preferred embodiment, the dock sections (26) are 1000 series dock components manufactured by Connect-A-Dock, Inc. of Atlantic, Iowa. **Figure 1:** 	
ground engaging propulsion structure;		**[0044]:** As shown in FIG. 1, frame assembly 30 is supported on track members 12, 14. In one embodiment, track members 12, 14 may be comprised of a polymeric material (e.g., rub-ber) and may be approximately 12 inches in width (approxi-mately 0.3 m). Frame assembly 30 also may support a plu-rality of body panels, for example a hood 16, a front fender 17, side fenders 18, and a rear fender 19. Front fender 17 and rear fender 19 are provided to protect components of vehicle 10 from dirt, mud, debris, and/or damage. Additionally, frame assembly 30 supports an operator area 20, which includes an operator seat 22, a

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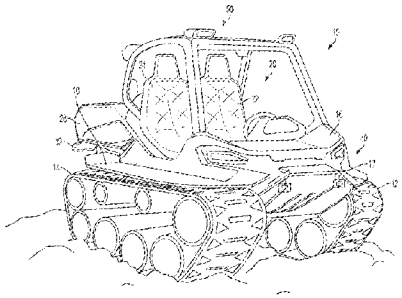
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		passenger seat 24, a dash board assembly 25 (FIG. 6), and operator controls, as detailed further herein. Operator seat 22 and passenger seat 24 may be in a side-by-side arrangement and may include a seat back and a seat bottom. In the illustrative embodiment of vehicle 10 of FIG. 1, operator seat 22 is adjacent to and is separate from passen-ger seat 24. Alternatively, as shown in FIG. 4, operator seat 22 may be coupled to passenger seat 24 such that the seat bot-toms are configured as a bench seat and the seat backs are configured as a single back rest. **[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10. **Figure 1**  FIG. 1
a fluid pump for pumping liquid manure;	**[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to	**[0059]:** The inverted "U" shape of bottom wall 45 is designed to direct any water in tub 40 toward perimeter 47 of bottom wall 45. As shown in FIG. 19, vehicle 10 may include a plurality of pumps, for example bilge

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	draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **Figure 4:**	pumps 630, positioned around perimeter 47 of tub 40 in order to evacuate any water from tub 40. In one embodiment, vehicle 10 may include four pumps 630 coupled to bottom wall 45 at perimeter 47 (i.e., adjacent side walls 48) of tub 40. Pumps 630 may be configured for automatic operation upon the detection of water in tub 40 and/or may be manually operated. Vehicle 10 also may be configured to support a jet pump and/or propeller member to assist with amphibious operation, as detailed further herein. **[0079]:** As illustrated in FIG. 14, gearbox 510 drives an attachment shaft 511 for transferring engine torque to an attachment or implement (e.g., a work tool) attached to vehicle 10. Attachment shaft 511 illustratively extends out-wardly from a backside of gearbox 510 opposite drive shaft 506 and towards the back of vehicle 10 (e.g., through an aperture of the tub) for attaching the external implement. In one embodiment, attachment shaft 511 provides a power take-off for driving the implement with engine 502. In one embodiment, gearbox 510 selectively engages attachment shaft 511 based on an operator input. For example, the shift lever may be actuated to engage attachment shaft 511 to power the implement coupled to vehicle 10. In one embodi-ment, a clutch assembly is selectively engaged by the operator to engage attachment shaft 511 via gearbox 510. The clutch assembly may be hydraulically or electronically operated. In one embodiment, attachment shaft 511 is used to drive a jet pump and/or propeller member to assist in propelling vehicle in water during amphibious operation.

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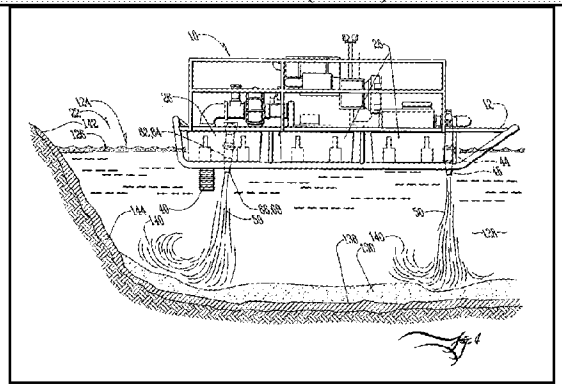
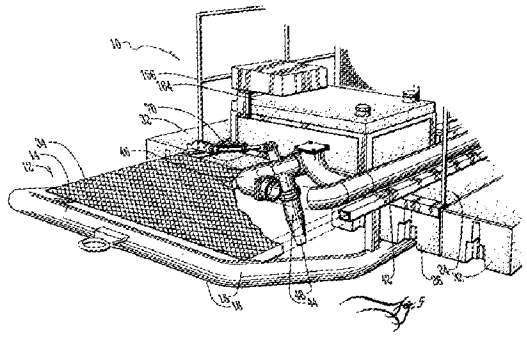
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	Figure 5:	
		
	Figure 6:	

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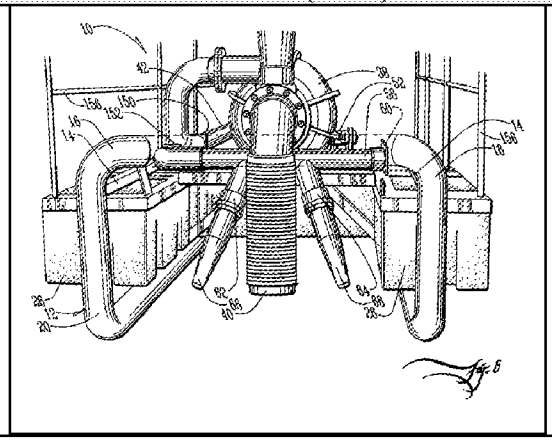
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at least one fluid nozzle connected by a fluid conduit to the fluid pump;	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a	

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	steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0028]:** As shown in FIG. 6, journaled to the rear outlet of the transport pipe (42) is a pivot pipe (58). The pivot pipe (58) is also journaled to a bearing (60) secured to the frame (14). (FIG. 6). Depending from the pivot pipe (58) are a second slurry output (62) and a third slurry output (64). Preferably the slurry outputs (62) and (64) are angled outward from the centerline of the vessel (12), along which the intake pipe (40) is located. (FIGS. 4 and 6). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second	

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	slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port. The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) starboard. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the agitator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the	

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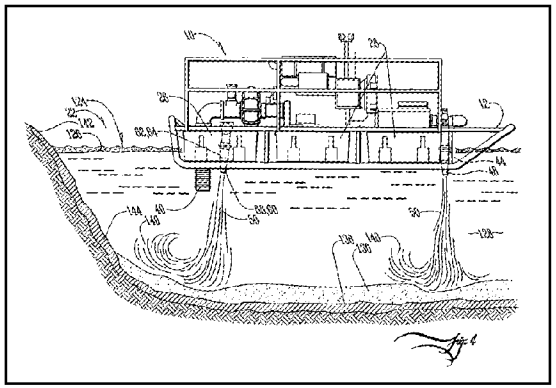
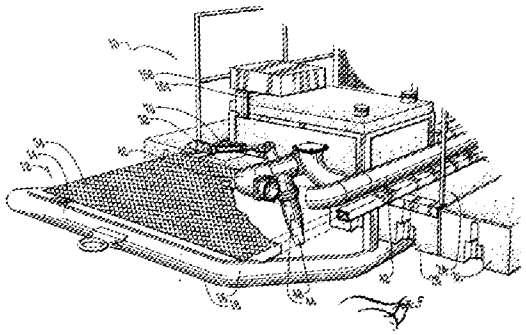
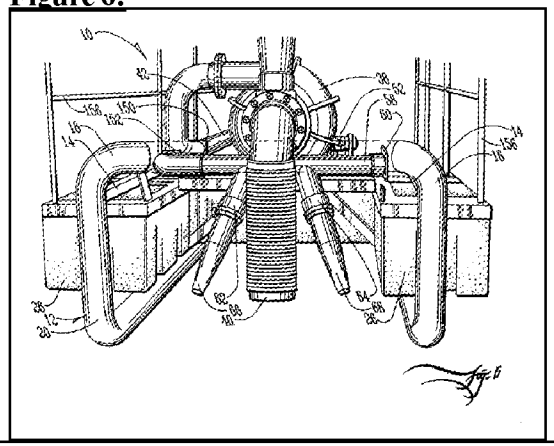
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	power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **Figure 4:**  **Figure 5:**	

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	 **Figure 6:** 	
a power source connected to a hydraulic pump and configured to provide power to both the ground engaging propulsion structure and the fluid pump; and,	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one

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	[0025] Coupled to the power source (36) is a liquid manure pump such as a slurry pump (38). In the preferred embodiment, the slurry pump (38) is a Cornell Redi-Prime centrifugal pump capable of handling both solid and liquid material. The slurry pump (38) is preferably designed to move between one thousand and twenty-four thousand liters of material per minute, more preferably between eight thousand and twenty thousand liters of material per minute, and most preferably about sixteen thousand liters of material per minute.	embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10
remote control structure configured to control the ground engaging propulsion structure and a flow of fluid from the fluid nozzle, wherein the speed and/or direction of the vehicle is remotely controllable by an operator remote from the vehicle when the vehicle is ground engaging and when the vehicle is floating.	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs	**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation. **[0121]:** In one embodiment, vehicle 10 is adapted to be remotely controlled. For example, a remote control electronic device may be used to control vehicle 10 wirelessly without an operator being positioned in the vehicle 10. In one embodi-ment, vehicle 10 is operative to drive autonomously without human input.

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	may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs	

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	(44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130).	
2. The vehicle according to claim 1, wherein the ground engaging propulsion structure comprises a set of wheels or an endless track.		**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation.

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3. The vehicle according to claim 1, wherein the power source is configured to provide hydraulic fluid power to both the ground engaging propulsion structure and the fluid pump.	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10.
4. The vehicle according to claim 3, wherein the ground engaging propulsion structure is operable at variable speed by a hydraulic motor.	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG.1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10. **[0084]:** In operation, to drive vehicle 10 straight forward, steering and drive assembly 508 applies power from engine 502 to both drive units 590, 592 (FIG. 16) such that both left and right tracks 12, 14 rotate at the same speed. To steer the vehicle 10 based on the steering angle of steering wheel 529 (FIG. 8), steering and drive assembly 508 applies a differential to the driving speeds of each drive unit 590, 592 (FIG. 16). The speed difference between the left and right drive units 590, 592 is different depending on the desired corner radius that vehicle 10 is driven.
5. The vehicle according to claim 1, wherein the at least one fluid nozzle	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the	

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comprises a plurality of fluid nozzles connected to the fluid conduit.	vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five	

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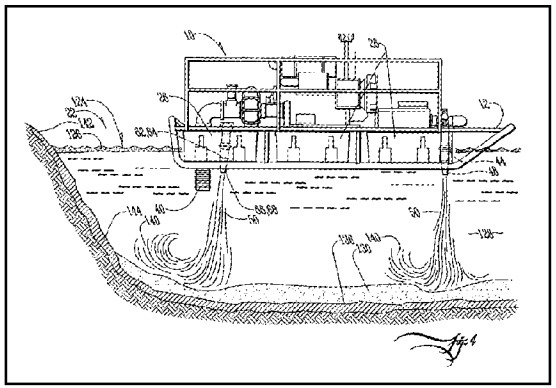
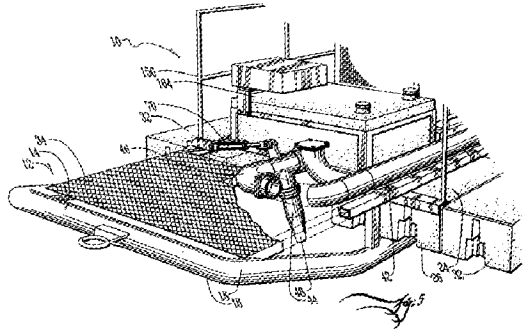
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	degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **Figure 4:**  **Figure 5:** 	

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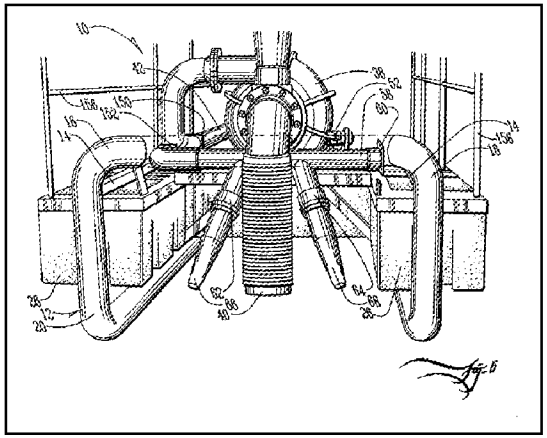
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	Figure 6: 	
6. The vehicle according to claim 1, wherein the location of the ground engaging propulsion structure, power source and fluid pump are selected to provide a desired location for a center of gravity of the vehicle.	**[0041]** As shown, the fuel reservoir (164) is provided at least partially below the deck (34) of the vessel (12) to allow access to the fuel reservoir (164), while still providing the agitator (10) with a low center of gravity to increase the stability of the agitator (10).	**[0041]:** Corresponding reference characters indicate corre-sponding parts throughout the several views. Although the drawings represent embodiments of various features and components according to the present disclosure, the drawings are not necessarily to scale and certain features may be exag-gerated in order to better illustrate and explain the present disclosure. The exemplifications set out herein illustrate embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.
7. The vehicle according to claim 1, wherein the amount of fluid flow from the at least one fluid nozzle and/or the direction of the at least one fluid nozzle are remotely controllable by	**[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port.	**[0035]:** FIG. 20 is a block diagram illustrating a torque compensation function of an engine control unit of the vehicle of FIG. 4;

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the operator remote from the vehicle when the vehicle is floating.	The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) starboard. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the agitator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward. **[0033]** If desired, the remote control system (84) may be provided with a first gate close button (114) that closes a valve (115) on the transport pipe (42) positioned between the fluid intake pipe (40) and forward nozzle (48). A gate open button (116) is also provided to open the valve (150). Similarly, a close gate button (118) and open gate button (120) are provided to open and close a valve (152) provided between the fluid intake pipe (40) and the nozzles (66) and (68). The gate buttons (114), (116), (118) and (120) allow a user to selectively supply fluid through one, two or three of the nozzles (48), (66) and (68) as is desired to appropriately agitate the fluid (128) within which the agitator (10) is floating. The remote control system (84) is also provided with a button(122) to actuate lights (154) provided on the agitator (10) if it is desired to use the agitator (10) in circumstances where additional lighting is desired. The remote control system (84) may be configured to receive feedback from the control panel (74), such as system status, latitude, longitude and height coordinates. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw	

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	supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130).	
8. An amphibious vehicle comprising:		**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track

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		member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation.
a floatable vehicle body;	**Abstract:** A floating manure agitator that floats on the surface of a manure lagoon and that may be remotely controlled to agitate manure supernatant into a slurry with sludge settling on the bottom of the lagoon. The agitator is provided with a plurality of fluid outputs, the direction of which may be controlled to motivate and steer the agitator. The outputs are angled to develop vortices of supernatant into the sludge to further mix the materials into a slurry. **[0001]** The present invention relates in general to a manure agitator and, more particularly, to a floating manure agitator for use in association with a manure lagoon. **[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid	**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging members, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be configured for military applications and is configured to travel through various terrains or surfaces. More particularly, vehicle 10 is configured for both land and amphibious operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be configured to travel at speeds of approximately 50 mph during land operation. **[0051]:** Longitudinal frame members 32, 33 and cross frame members 34 may be comprised of a metallic or polymeric material. Frame assembly 30 of FIGS. 7A-7C may be com-prised of an aluminum material, for example 6061-T6 Alu-minum. Similarly, tub 40 may be comprised of an aluminum material, for example 5052-H32 Aluminum. Alternatively, at least a portion of frame assembly 30 and/or tub 40 may include ultra-high molecular weight polyethylene. Addition-ally, frame assembly 30 and/or tub 40 may include a marine-grade pourable urethane coating and/or foam material inserts in order to fill volume voids and resist water ingestion during amphibious operation. As such, frame assembly 30 and tub 40 are configured to minimize water accumulation within vehicle 10. Flotation devices, such as inflatable units, may also be included and secured to vehicle 10 to further increase the buoyancy of vehicle 10 during amphibious operation. In one embodiment, vehicle 10 is configured to

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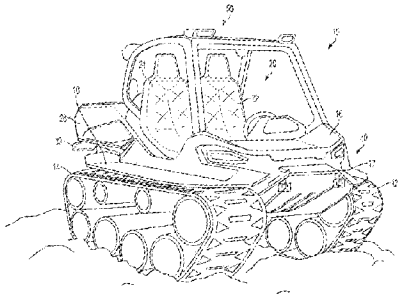
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	downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0022]:** A floating fluid agitator is shown generally as (10) in FIG. 1. A vessel (12) is provided having a frame (14) preferably constructed of welded tubular steel pipes (16). The vessel (12) may alternatively be constructed of any suitable material or may be constructed with a more standard hull, such as those known in the art. The frame (14) is constructed with an angled bow (18) and a vertical stern (20). The angled bow (18) facilitates the launch and	float at approxi-mately 1,600 kg without any urethane materials, however, urethane materials may increase the buoyancy of vehicle 10 during amphibious operation. **Figure 1**  FIG. 1

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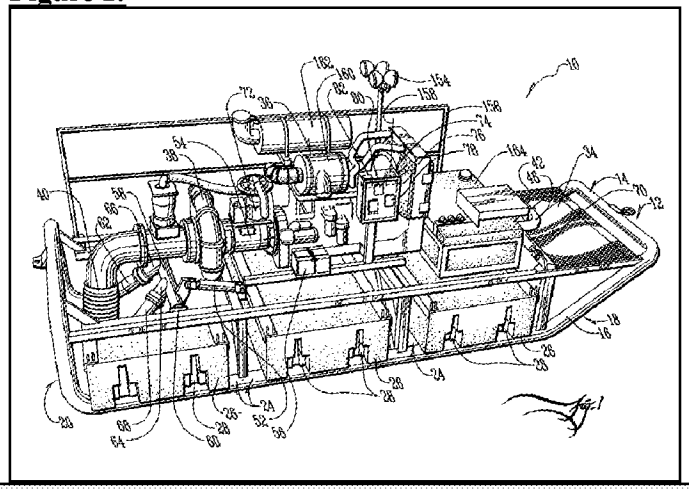
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	retrieval of the agitator (10) from a manure lagoon (22). (FIGS. 1-2). The frame (14) defines a plurality of receiver slots (24) into which are provided modular dock sections (26), such as those known in the art. In the preferred embodiment, the dock sections (26) are 1000 series dock components manufactured by Connect-A-Dock, Inc. of Atlantic, Iowa. **Figure 1:** 	
four hydraulically powered ground engaging wheels;		**[0003]:** Generally, all-terrain vehicles ("ATVs") and utility vehicles ("UVs") are used to carry one or more passengers over a variety of terrain. More particularly, some ATVs and UVs may include side-by-side seating, in which a passenger may be seated next to the driver at the front of the vehicle. Side-by-side vehicles also may include a rear seating area to accommodate additional passengers in the vehicle. A roll cage may be provided over the seating of the vehicle. Additionally, ATVs and UVs may provide a cargo area in the front and/or the rear of the vehicle in order to carry cargo. ATVs and UVs include ground-engaging members, which may be tires, tracks, skis, or any other device for moving the vehicle across the ground.

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		[0057]: Front members 52, rear members 54, and cross members 56, 57 may have a profiled cross-section in a figure-eight or hourglass configuration. As such, front members 52, rear members 54, and cross members 56, 57 include recessed portions for receiving accessories, such as windows, doors, a front windshield, a rear windshield, and/or a roof, which may enclose operator area 20. The recessed portions of roll cage assembly 50 may include sealing members in order to seal-ingly enclose operator area 20. Additional details of the pro-filed configuration of front members 52, rear members 54, and cross members 56, 57, as well as the enclosing accesso-ries (e.g., doors, windshields, windows, and/or a roof) are disclosed in U.S. Patent Application Publication No. 2013/ 0033070, filed on Jun. 8, 2012, the complete disclosure of which is expressly incorporated by reference herein. If opera-tor area 20 is enclosed, operator area 20 may be configured to supply heat, defrost, and/or air conditioning, as well as other accessories, for the comfort and convenience of the operator and the passenger. **[0062]:** Referring now to FIGS. 8, 9A, and 9B, suspension assembly 70 includes a plurality of lower guide or carrier rollers 72, a plurality of upper carrier rollers 73, drive units 590, 592, at least one idler wheel 79, and a plurality of load wheels 75. Carrier rollers 72 and 73, drive units 590, 592, idler wheel 79, and/or load wheels 75 may be comprised of metallic and/or polymeric materials. For example, as shown in FIGS. 9A and 9B, at least one load wheel 75 is configured as a non-pneumatic tire while carrier rollers 72, 73 and idler wheel 79 are configured as spoked wheels. In one embodi-ment, these spoked wheels are made of a polymer. Non-pneumatic tires may be comprised of a polymeric material and may be used to increase the compliance of suspension assembly 70 and track members 12, 14 during operation of vehicle 10. **[0063]:** Carrier rollers 72, 73, drive units 590, 592, and load wheels 75 are in contact with track members 12, 14 and are supported on side walls 48 of tub 40. In one embodiment, idler wheels 79 are connected to suspension members. Drive units 590, 592 may be supported by front axle assembly 532. Drive units 590, 592 are profiled to engage track members 12, 14, as detailed further herein. Upper carrier rollers 73 may be fixed to side walls

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		48 of tub 40. Upper carrier rollers 73 and idler wheel 79 are configured to maintain the tension in track members 12, 14. In one embodiment, for example on vehicle 10" of FIG. 3, at least one of upper carrier rollers 73 may be partially covered with a shroud 122. Shroud 122 may be integrally formed with side fender 18" or may be coupled thereto and/or to side body panel 27" with conventional fas-teners. **[0064]:** Lower carrier rollers 72 and load wheels 75 may be operably coupled to side walls 48 of tub 40 with a plurality of shafts 76 and a plurality of control arms 78. As shown in FIGS. 4, 6, 8, 9A, and 9B, shafts 76 are coupled to side walls 48 with conventional fasteners (e.g., welds, rivets, bolts, adhesive) and an upper end of control arms 78 may be pivot-ally coupled to shafts 76. Lower ends of control arms 78 are operably coupled to lower carrier rollers 72 and load wheels 75. Load wheels 75 include a front load wheel 75a and a rear load wheel 75b and are configured to support the majority of the load of vehicle 10. Lower carrier rollers 72 are configured to support a portion of the load of vehicle 10 and also are configured to guide track members 12, 14 to prevent derail-ment. For example, load wheels 75 may support approxi-mately 75% of the load of vehicle 10 while lower carrier rollers 72 may support approximately 25% of the load of vehicle 10. **[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configuration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic components of vehicle 10. **Figure 8:**

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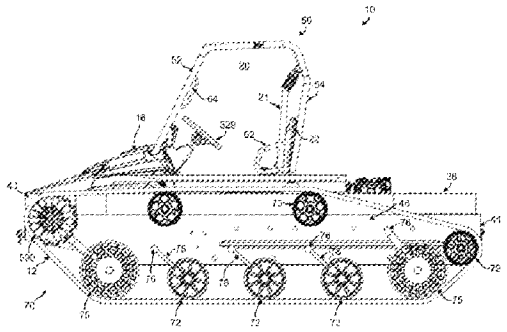
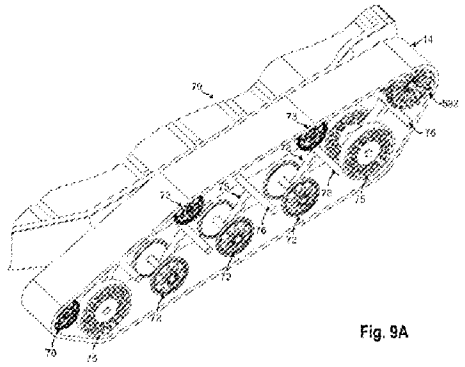
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		 Fig. 8 **Figure 9A:**  Fig. 9A **Figure 9B:**

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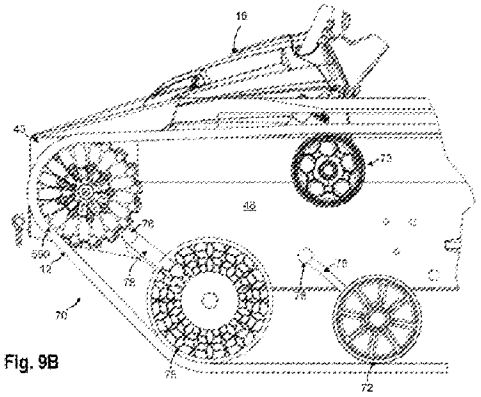
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		 Fig. 9B
four hydraulic motors, one hydraulic motor per wheel, for powering the four hydraulically powered ground engaging wheels;		**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10. **[0107]:** Referring to FIG. 21, ECU 520 is operative to control the activation of hydraulic pumps (e.g., pumps 602, 604 of FIG. 18) of hydraulic pump assembly 518. Based on the detected vehicle speed from speed sensor 642, the detected steering angle of steering wheel 529 from sensor 640, and the detected engine speed from an engine speed sensor 648, ECU 520 is operative to selectively active pumps 602, 604 of hydraulic pump assembly 518. As described herein, ECU 520 activates one or more pumps of hydraulic pump assembly 518 based on the vehicle speed decreasing to below the threshold speed. As such, hydraulic pump assembly 518 is used to drive hydraulic motor 552 of steering and drive

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		assembly 508 (FIG. 15) at low or zero vehicle speeds, as described herein. ECU 520 monitors the vehicle speed and steering angle to determine if pump assembly 518 requires activation at speeds greater than the threshold, such as if additional steering power is required. In one embodiment, ECU 520 monitors the engine speed and increases the engine speed upon determining, based on the steering demand, vehicle speed, and engine speed, that additional power is required for driving the pumps of hydraulic pump assembly 518. In one embodiment, hydraulic pump assembly 518 includes at least two hydraulic pumps coupled in series. FIG. 21 illustrates hydraulic pump assembly 518 having three pumps in series. In one embodiment, when an operator is not detected in seat 22 based on output from seat sensor 652, ECU 520 disables operation of hydraulic pump assembly 518, as described herein.
a fluid pump for pumping liquid manure;	**[0006]** It is also known in the art to provide a large vehicle that may be lowered into the lagoon. The vehicle may equipped with a fluid intake, a pump and a fluid output to draw supernatant into the pump and force the supernatant at high speed downward toward the sludge. The vehicle is typically moved with cables by operators on the shore. **[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly	**[0059]:** The inverted "U" shape of bottom wall 45 is designed to direct any water in tub 40 toward perimeter 47 of bottom wall 45. As shown in FIG. 19, vehicle 10 may include a plurality of pumps, for example bilge pumps 630, positioned around perimeter 47 of tub 40 in order to evacuate any water from tub 40. In one embodiment, vehicle 10 may include four pumps 630 coupled to bottom wall 45 at perimeter 47 (i.e., adjacent side walls 48) of tub 40. Pumps 630 may be configured for automatic operation upon the detection of water in tub 40 and/or may be manually operated. Vehicle 10 also may be configured to support a jet pump and/or propeller member to assist with amphibious operation, as detailed further herein. **[0079]:** As illustrated in FIG. 14, gearbox 510 drives an attachment shaft 511 for transferring engine torque to an attachment or implement (e.g., a work tool) attached to vehicle 10. Attachment shaft 511 illustratively extends out-wardly from a backside of gearbox 510 opposite drive shaft 506 and towards the back of vehicle 10 (e.g., through an aperture of the tub) for attaching the external implement. In one embodiment, attachment shaft 511 provides a power take-off for driving the implement with engine 502. In one embodiment, gearbox 510 selectively engages attachment shaft 511 based on an operator input. For example, the shift lever may be actuated to engage attachment shaft 511 to power the implement coupled to vehicle 10. In one embodi-ment, a clutch assembly is selectively engaged by the operator to engage attachment shaft 511 via gearbox 510.

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	directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **Figure 4:**	The clutch assembly may be hydraulically or electronically operated. In one embodiment, attachment shaft 511 is used to drive a jet pump and/or propeller member to assist in propelling vehicle in water during amphibious operation.

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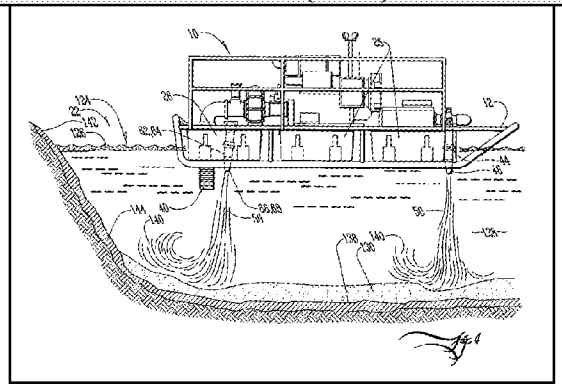
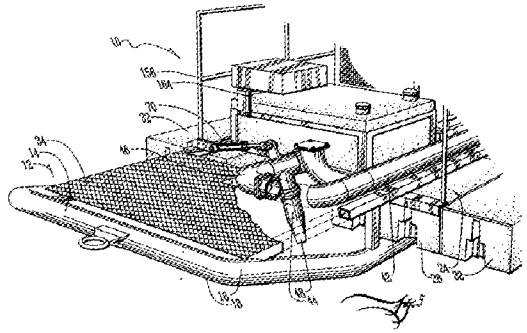
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	Figure 5:	
		
	Figure 6:	

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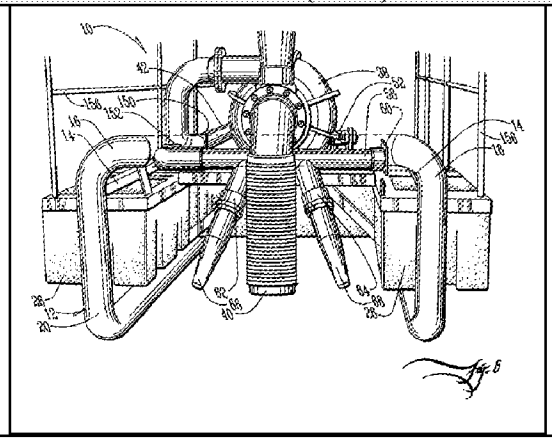
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at least one directionally adjustable nozzle through which the liquid manure is pumped;	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a	

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	steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5).	

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	[0029] Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **[0032]** The remote control system (64) also includes an engine stop button (98), start button (100), a throttle down button (102) and throttle up button (104). To steer the agitator (10) the remote control system (84) is provided with a bow left button (106) and bow right button (108). The bow left button (106) causes the steering control hydraulic cylinder (52) to extend, thereby directing the nozzle (48) to starboard and driving the agitator (10) port. The remote control system (84) is also provided with a bow right button (108) to retract the hydraulic cylinder (52) and steer the agitator (10) starboard. The remote control system (84) is provided with a reverse button (110) which causes the hydraulic cylinder (70) to extend, thereby forcing the pivot pipe (58) to direct the slurry outputs (62) and (64) toward the bow (18) of the agitator (10), thereby driving the vessel (12) rearward. Similarly, a forward button (112) causes the hydraulic cylinder (70) to retract and drive the agitator (10) forward.	

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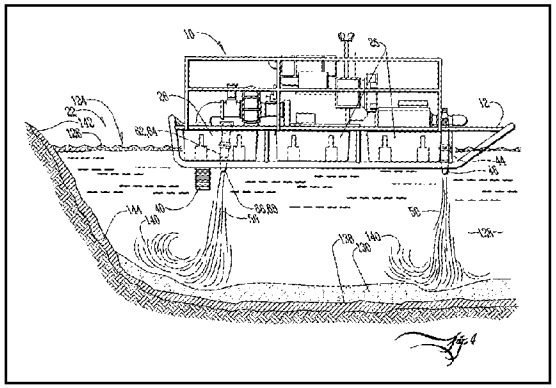
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	[0035] Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **Figure 4:**  **Figure 5:**	

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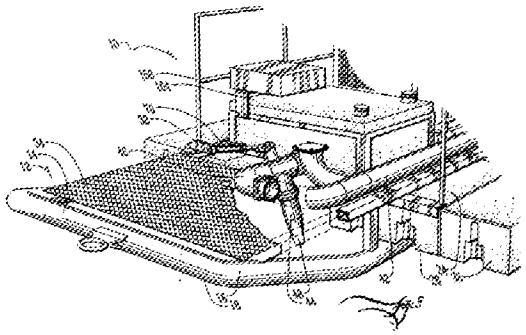
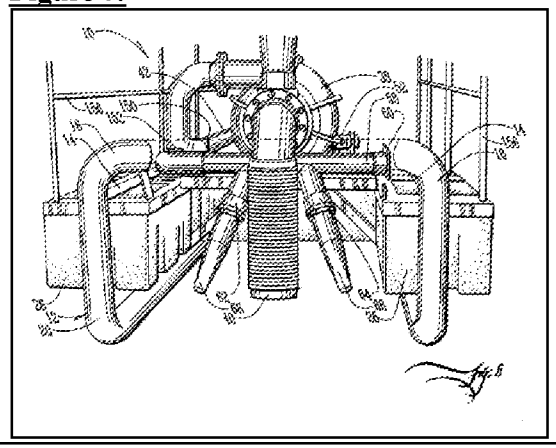
Ground IV - Puck in view of Bennett		
U.S. Patent No. 10,974,557	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent Application Publication No. US 2014/0288763 (Bennett)**
	 **Figure 6:** 	
an internal combustion engine configured to provide power to both the four variable speed hydraulic motors and the fluid pump;	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG. 1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10.

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	[0025] Coupled to the power source (36) is a liquid manure pump such as a slurry pump (38). In the preferred embodiment, the slurry pump (38) is a Cornell Redi-Prime centrifugal pump capable of handling both solid and liquid material. The slurry pump (38) is preferably designed to move between one thousand and twenty-four thousand liters of material per minute, more preferably between eight thousand and twenty thousand liters of material per minute, and most preferably about sixteen thousand liters of material per minute. **Claim 13:** The floating slurry agitator of clam 1, wherein the power source is a diesel engine.	**[0084]:** In operation, to drive vehicle 10 straight forward, steering and drive assembly 508 applies power from engine 502 to both drive units 590, 592 (FIG. 16) such that both left and right tracks 12, 14 rotate at the same speed. To steer the vehicle 10 based on the steering angle of steering wheel 529 (FIG. 8), steering and drive assembly 508 applies a differen-tial to the driving speeds of each drive unit 590, 592 (FIG.16). The speed difference between the left and right drive units 590, 592 is different depending on the desired comer radius that vehicle 10 is driven. **[0085]:** In one embodiment, the differential speed of the two driving units 590, 592 is achieved by a controlled variation of the drive ratio between the two driving units 590, 592, and not by applying brakes 536. As such, the distribution of the torque applied to drive units 590, 592 is adjusted without changing the total torque applied. The torque reduced on the one side of vehicle 10 is applied to the other side of vehicle 10. Based on this behavior, the vehicle 10 keeps a constant driving speed during steering. In an alternative embodiment, brakes 536 are actuated to assist with steering vehicle 10.
the location of the four hydraulically powered ground engaging wheels, the internal combustion engine and the fluid pump selected to provide a desired location for a center of gravity of the vehicle; and,	**[0041]** As shown, the fuel reservoir (164) is provided at least partially below the deck (34) of the vessel (12) to allow access to the fuel reservoir (164), while still providing the agitator (10) with a low center of gravity to increase the stability of the agitator (10).	
remote control structure configured to control the four variable speed hydraulic motors and the fluid pump,	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer.	**[0043]:** Referring to FIG. 1, an illustrative embodiment of a vehicle 10 is shown. As detailed further herein, vehicle 10 may be a tracked ATV that includes ground engaging mem-bers, illustratively a left side track member 12 and a right side track member 14, a powertrain assembly 500 (FIG. 13), a frame assembly 30, a body or tub 40 (FIG. 4), a roll cage assembly 50, and a suspension assembly 70 (FIG. 4). Vehicle 10 may be

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wherein the speed and/or direction of the vehicle is remotely controllable by an operator remote from the vehicle when the vehicle is ground engaging and when the vehicle is floating.	It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44).	configured for military applications and is configured to travel through various terrains or surfaces. More par-ticularly, vehicle 10 is configured for both land and amphibi-ous operation. Additionally, vehicle 10 may be operated by remote control. In one embodiment, vehicle 10 may be con-figured to travel at speeds of approximately 50 mph during land operation. **[0121]:** In one embodiment, vehicle 10 is adapted to be remotely controlled. For example, a remote control electronic device may be used to control vehicle 10 wirelessly without an operator being positioned in the vehicle 10. In one embodi-ment, vehicle 10 is operative to drive autonomously without human input.

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	Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The	

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	remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130).	
9. The vehicle according to claim 8, wherein the power source is configured to provide hydraulic fluid power to the four hydraulic motors and the fluid pump.	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG. 1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0031]:** The hydraulic cylinder (70) is coupled to the hydraulic pump (54). The hydraulic pump (54) is coupled to a control manifold (72) that is electronically coupled to a control panel (74) provided with a central processing unit (76) and a global positioning system (78). (FIGS. 1	**[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10.

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	and 7). Also coupled to the control panel (74) are a wireless receiver (80) and wireless transmitter (82), that allow the control panel (74) to operate as a wireless remote control, actuated by a remote control system (84). (FIGS. 1 and 5). The remote control system (84) may be a portable computer (not shown) or simply a handset (86) provided with a battery (88), wireless transmitter (90) and a wireless receiver (92). The remote control system (84) may be provided with one or more joysticks, touchscreens, keyboards or other input devices known in the art (not shown), to allow the remote control system (84) to accept commands. In the preferred embodiment, the remote control system (84) is provided with a plurality of buttons (94) as shown in FIG. 7. The remote control system (84) is provided with a pump prime button (96). The prime pump button (96) signals the control panel (74) to circulate fluid within the slurry pump (38) to prime the pump (38) prior to use.	
10. The vehicle according to claim 9, wherein the four hydraulic motors are variable speed hydraulic motors and wherein the four hydraulically powered ground engaging wheels are each operable at variable speed.	**[0024]** The vessel (12) is provided with a deck (34) and a power source (36). (FIG. 1). While the power source (36) may be any suitable power source, in the preferred embodiment the power source (36) is a John Deere Tier 3 diesel engine. Depending on the desired size and efficiency of the agitator (10), the power source (36) is preferably between twenty and two-thousand horsepower, more preferably between fifty and five hundred horsepower, and most preferably between one hundred fifty and two hundred fifty horsepower.	**[0003]:** Generally, all-terrain vehicles ("ATVs") and utility vehicles ("UVs") are used to carry one or more passengers over a variety of terrain. More particularly, some ATVs and UVs may include side-by-side seating, in which a passenger may be seated next to the driver at the front of the vehicle. Side-by-side vehicles also may include a rear seating area to accommodate additional passengers in the vehicle. A roll cage may be provided over the seating of the vehicle. Additionally, ATVs and UVs may provide a cargo area in the front and/or the rear of the vehicle in order to carry cargo. ATVs and UVs include ground-engaging members, which may be tires, tracks, skis, or any other device for moving the vehicle across the ground. **[0057]:** Front members 52, rear members 54, and cross members 56, 57 may have a profiled cross-section in a figure-eight or hourglass configuration. As such, front members 52, rear members 54, and cross members 56, 57 include recessed portions for receiving accessories, such

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		as windows, doors, a front windshield, a rear windshield, and/or a roof, which may enclose operator area 20. The recessed portions of roll cage assembly 50 may include sealing members in order to seal-ingly enclose operator area 20. Additional details of the pro-filed configuration of front members 52, rear members 54, and cross members 56, 57, as well as the enclosing accesso-ries (e.g., doors, windshields, windows, and/or a roof) are disclosed in U.S. Patent Application Publication No. 2013/ 0033070, filed on Jun. 8, 2012, the complete disclosure of which is expressly incorporated by reference herein. If opera-tor area 20 is enclosed, operator area 20 may be configured to supply heat, defrost, and/or air conditioning, as well as other accessories, for the comfort and convenience of the operator and the passenger. **[0059]:** The inverted "U" shape of bottom wall 45 is designed to direct any water in tub 40 toward perimeter 47 of bottom wall 45. As shown in FIG. 19, vehicle 10 may include a plurality of pumps, for example bilge pumps 630, positioned around perimeter 47 of tub 40 in order to evacuate any water from tub 40. In one embodiment, vehicle 10 may include four pumps 630 coupled to bottom wall 45 at perimeter 47 (i.e., adjacent side walls 48) of tub 40. Pumps 630 may be configured for automatic operation upon the detection of water in tub 40 and/or may be manually operated. Vehicle 10 also may be configured to support a jet pump and/or propeller member to assist with amphibious operation, as detailed further herein. **[0083]:** A hydraulic pump assembly 518 is also coupled to engine 502 and is driven by the crankshaft of engine 502. As described herein, hydraulic pump assembly 518 is operative to drive hydraulic motor 552 of steering and drive assembly 508 to facilitate zero-speed turning and low-speed turning of vehicle 10. In one embodiment, hydraulic pump assembly 518 includes a dual hydraulic pump in a dual stage configu-ration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. 18, for example). Hydraulic lines are routed from hydraulic pump assembly 518 to hydraulic motor 552 of steering and drive assembly 508. In one embodiment, hydraulic pump assembly 518 drives other hydraulic compo-nents of vehicle 10.

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		[0084]: In operation, to drive vehicle 10 straight forward, steering and drive assembly 508 applies power from engine 502 to both drive units 590, 592 (FIG. 16) such that both left and right tracks 12, 14 rotate at the same speed. To steer the vehicle 10 based on the steering angle of steering wheel 529 (FIG. 8), steering and drive assembly 508 applies a differen-tial to the driving speeds of each drive unit 590, 592 (FIG.16). The speed difference between the left and right drive units 590, 592 is different depending on the desired comer radius that vehicle 10 is driven. **[0085]:** In one embodiment, the differential speed of the two driving units 590, 592 is achieved by a controlled variation of the drive ratio between the two driving units 590, 592, and not by applying brakes 536. As such, the distribution of the torque applied to drive units 590, 592 is adjusted without changing the total torque applied. The torque reduced on the one side of vehicle 10 is applied to the other side of vehicle 10. Based on this behavior, the vehicle 10 keeps a constant driving speed during steering. In an alternative embodiment, brakes 536 are actuated to assist with steering vehicle 10. **[0107]:** Referring to FIG. 21, ECU 520 is operative to control the activation of hydraulic pumps (e.g., pumps 602, 604 of FIG. 18) of hydraulic pump assembly 518. Based on the detected vehicle speed from speed sensor 642, the detected steering angle of steering wheel 529 from sensor 640, and the detected engine speed from an engine speed sensor 648, ECU 520 is operative to selectively active pumps 602, 604 of hydraulic pump assembly 518. As described herein, ECU 520 activates one or more pumps of hydraulic pump assembly 518 based on the vehicle speed decreasing to below the threshold speed. As such, hydraulic pump assembly 518 is used to drive hydraulic motor 552 of steering and drive assembly 508 (FIG. 15) at low or zero vehicle speeds, as described herein. ECU 520 monitors the vehicle speed and steering angle to determine if pump assembly 518 requires activation at speeds greater than the threshold, such as if additional steering power is required. In one embodiment, ECU 520 monitors the engine speed and increases the engine speed upon determining, based on the steering demand, vehicle speed, and

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		engine speed, that additional power is required for driving the pumps of hydraulic pump assembly 518. In one embodiment, hydraulic pump assembly 518 includes at least two hydraulic pumps coupled in series. FIG. 21 illustrates hydraulic pump assembly 518 having three pumps in series. In one embodiment, when an operator is not detected in seat 22 based on output from seat sensor 652, ECU 520 disables operation of hydraulic pump assembly 518, as described herein.
11. The vehicle according to claim 8, wherein the at least one directionally adjustable nozzle is connected to a fluid conduit connected to the fluid pump.	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the	

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	speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0026]** The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented	

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	and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the	

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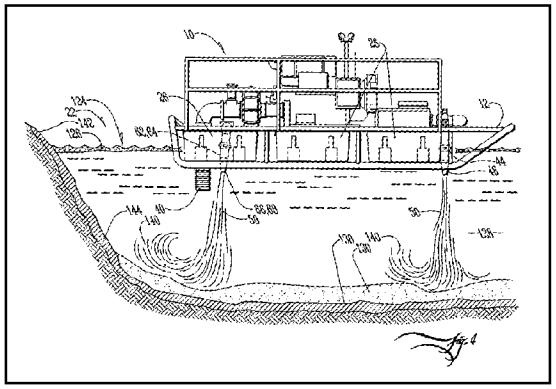
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	agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**  **Figure 5:**	

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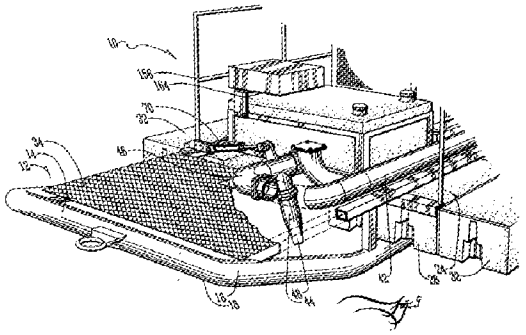
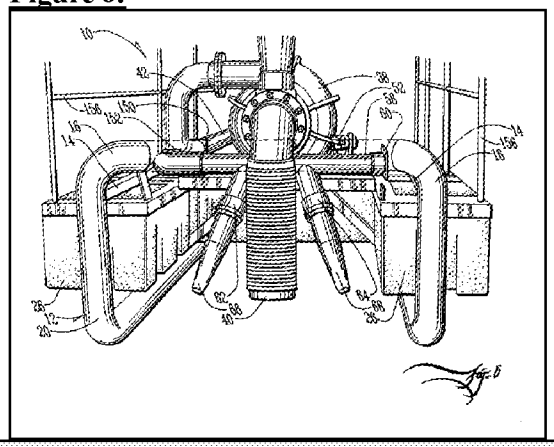
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	 **Figure 6:** 	
12. The vehicle according to claim 11, wherein a plurality of nozzles comprising the at least one directionally adjustable nozzle is connected to the fluid conduit.	**[0008]** It would, therefore, be desirable to provide a vehicle which floats on the manure pond and which is maneuverable. It would also be desirable to provide the vehicle with multiple outlet nozzles to direct the fluid downward into the lagoon a sufficient distance to agitate the solids in the bottom of the lagoon into suspension and create vortices within the lagoon to assist in carrying solids within the sludge into suspension in the supernatant. It would additionally be desirable to direct the nozzles to create vortices that mix the solids of the sludge into	

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	suspension with the supernatant, while minimizing the amount of unpleasant smelling hydrogen sulfide rising to the surface and escaping into the air. **[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore.	

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Ground IV - Puck in view of Bennett		
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	[0026] The slurry pump (38) is coupled to a liquid manure intake, such as a slurry intake, which is a downwardly directed intake pipe (40) in the preferred embodiment and is capable of handling manure crust, supernatant, sludge and the combined slurry. (FIGS. 1 and 4). If desired, the intake pipe (40) may be extensible to adjust the depth of the intake pipe (40). The intake pipe (40) is constructed to extend about twenty-four inches below the surface of the lagoon (22), but may be extended or retracted to any desired depth, including the entire depth of the lagoon (22). **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0029]** Releasably coupled to the second slurry output (62) and third slurry output (64) are a pair of nozzles (66) and (68) pivotably coupled to the vessel (12). The second slurry output (62) and third slurry output (64) are oriented and configured to direct the slurry (50) as desired and to increase the velocity with which the slurry (50) exits the nozzles (66) and (68). The second slurry output (62) is preferably directed between five and eighty degrees port, more preferably directed between ten and sixty degrees	

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	port and, most preferably, between fifteen and forty-five degrees port. The third slurry output (64) is preferably directed between five and eighty degrees starboard, more preferably between ten and sixty degrees starboard and, most preferably, between fifteen and forty-five degrees starboard. The intake pipe (40) is preferably positioned between the first slurry output (44) and the second slurry output (62). **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote	

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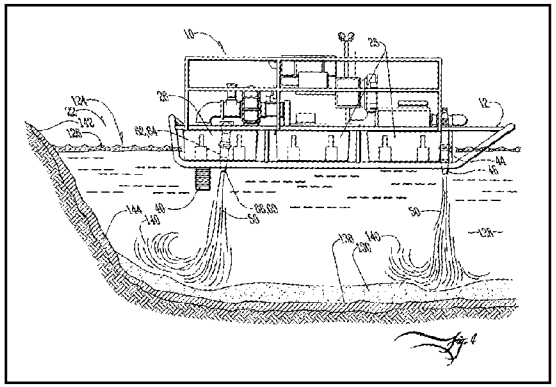
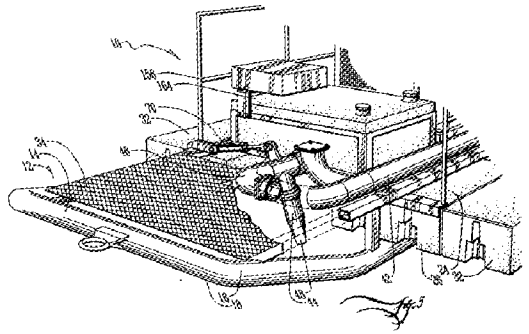
Ground IV - Puck in view of Bennett		
U.S. Patent No. 10,974,557	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent Application Publication No. US 2014/0288763 (Bennett)**
	control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 4:**  **Figure 5:** 	

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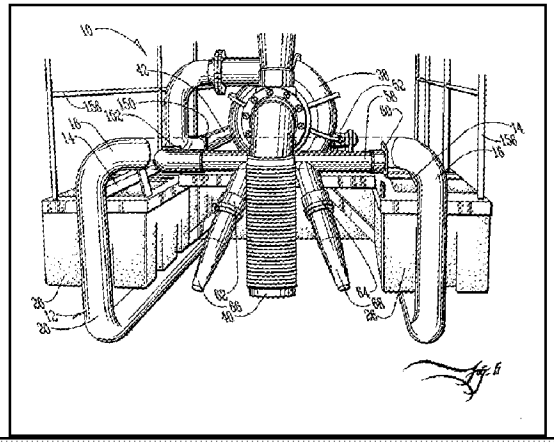
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U.S. Patent No. 10,974,557	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent Application Publication No. US 2014/0288763 (Bennett)**
	Figure 6: 	
13. The vehicle according to claim 8, wherein the amount of fluid flow from the directionally adjustable nozzle and/or the direction of the directionally adjustable nozzle are remotely controllable by the operator remote from the vehicle when the vehicle is floating.	**[0009]** It would further be desirable to provide a floating vehicle for the mixing of sludge solids into suspension with the supernatant that may be quickly and readily transported to a manure lagoon, launched into the lagoon, used to suspend sludge solids into suspension with the supernatant, and removed from the lagoon onto a trailer. It would also be desirable to provide a floating vehicle configured to the standard, height, weight and width restrictions associated with highway travel. Additionally, it would be desirable to provide a floating manure agitation vehicle that may be remotely controlled and guided to specific portions of the lagoon to move solids of the sludge into suspension with the supernatant as desired. **[0011]** In the preferred embodiment of this invention, a floating manure agitator is provided with a floating vessel and a power source. A slurry pump is coupled to the power source. A slurry intake and three slurry outputs are also coupled to the slurry pump. Two of the slurry outputs are	

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	directed outward from the floating vessel. The slurry intake is provided between the two rearward slurry outputs. An additional slurry output is provided closer to the bow of the floating vessel and is provided with a steering control to direct the slurry output to control the direction of the floating vessel. The two aft slurry outputs may be rotated more rearward to increase the speed of the floating vessel or rotated more stern to slow or reverse the speed of the floating vessel, or move downward to direct more of the supernatant into the sludge. A remote control device may be coupled to the slurry control to allow the floating vehicle to be steered from the shore. **[0027]** Coupled to the slurry pump (38) by a transport pipe (42) is a first slurry output (44). (FIG. 5). The first slurry output (44) is an angled pipe (46) pivotably coupled to the transport pipe (42). Releasably coupled to the angled pipe (46) is a tapered liquid manure nozzle (48) to increase the velocity of slurry (50) passing through the nozzle (48). (FIGS. 4-5). If desired, different sizes and configurations of nozzles (48) may be coupled to the angled pipe (46) to adjust the direction and velocity of slurry (50) exiting through the first slurry output (44). Coupled between the angled pipe (46) and the frame (14) is a steering control hydraulic cylinder (52). The hydraulic cylinder (52) is coupled to a hydraulic pump (54) that, in turn, is coupled to a 12-volt battery (56). (FIGS. 1 and 5). **[0033]** If desired, the remote control system (84) may be provided with a first gate close button (114) that closes a valve (115)on the transport pipe (42) positioned between the fluid intake pipe (40) and forward nozzle (48). A gate open button (116) is also provided to open the valve (150). Similarly, a close gate button (118) and open gate button (120) are provided to open and close a valve (152) provided	

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	between the fluid intake pipe (40) and the nozzles (66) and (68). The gate buttons (114), (116), (118) and (120) allow a user to selectively supply fluid through one, two or three of the nozzles (48), (66) and (68) as is desired to appropriately agitate the fluid (128) within which the agitator (10) is floating. The remote control system (84) is also provided with a button (122) to actuate lights (154) provided on the agitator (10) if it is desired to use the agitator (10) in circumstances where additional lighting is desired. The remote control system (84) may be configured to receive feedback from the control panel (74), such as system status, latitude, longitude and height coordinates. **[0035]** Once the agitator (10) is floating in the lagoon (22), the remote control system (84) is used to activate the power source (36) to cause the slurry pump (38) to draw supernatant (128) into the intake pipe (40) and out the outputs (44), (62) and (64). The remote control system (84) is used to direct the pivot pipe (58) to angle the slurry outputs (62) and (64) aft to drive the agitator (10) forward. The remote control system (84) then actuates the control panel (7 4) to direct the hydraulic cylinder (52) to angle the first slurry output (44) to turn the agitator (10) port or starboard as desired. The remote control system (84) is thereafter used to direct the volume of supernatant (128) drawn into the intake pipe (40) and the direction at which the supernatant (128) is expelled from the slurry outputs (44), (62) and (64). By manipulating the direction of the slurry outputs (44), (62) and (64) with the remote control system (84), a user may direct the agitator (10) to any desired portion of the lagoon. **[0037]** The remote control system (84) may be used to cause the slurry pump (38) to expel slurry (50) more slowly from the slurry outputs (44), (62) and (64) as the	

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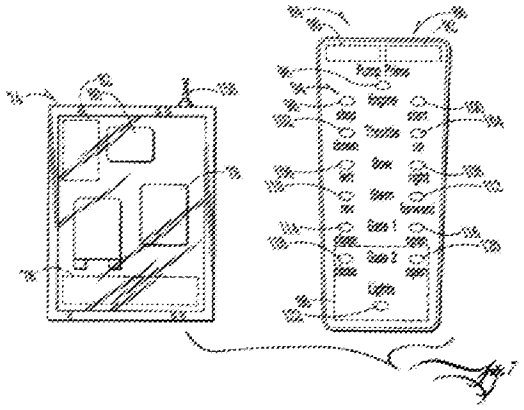
Ground IV - Puck in view of Bennett		
U.S. Patent No. 10,974,557	**U.S. Patent Application Publication No. 2014/0112093 (Puck)**	**U.S. Patent Application Publication No. US 2014/0288763 (Bennett)**
	agitator (10) is near the shore (142) of the lagoon (22) so as not to penetrate the lining (144) of the lagoon (22) thereby allowing the slurry (50) to escape. As the agitator (10) moves towards the center of the lagoon (22) which may range from five to forty feet deep, or more, the remote control system (84) can be used to increase the speed at which the supernatant (128) is passed from the slurry outputs (44), (62) and (64) to adequately mix the sludge (130) at the deepest portions of the lagoon (22). The remote control system (84) is used to direct the agitator (10) to all desired portions of the lagoon until the crust (126) and supernatant (128) is adequately mixed with the sludge (130). **Figure 7:** 	

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EXHIBIT E

US 20140288763A1

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(12) **Patent Application Publication**

Bennett et al.

(10) **Pub. No.: US 2014/0288763 A1**

(43) **Pub. Date: Sep. 25, 2014**

(54) **TRACKED ALL-TERRAIN VEHICLE**

(71) Applicant: **Polaris Industries Inc.**, Medina, MN (US)

(72) Inventors: **Jeffrey D. Bennett**, Roseau, MN (US); **Amber P. Malone**, Stacy, MN (US)

(73) Assignee: **Polaris Industries Inc.**, Medina, MN (US)

(21) Appl. No.: **14/225,206**

(22) Filed: **Mar. 25, 2014**

Related U.S. Application Data

(60) Provisional application No. 61/805,113, filed on Mar. 25, 2013.

Publication Classification

(51) **Int. Cl.**

B62D 55/06 (2006.01)
G06F 11/30 (2006.01)
B62D 11/04 (2006.01)

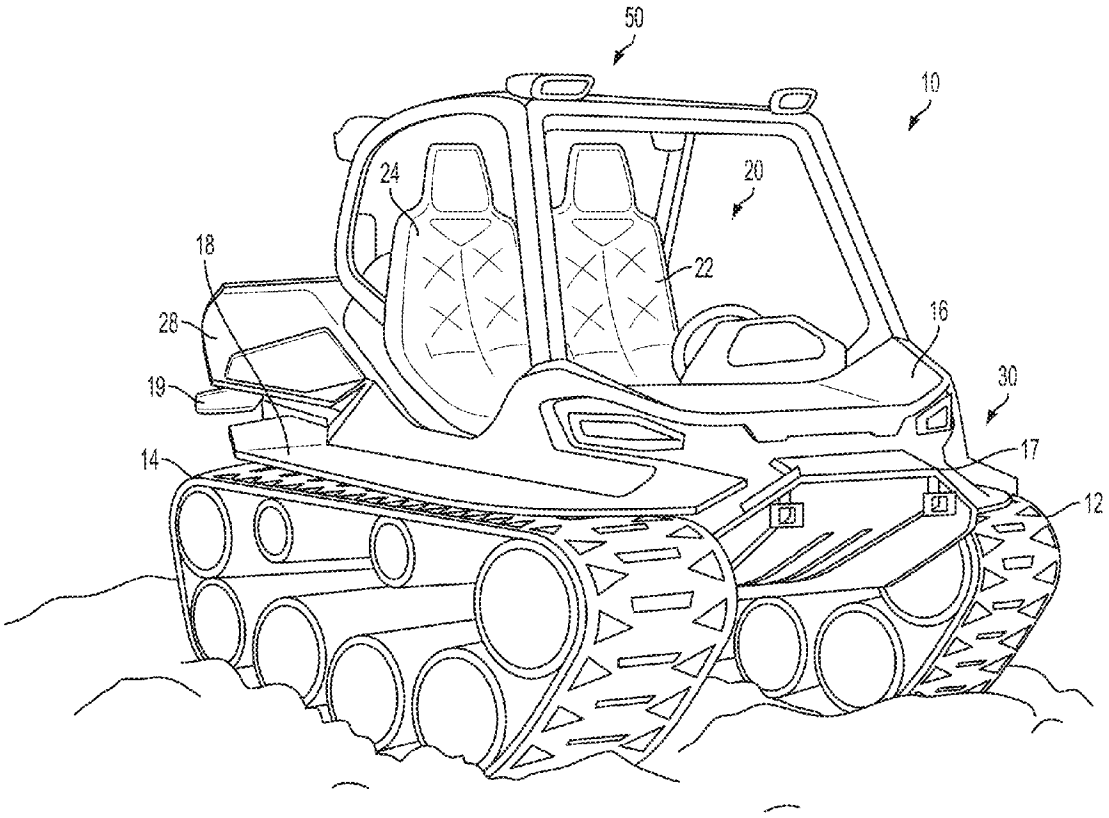
(52) **U.S. Cl.**

CPC ***B62D 55/06*** (2013.01); ***B62D 11/04*** (2013.01); ***G06F 11/30*** (2013.01)

USPC **701/31.6**; 180/6.44; 180/9.5

(57) **ABSTRACT**

A tracked ATV includes a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track. The tracked ATV further includes a steering and drive assembly, which has a first hydraulic pump coupled to the tracks for large radius turns. The steering and drive assembly also has a second hydraulic pump coupled to the tracks for small radius turns.



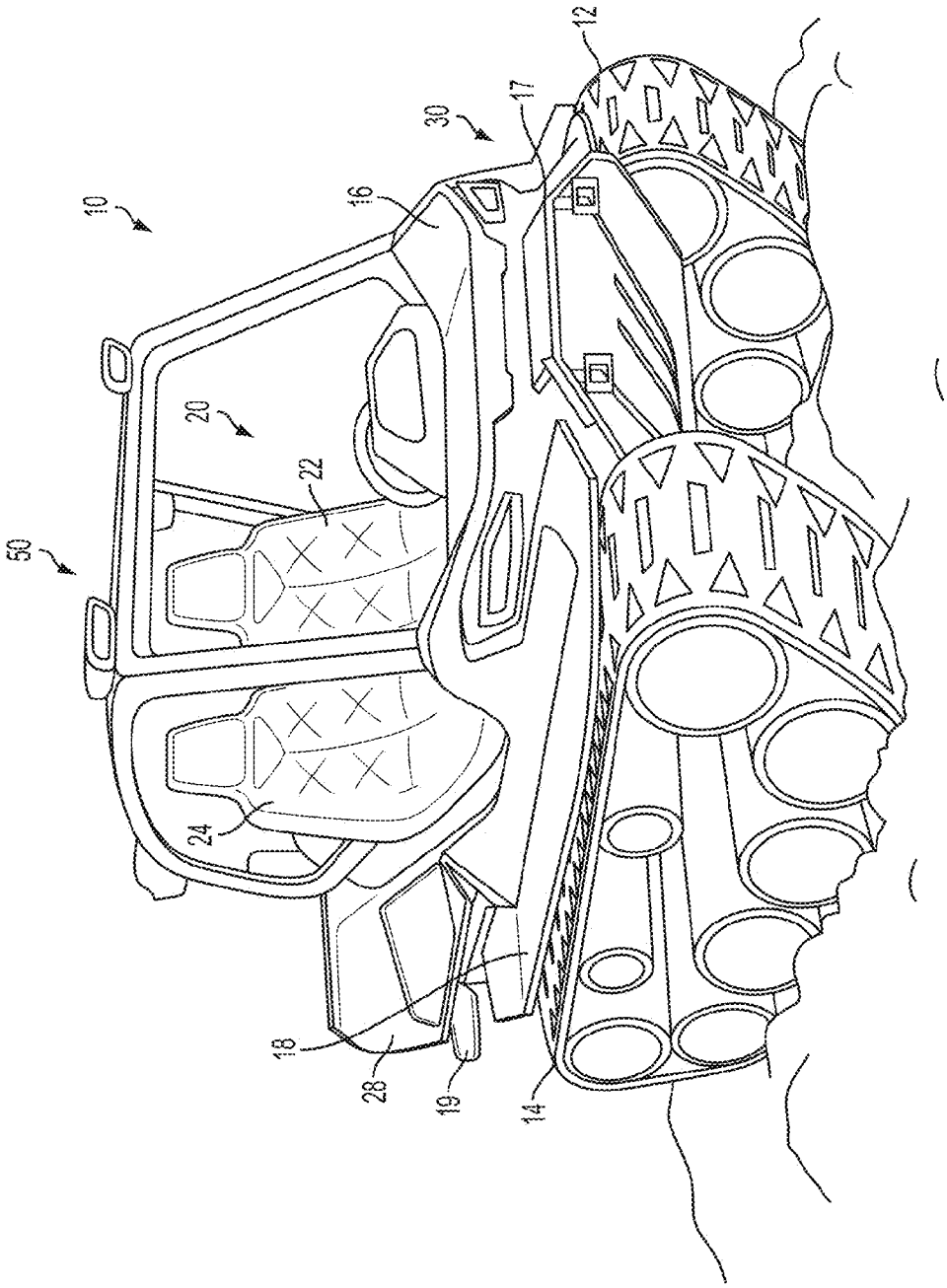


FIG. 1

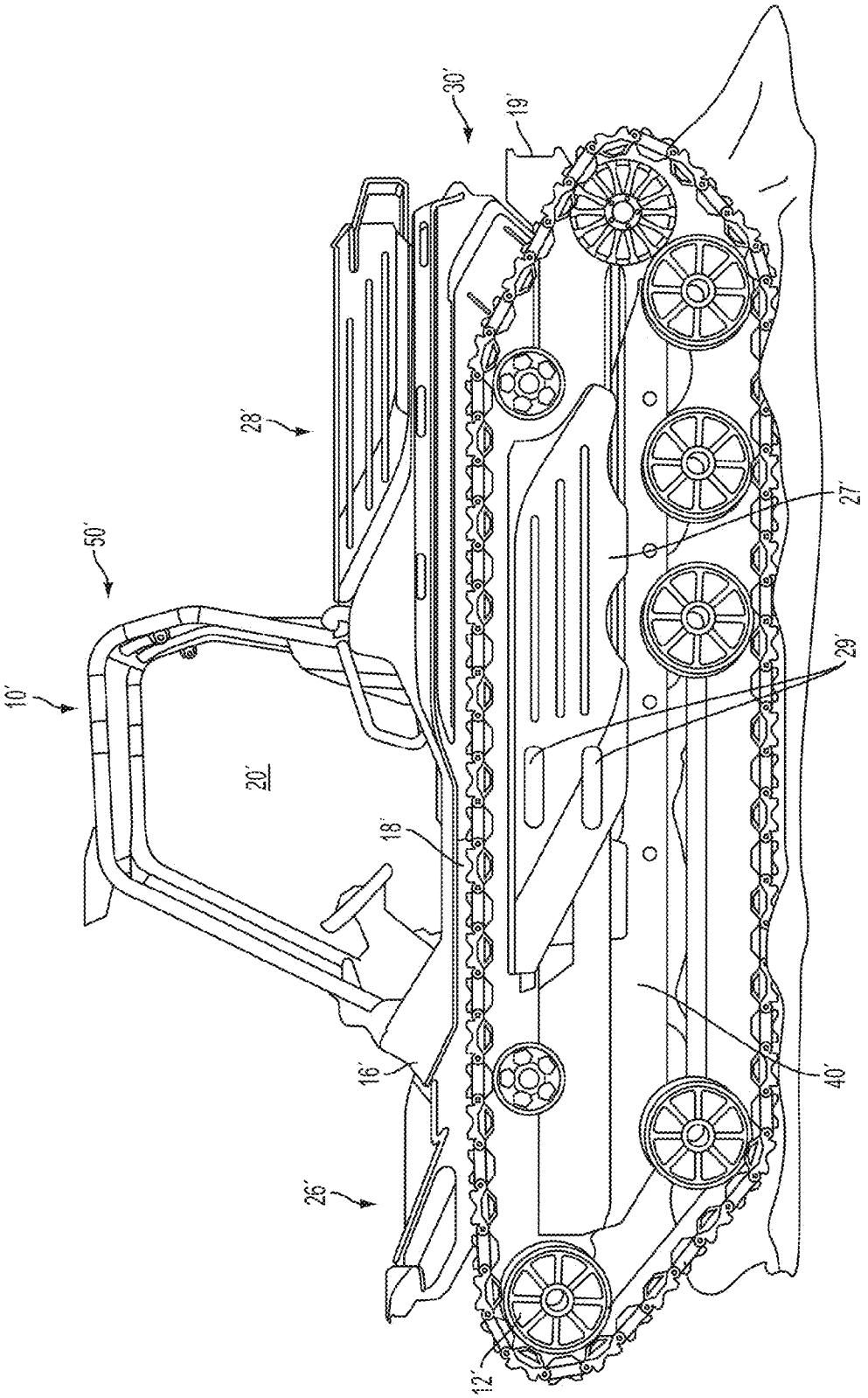


FIG. 2

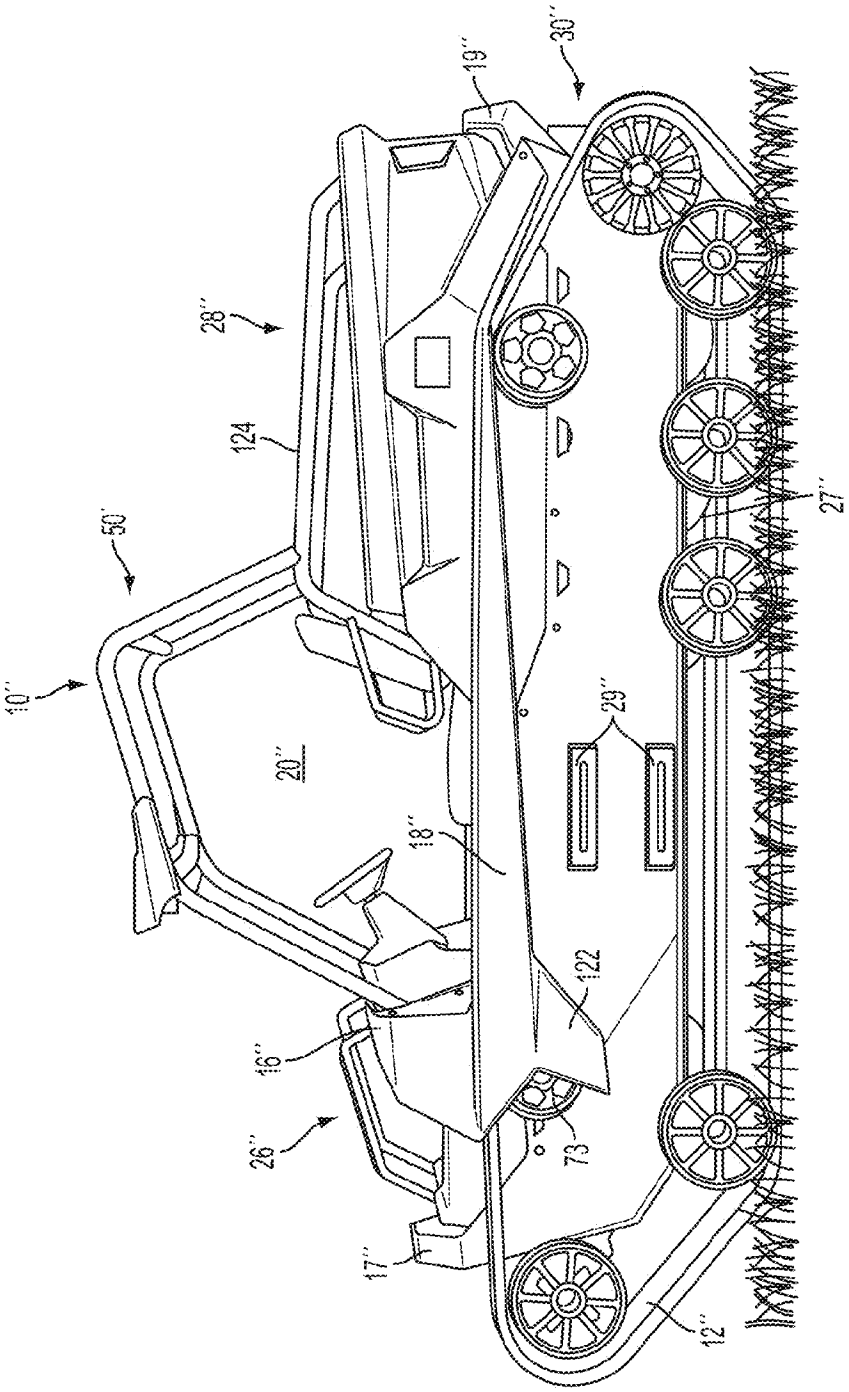


FIG. 3

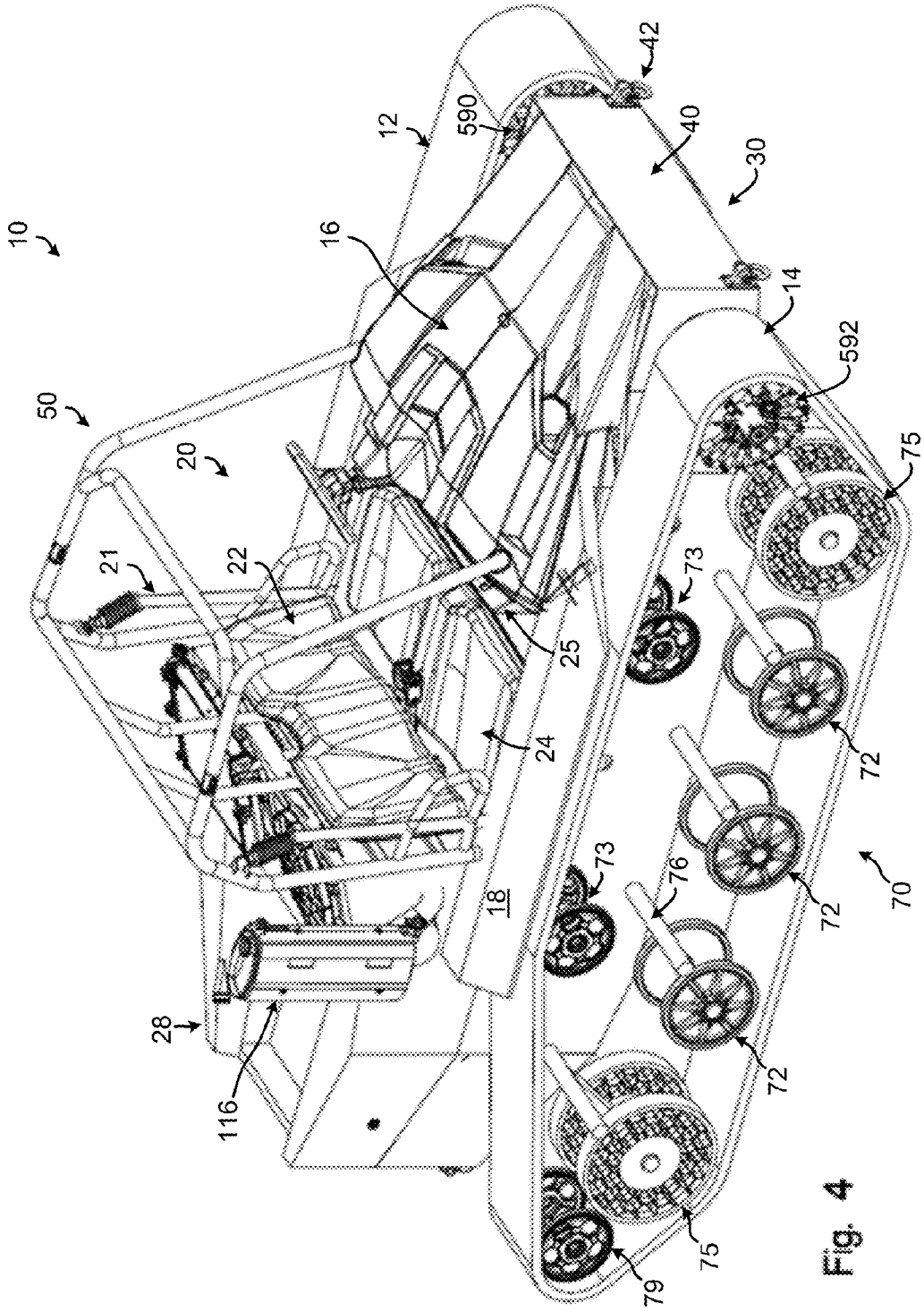


Fig. 4

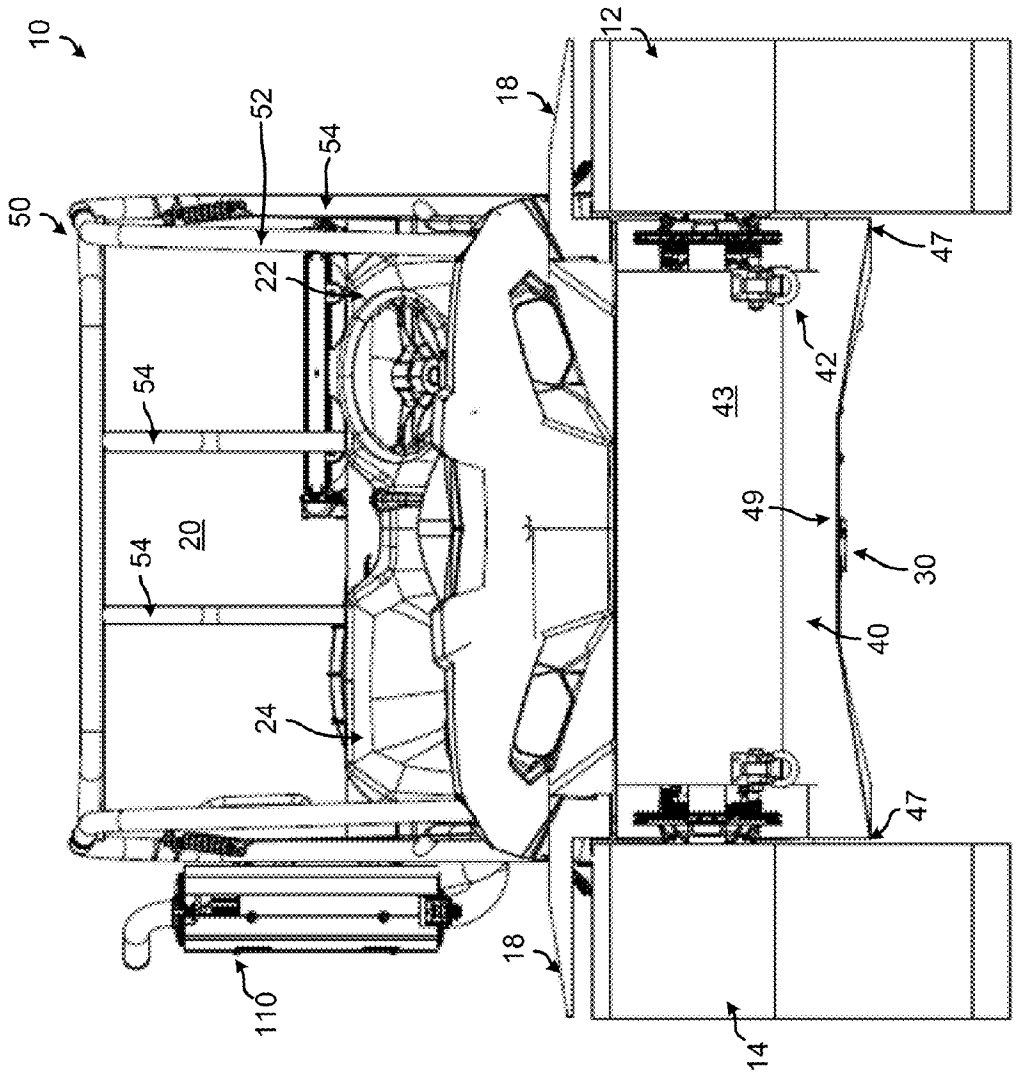


Fig. 5

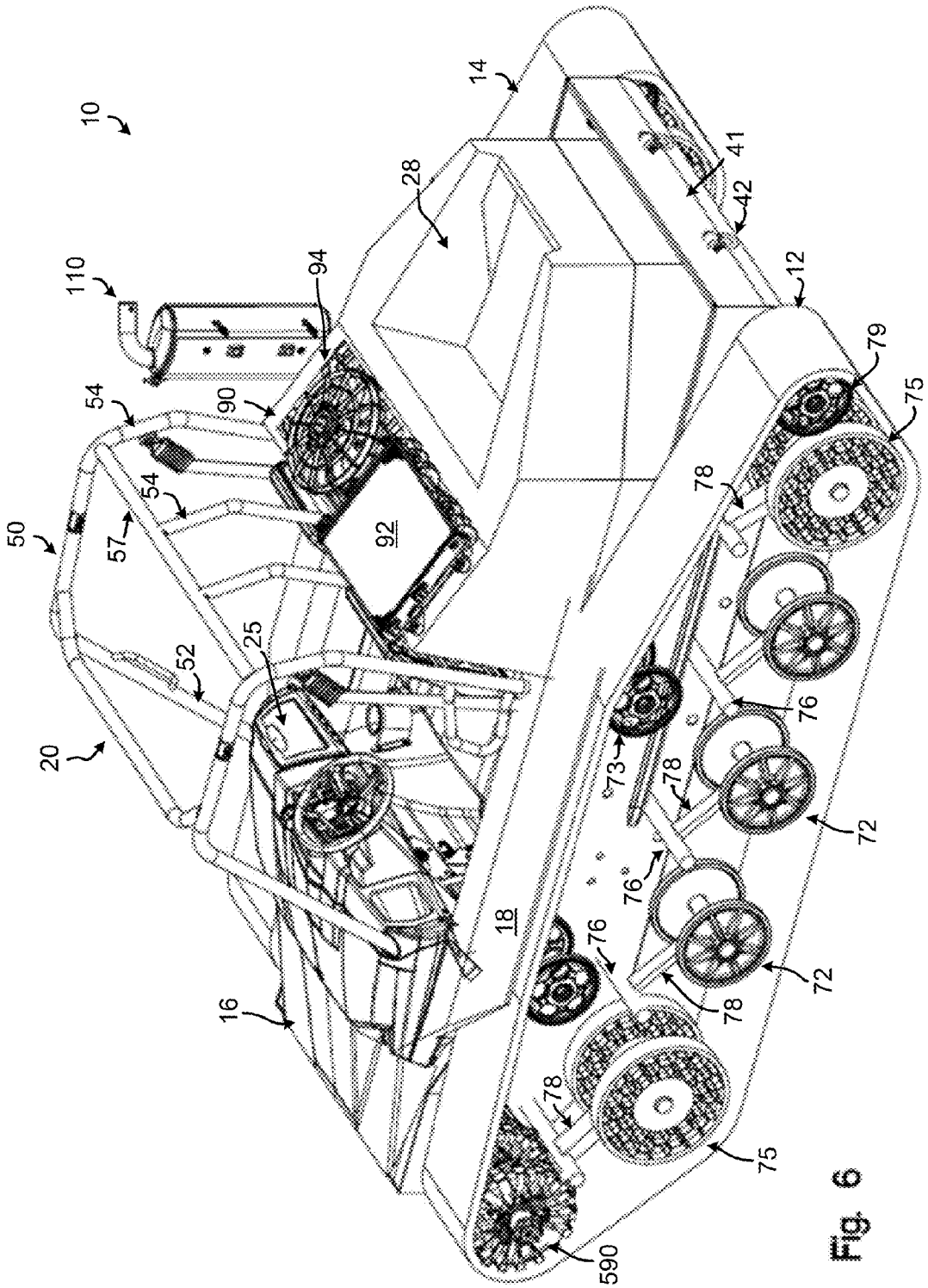

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Fig. 6

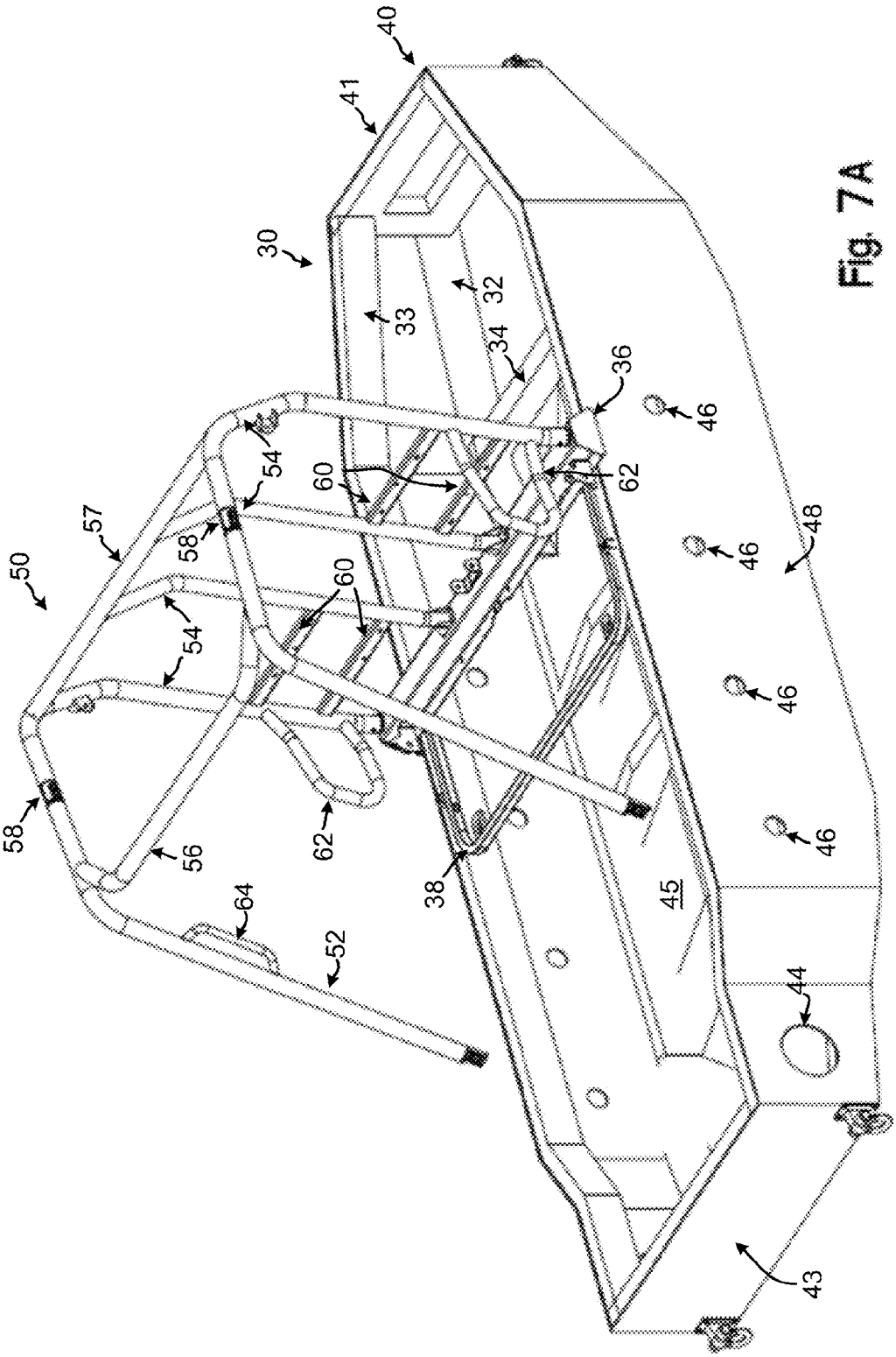

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Fig. 7A

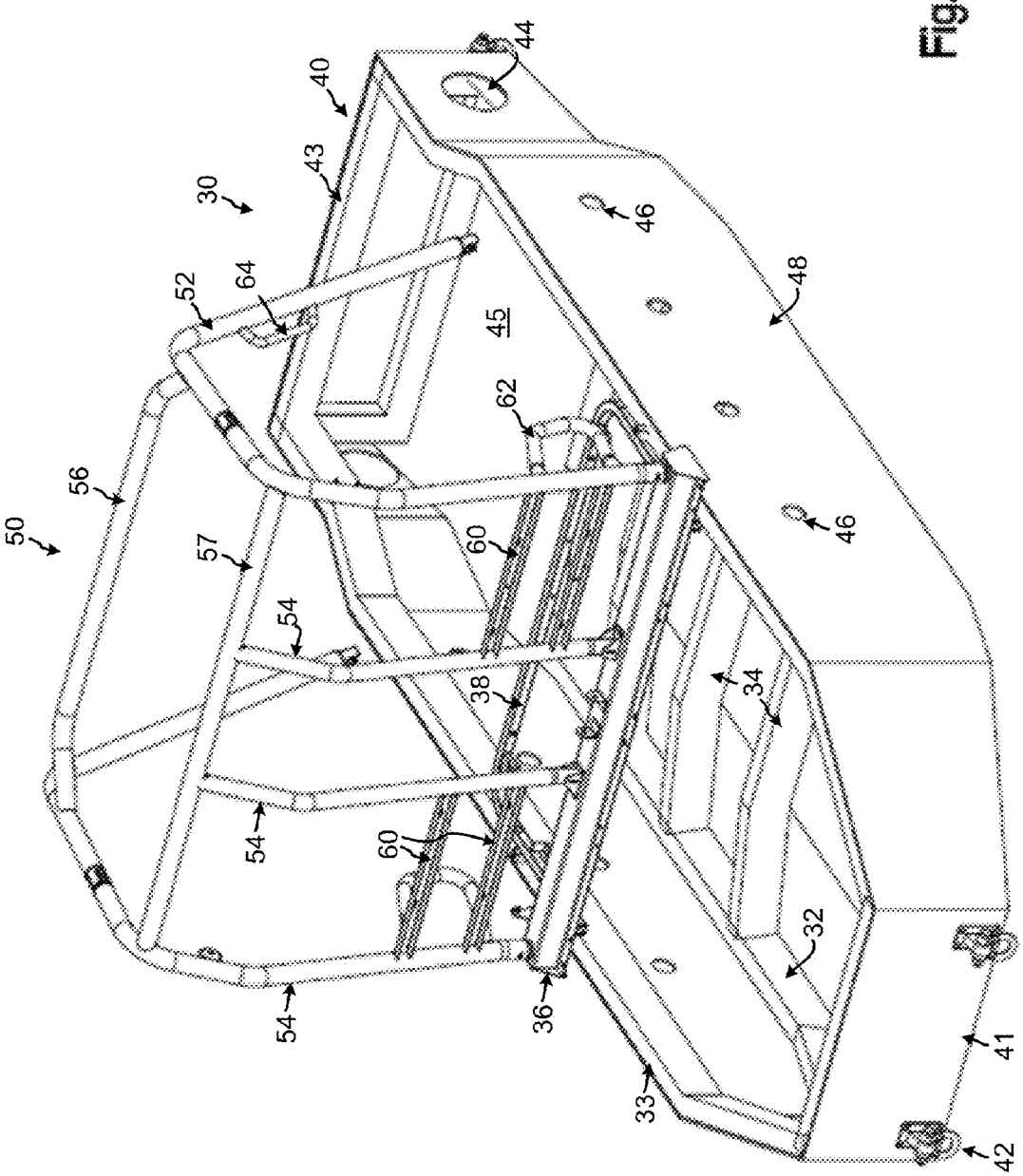

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Fig. 7B

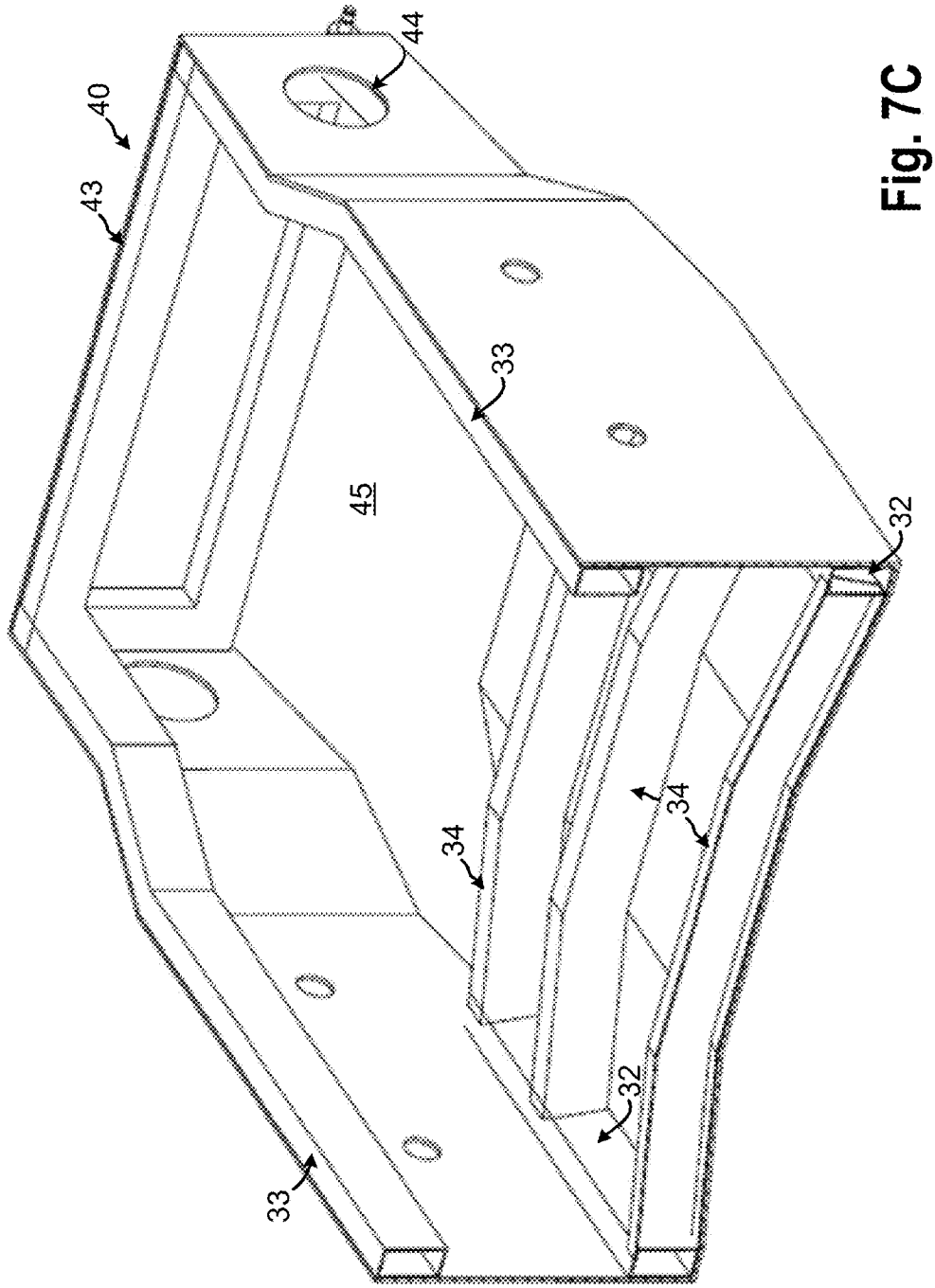


Fig. 7C

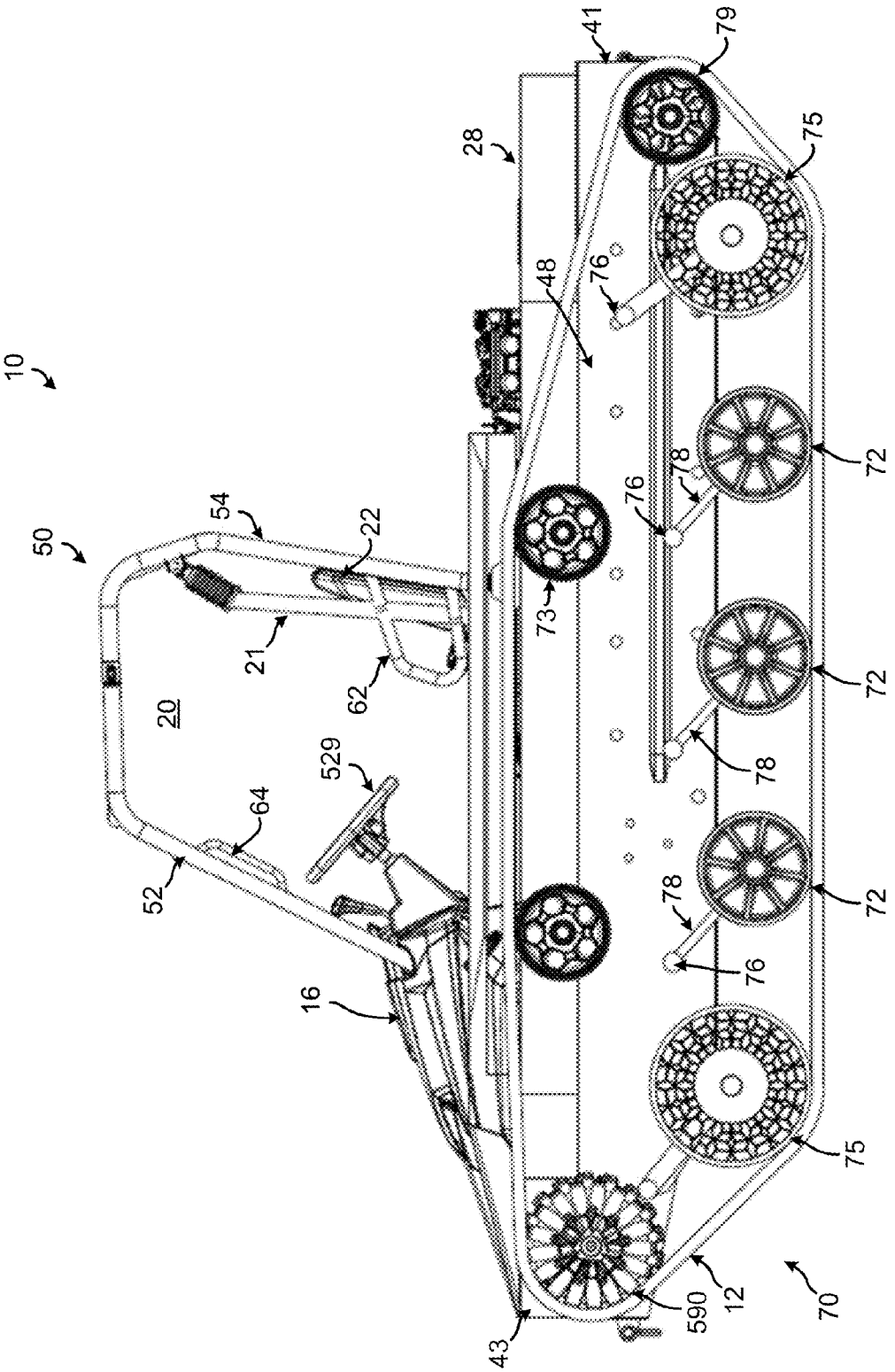

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Fig. 8

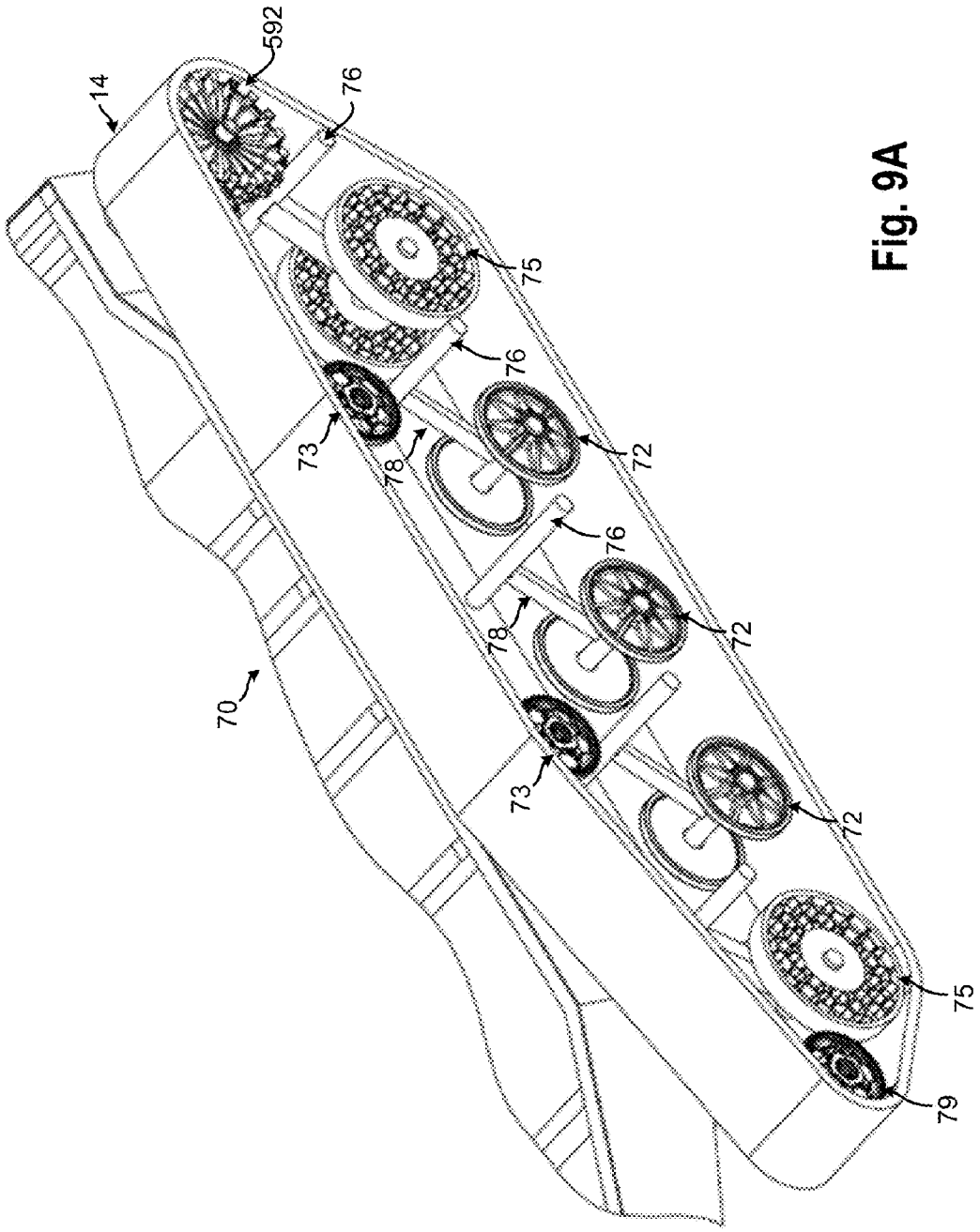


Fig. 9A

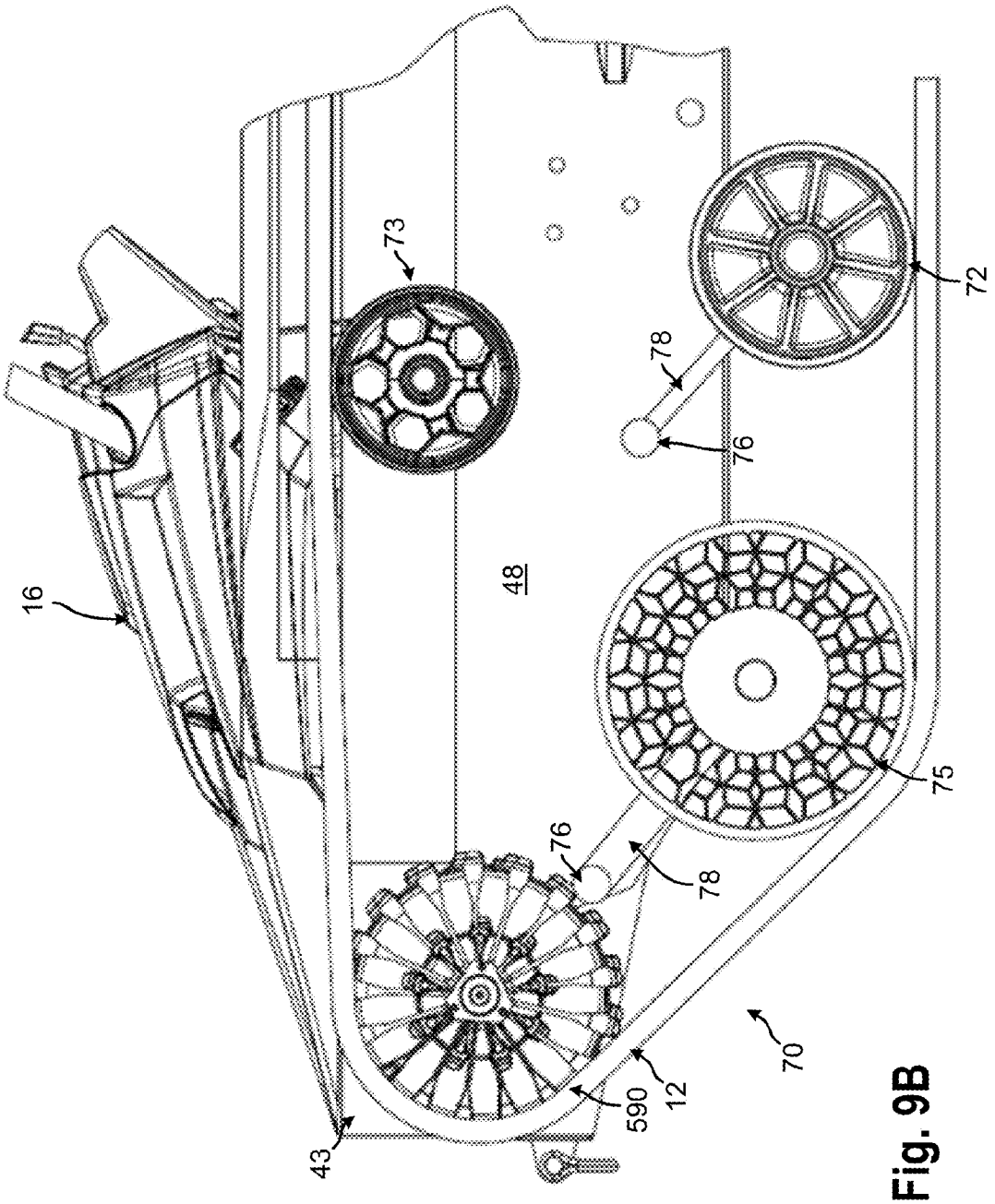


Fig. 9B

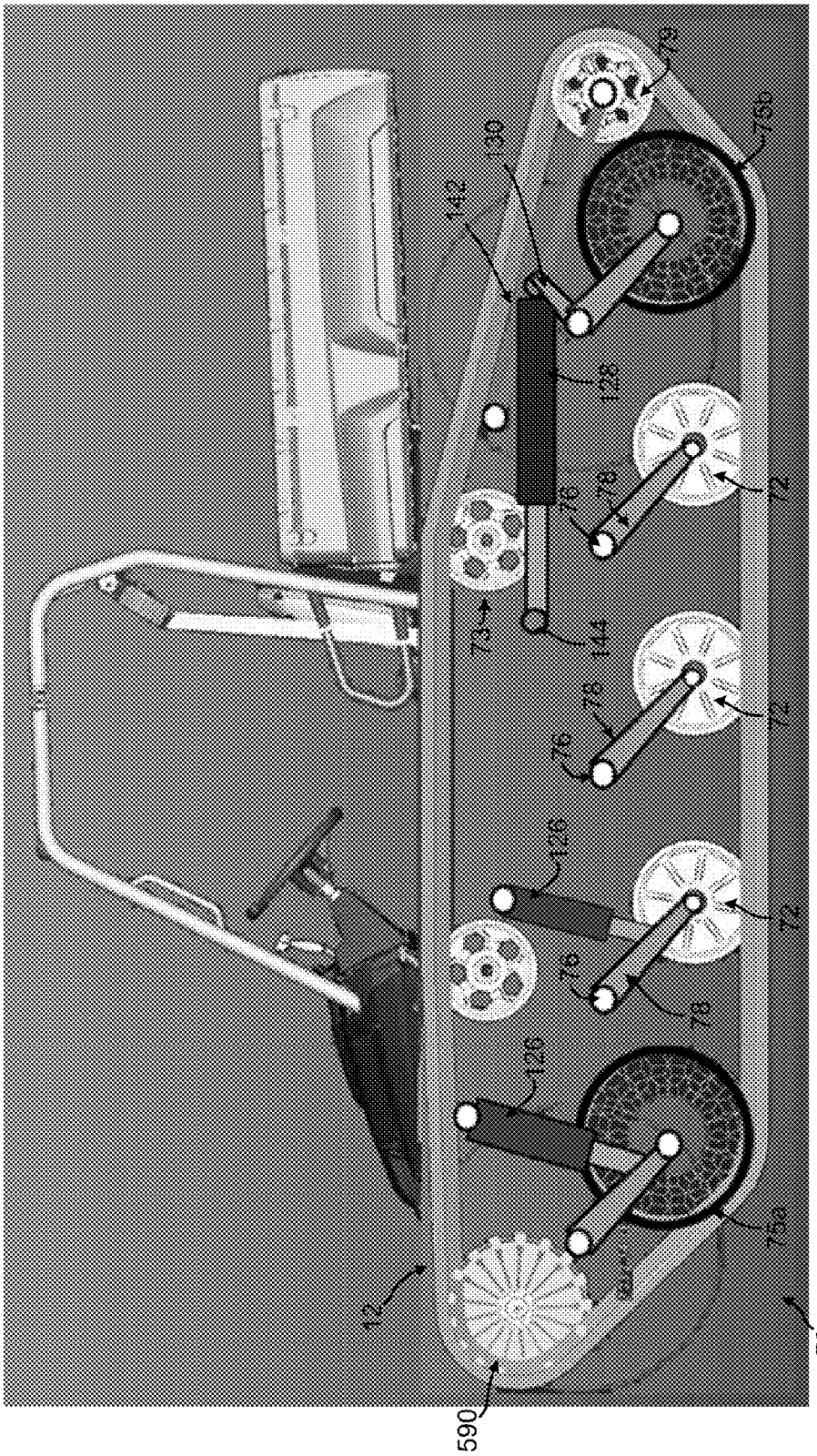


Fig. 9C

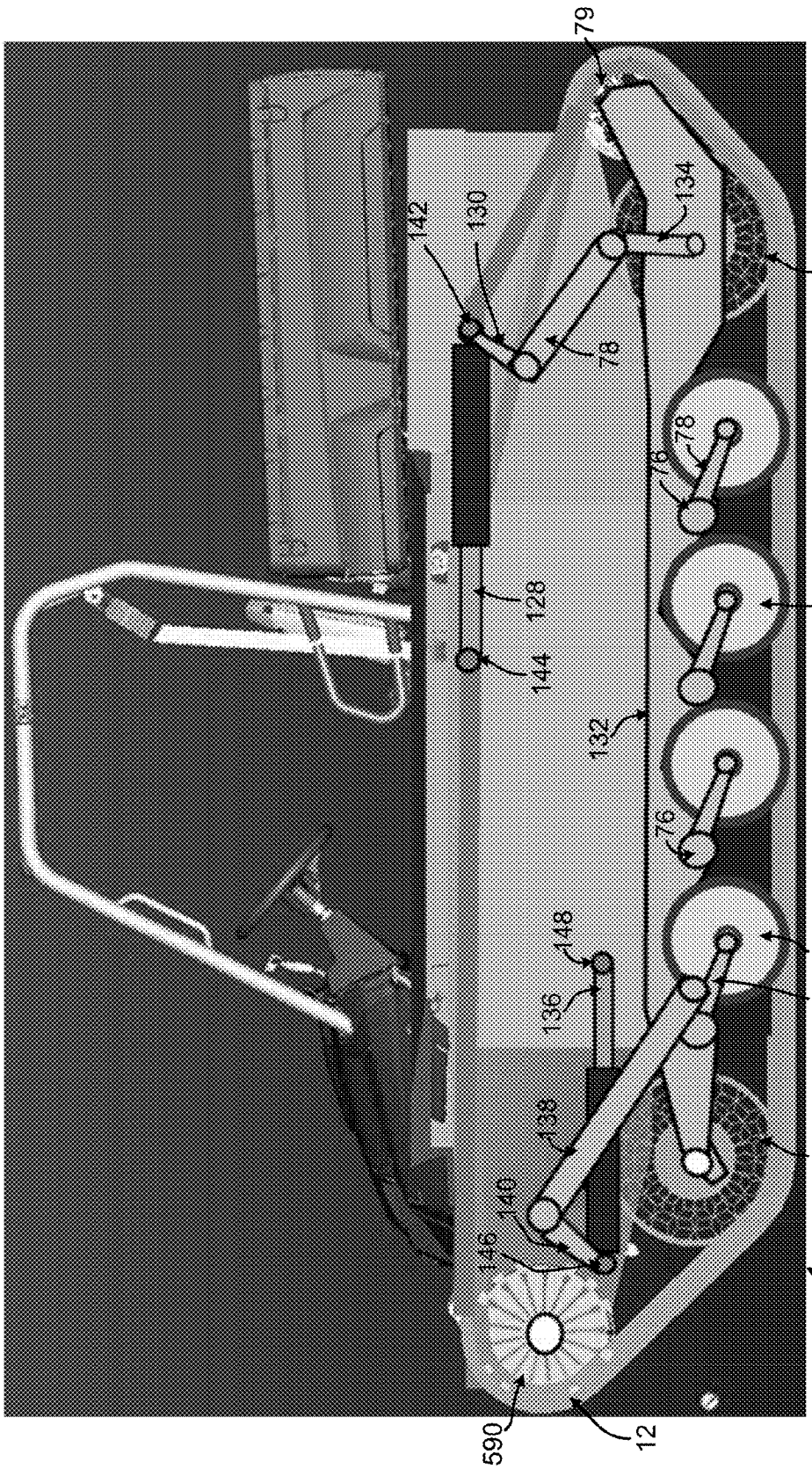

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Fig. 9D

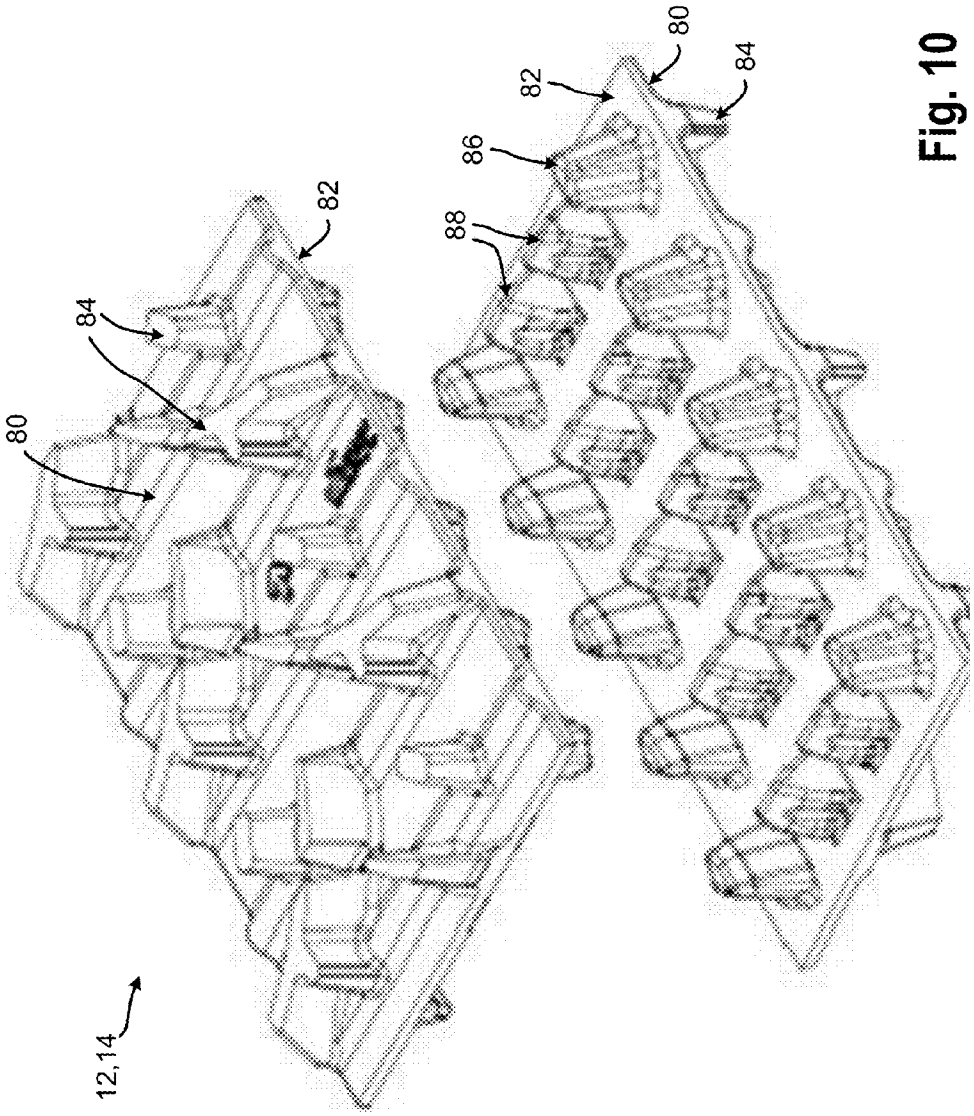


Fig. 10

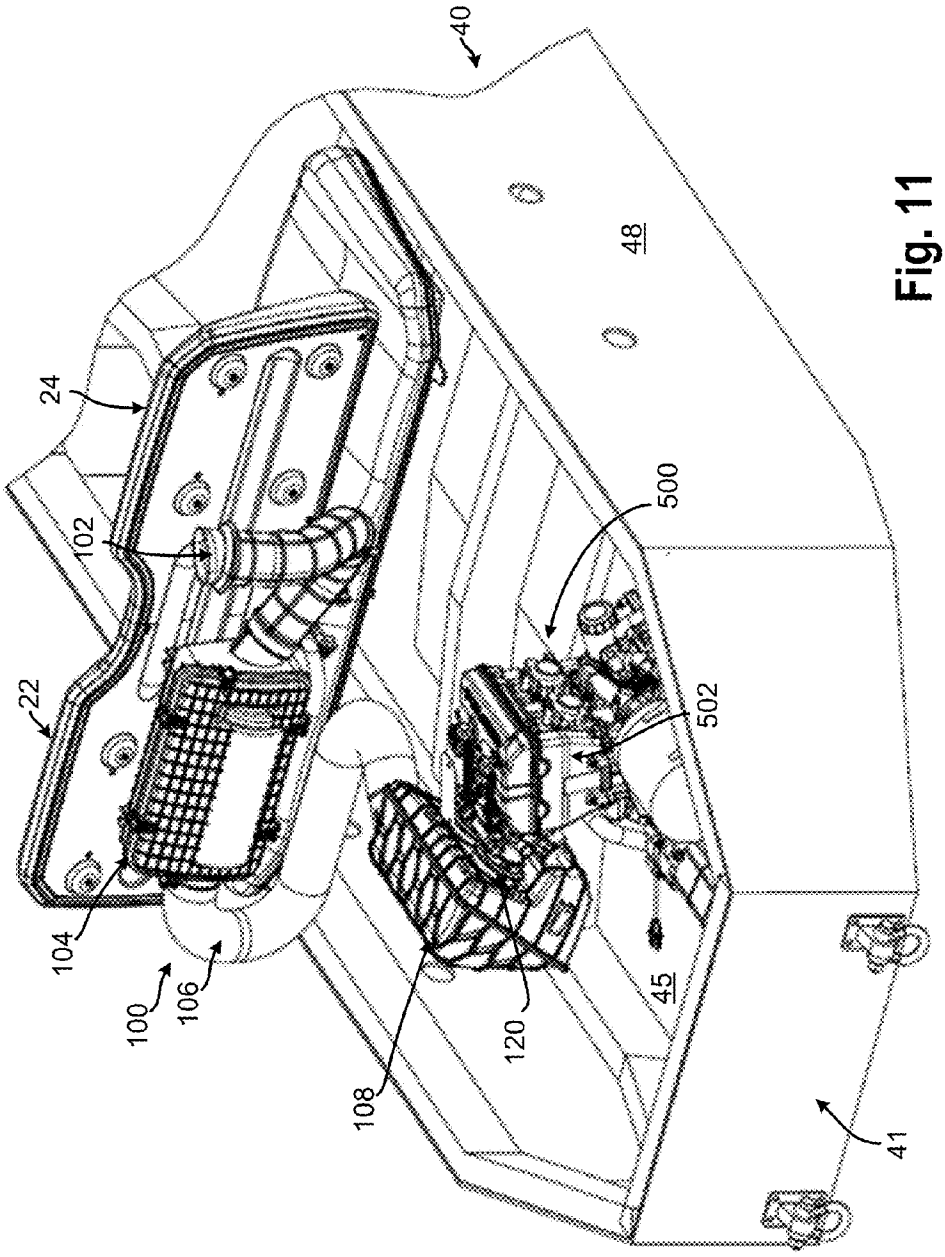


Fig. 11

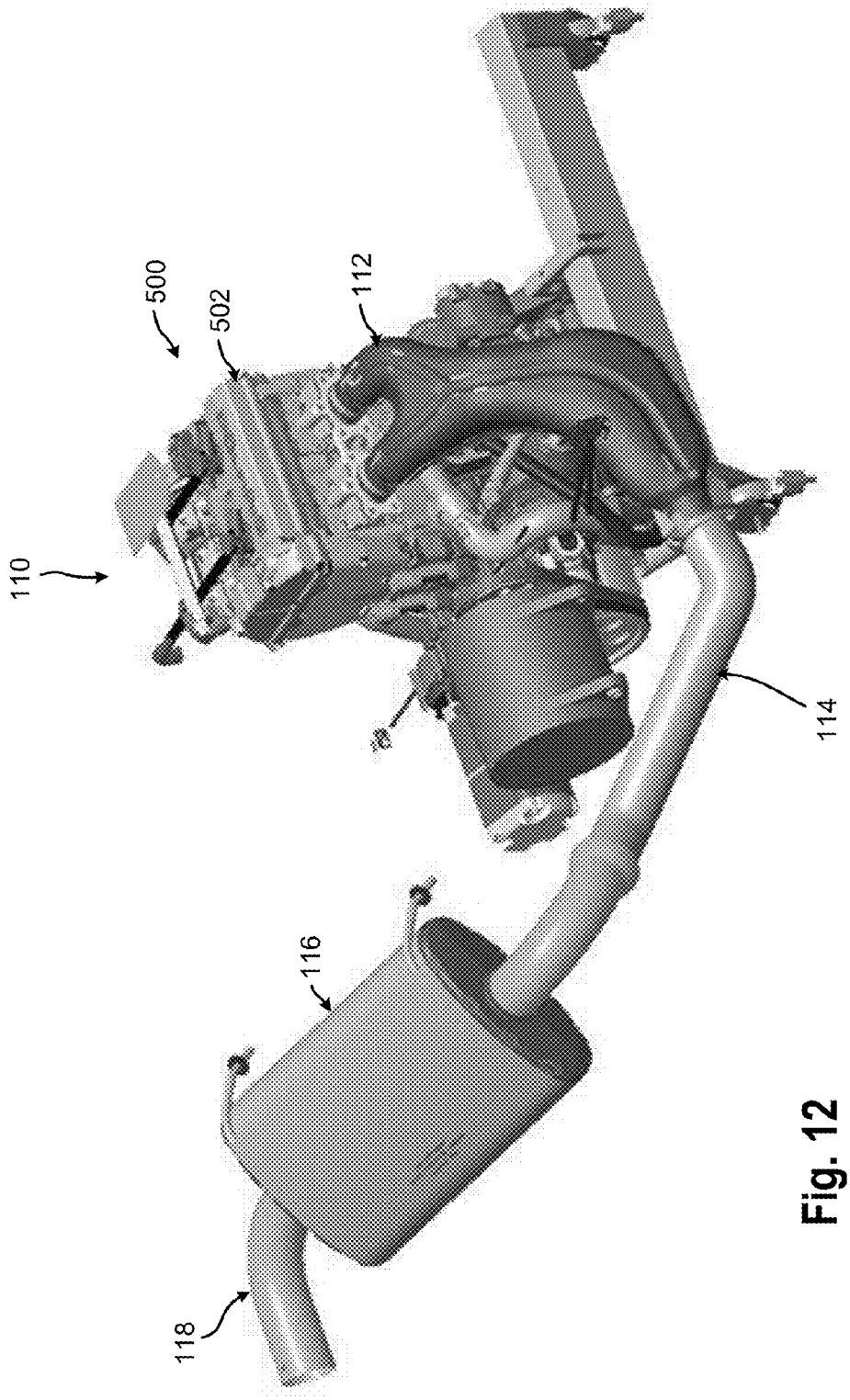


Fig. 12

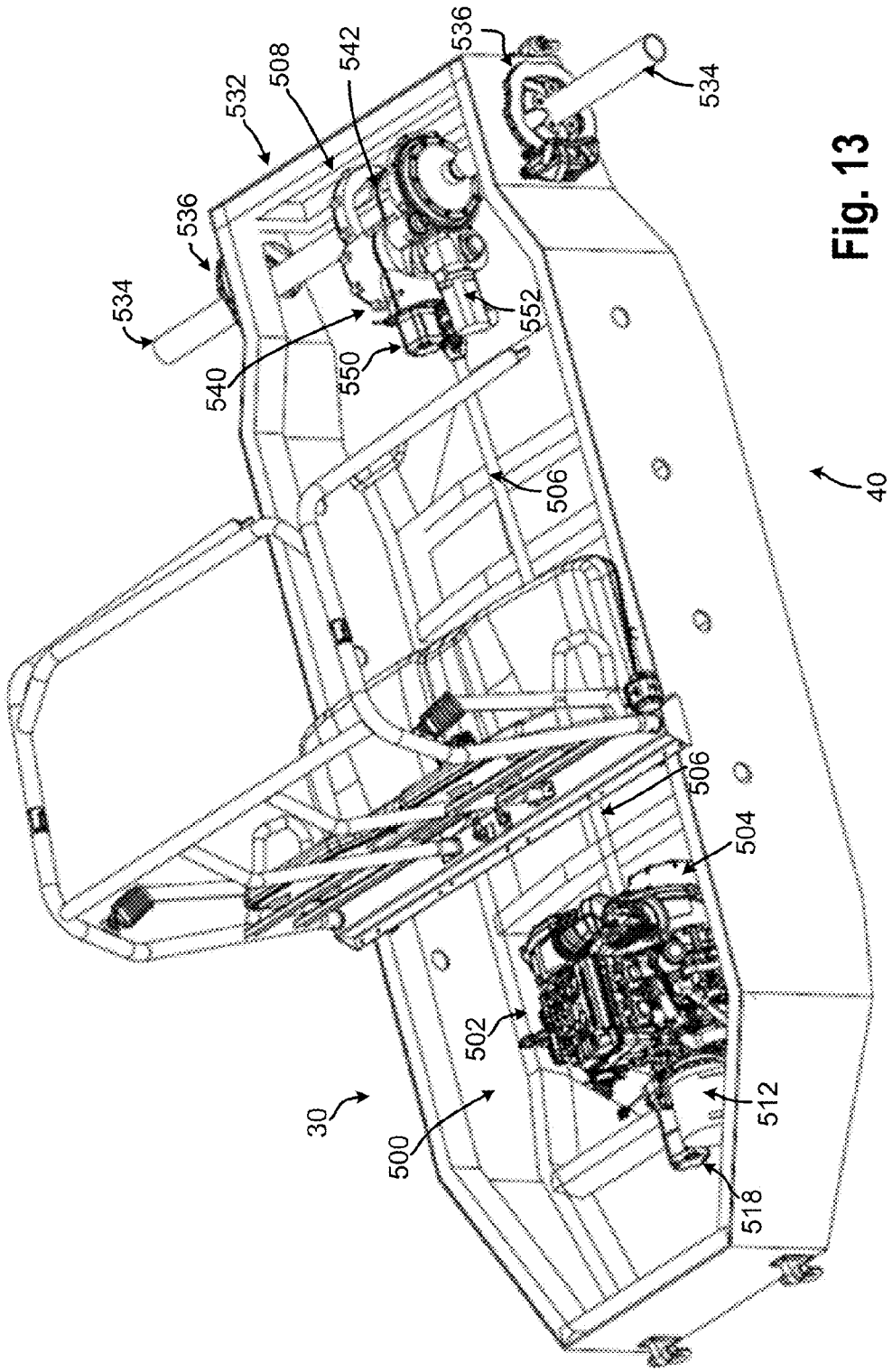

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Fig. 13

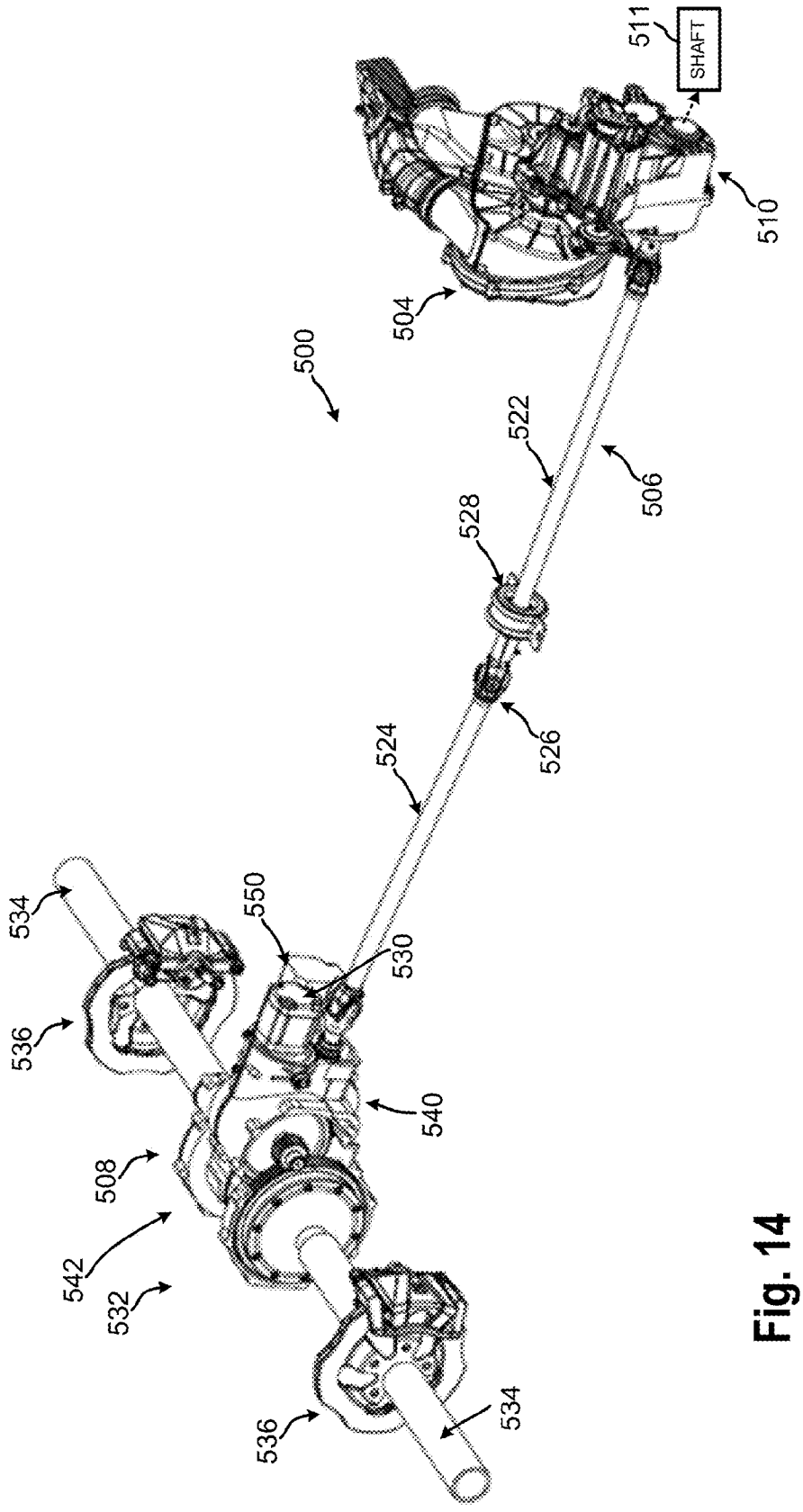

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Fig. 14

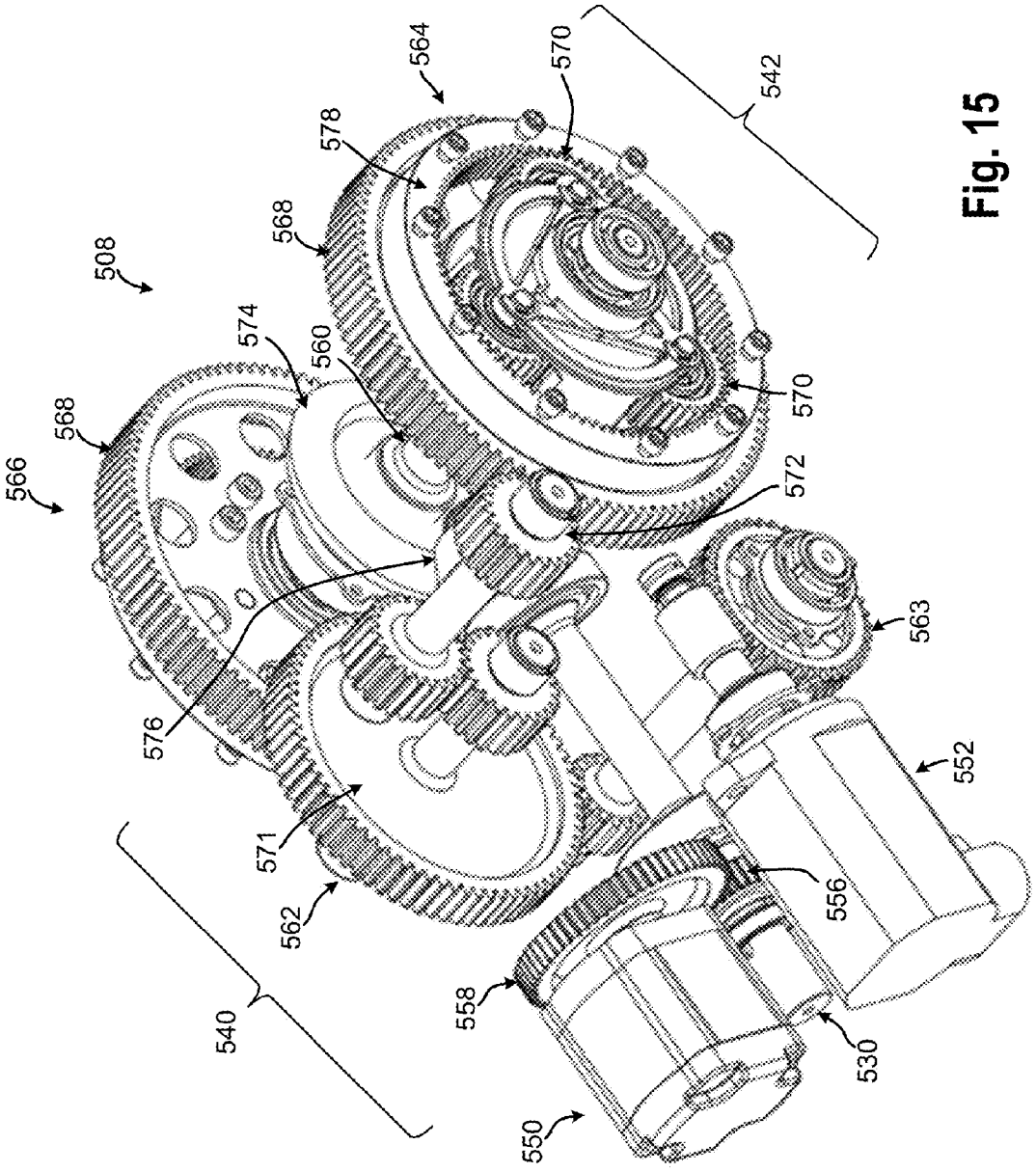

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Fig. 15

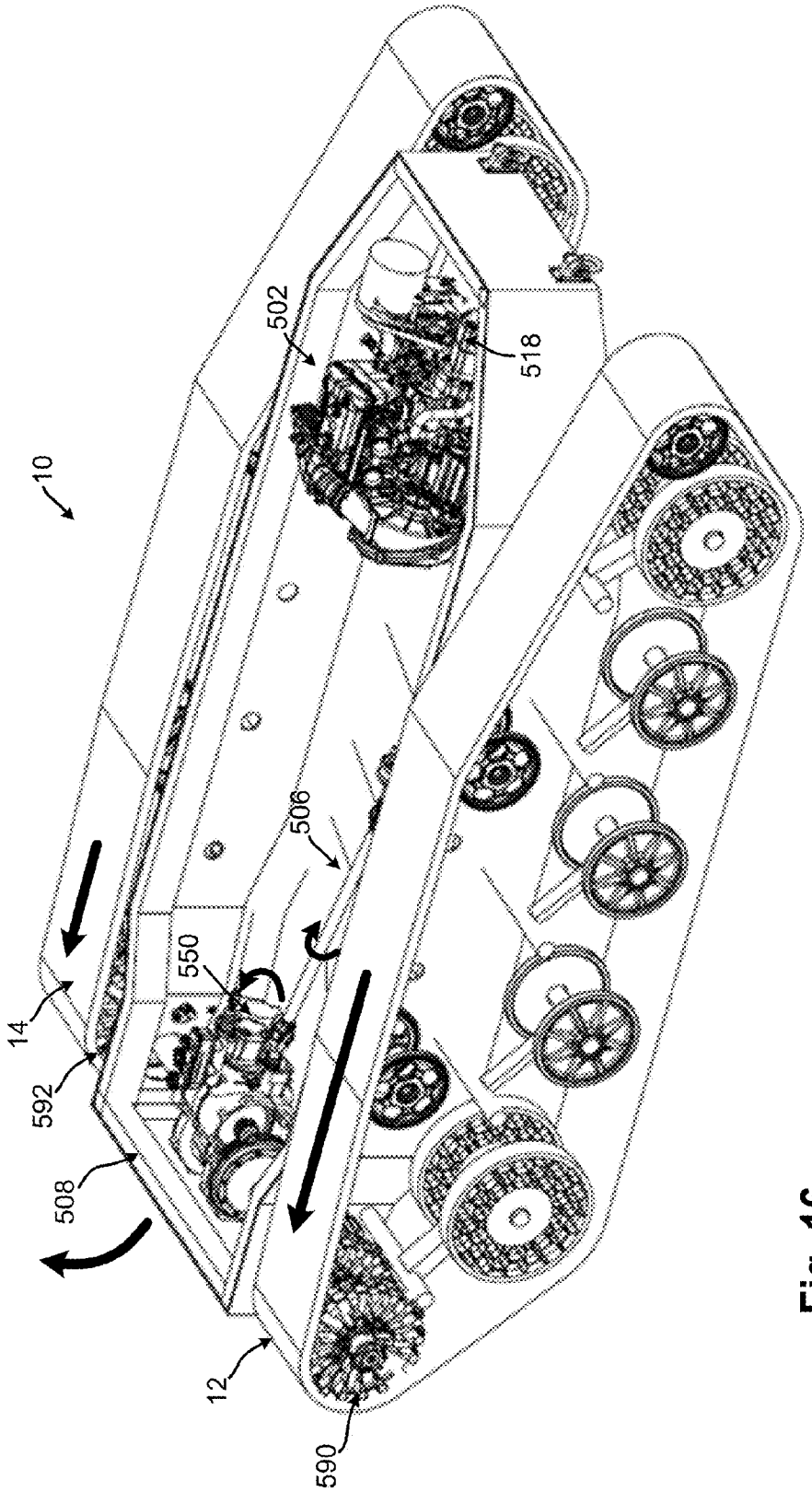


Fig. 16

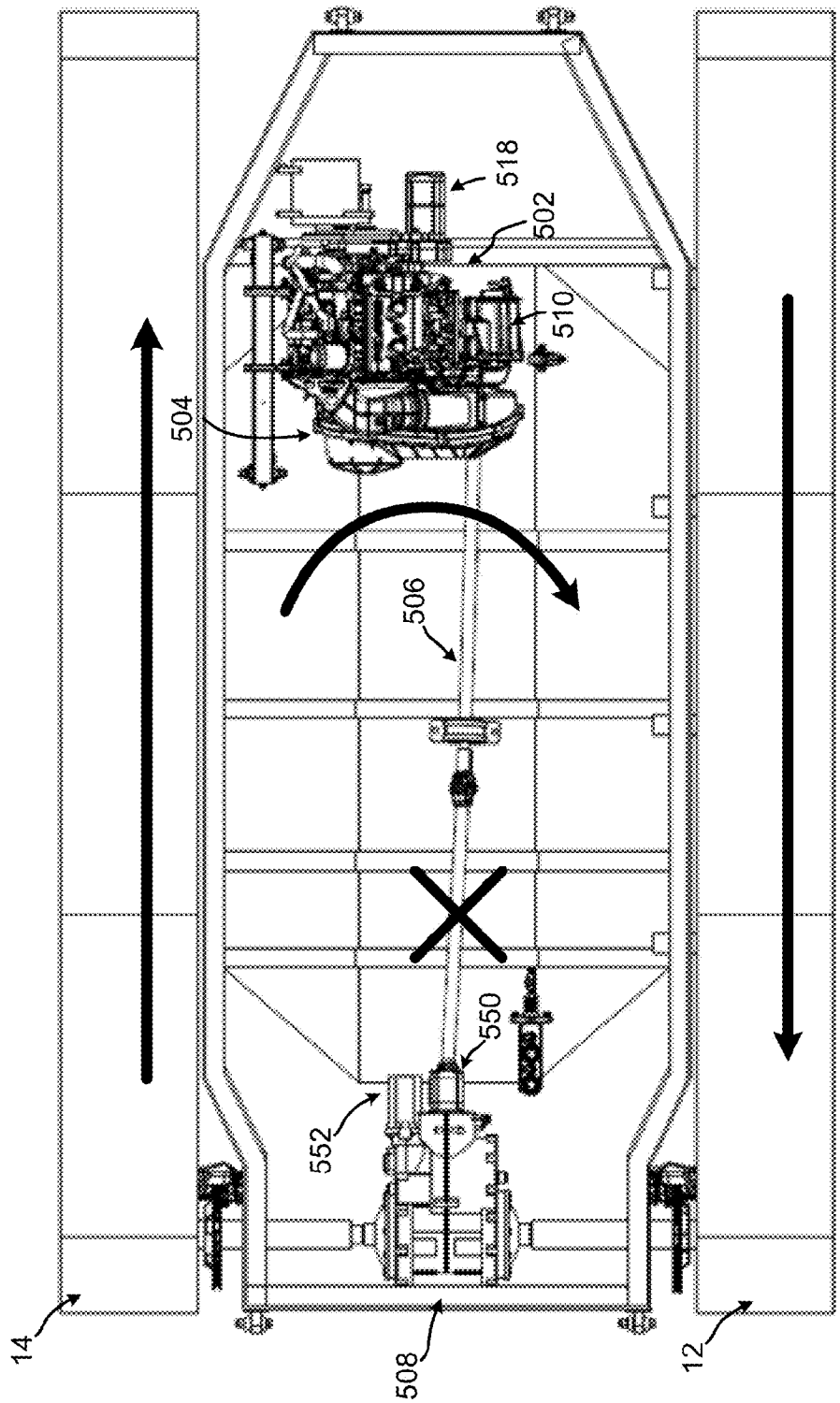


Fig. 17

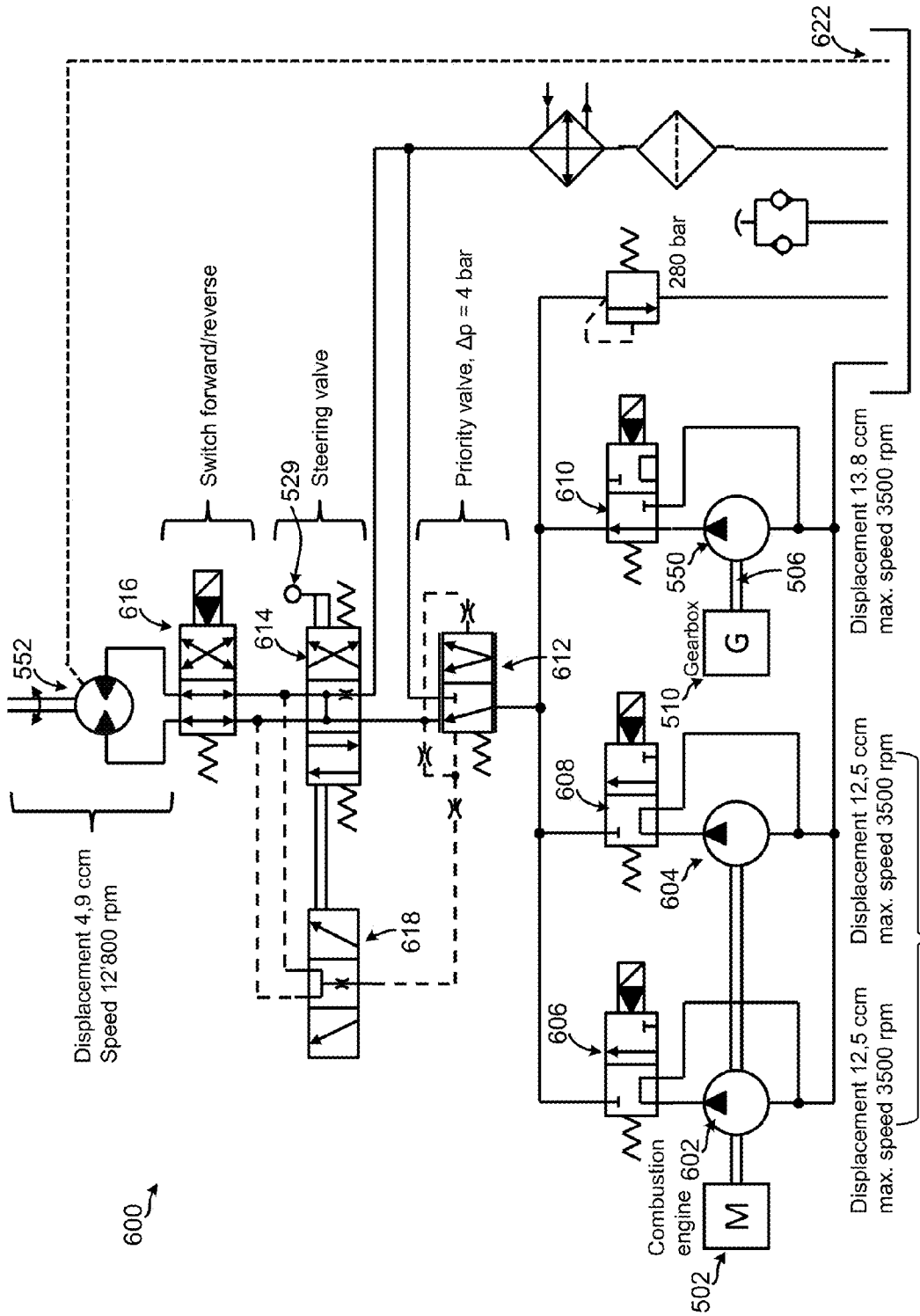

600
552
Displacement 4,9 ccm
Speed 12'800 rpm
616
Switch forward/reverse
614
529
Steering valve
618
612
Priority valve, Δp = 4 bar
622
280 bar
610
608
606
604
602
Combustion engine
M
502
550
506
Gearbox
G
510
Displacement 13.8 ccm
max. speed 3500 rpm
Displacement 12,5 ccm
max. speed 3500 rpm
Displacement 12,5 ccm
max. speed 3500 rpm
518

Fig. 18

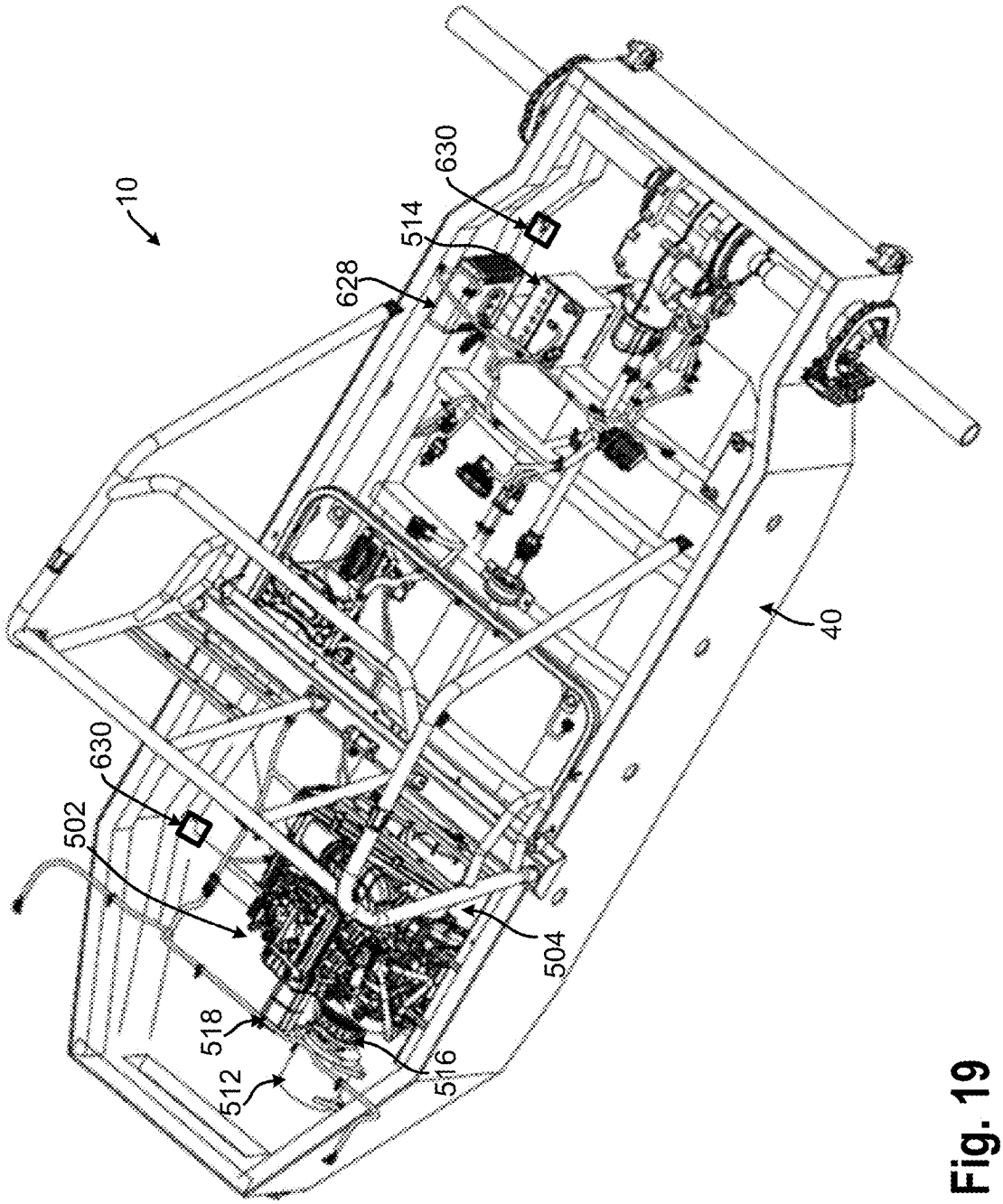


Fig. 19

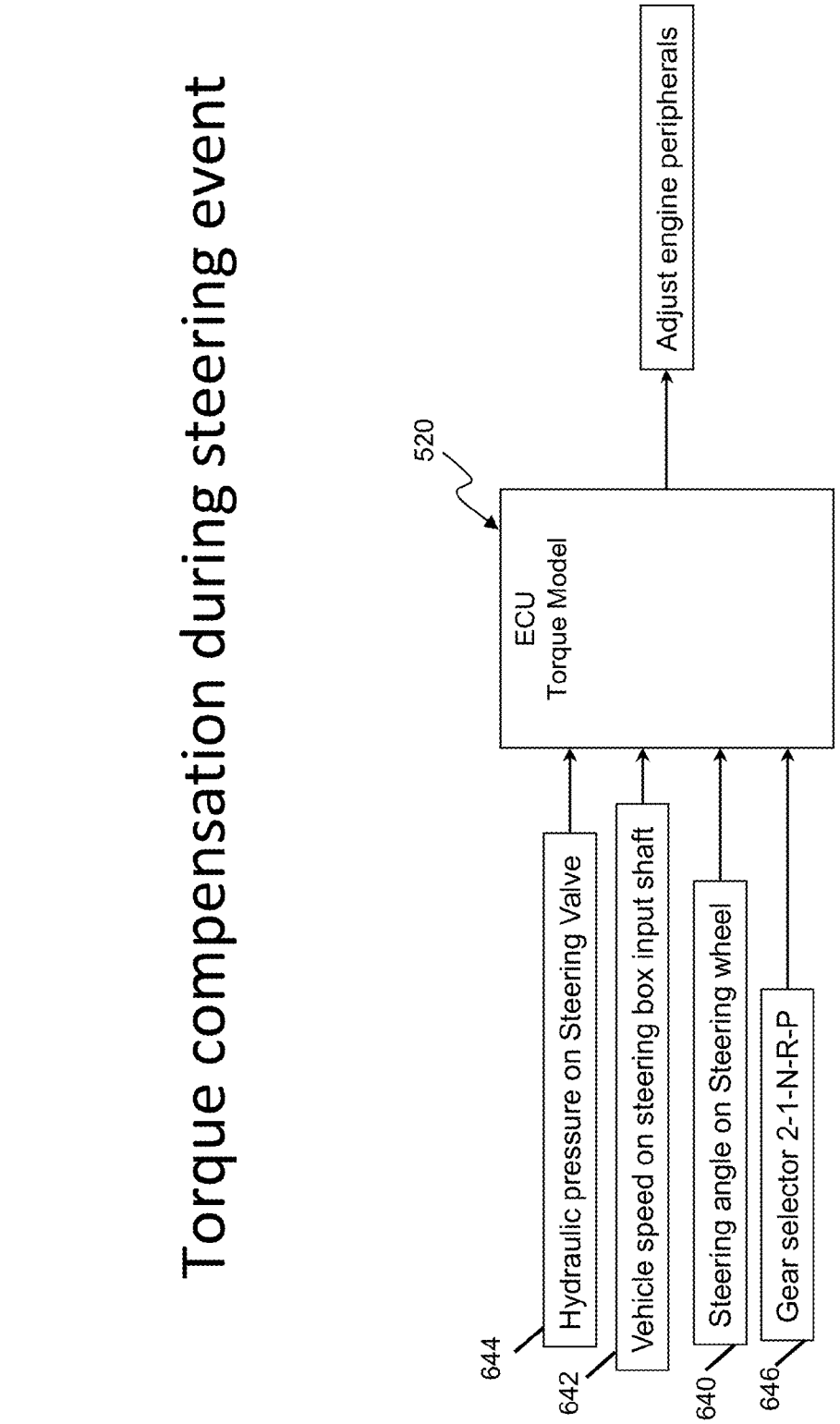

Torque compensation during steering event
520
ECU
Torque Model
Adjust engine peripherals
Hydraulic pressure on Steering Valve
Vehicle speed on steering box input shaft
Steering angle on Steering wheel
Gear selector 2-1-N-R-P
644
642
640
646

FIG. 20

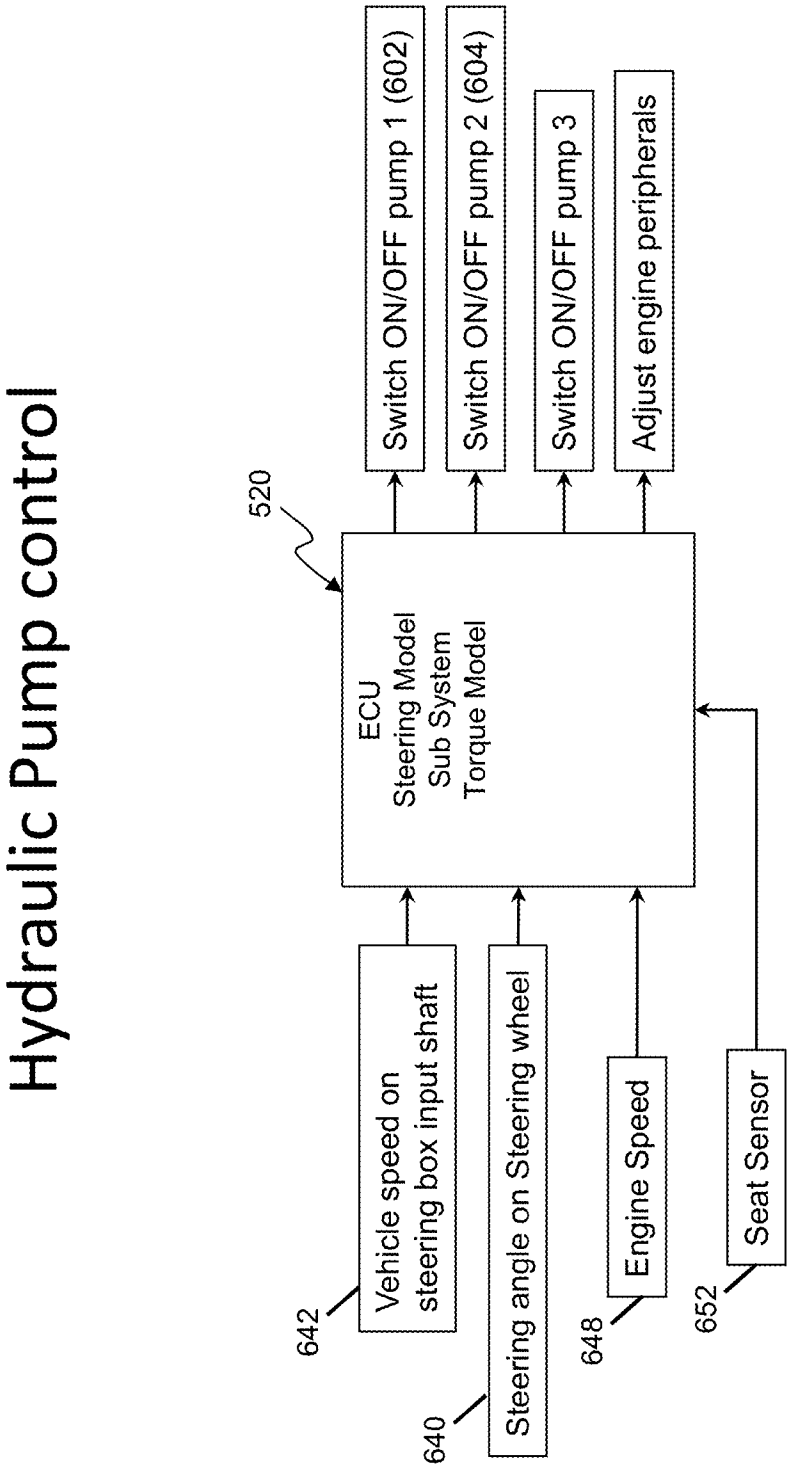

Hydraulic Pump control
520
ECU
Steering Model
Sub System
Torque Model
Switch ON/OFF pump 1 (602)
Switch ON/OFF pump 2 (604)
Switch ON/OFF pump 3
Adjust engine peripherals
642
Vehicle speed on steering box input shaft
640
Steering angle on Steering wheel
648
Engine Speed
652
Seat Sensor

FIG. 21

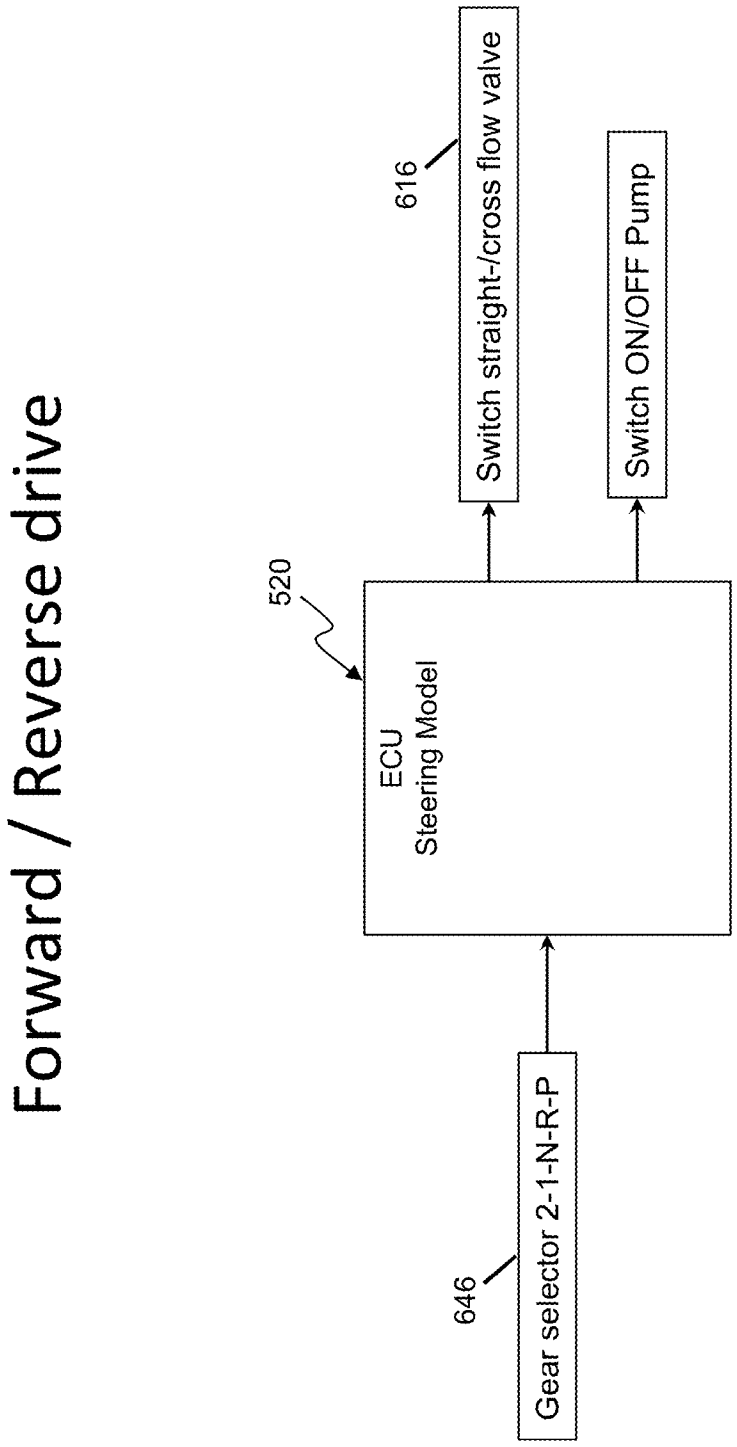

Forward / Reverse drive
646
Gear selector 2-1-N-R-P
520
ECU
Steering Model
616
Switch straight-/cross flow valve
Switch ON/OFF Pump

FIG. 22

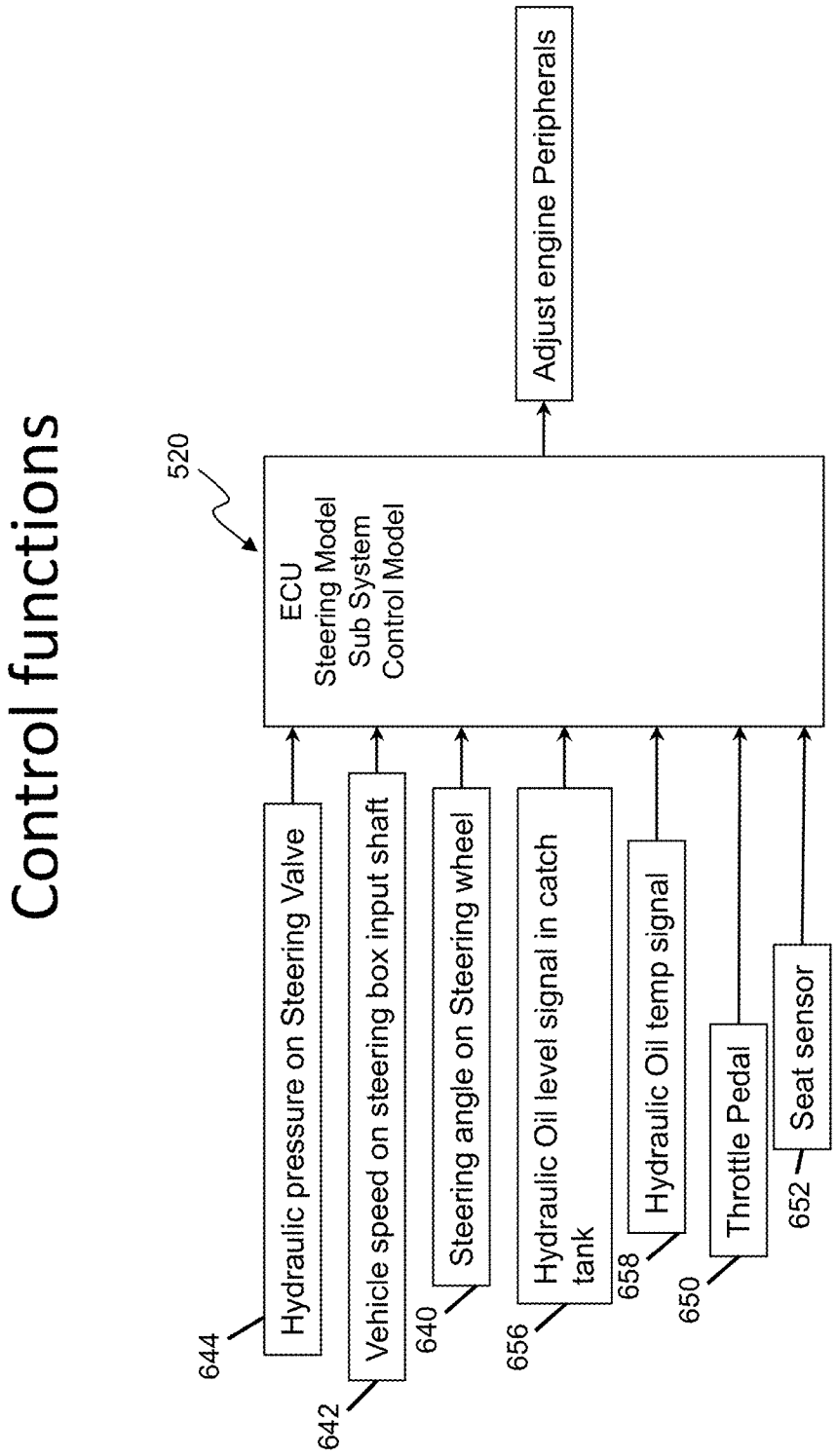

Control functions
520
ECU
Steering Model
Sub System
Control Model
Adjust engine Peripherals
Hydraulic pressure on Steering Valve
644
Vehicle speed on steering box input shaft
642
Steering angle on Steering wheel
640
Hydraulic Oil level signal in catch tank
656
Hydraulic Oil temp signal
658
Throttle Pedal
650
Seat sensor
652

FIG. 23

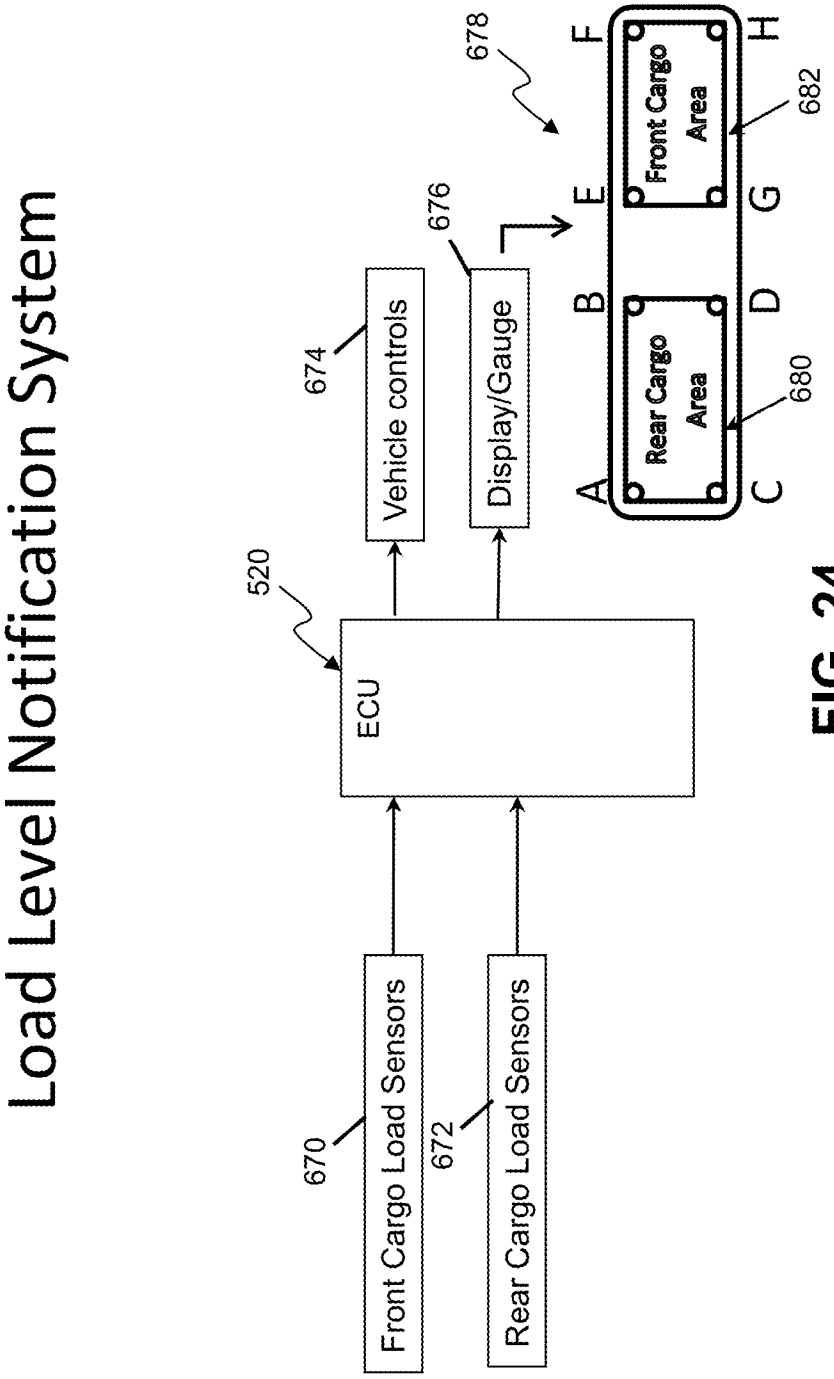

Load Level Notification System
Front Cargo Load Sensors
Rear Cargo Load Sensors
ECU
Vehicle controls
Display/Gauge
Rear Cargo Area
Front Cargo Area
A
B
C
D
E
F
G
H
670
672
520
674
676
678
680
682

FIG. 24

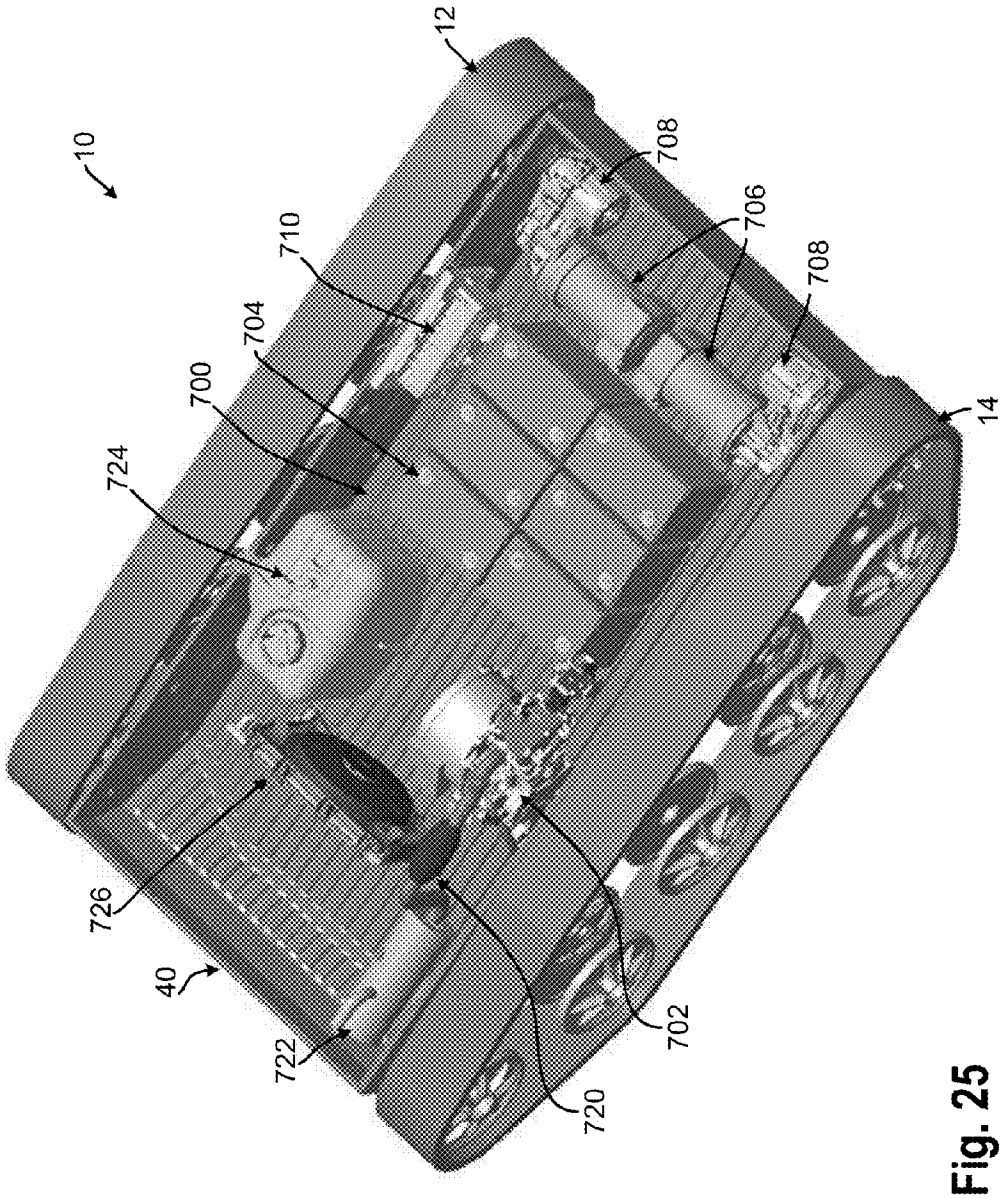


Fig. 25

TRACKED ALL-TERRAIN VEHICLE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Application No. 61/805,113, filed on Mar. 25, 2013, the entire disclosure of which is expressly incorporated by reference herein.

BACKGROUND OF THE DISCLOSURE

[0002] The present disclosure relates to vehicles, and more particularly to utility and all-terrain vehicles.

[0003] Generally, all-terrain vehicles ("ATVs") and utility vehicles ("UVs") are used to carry one or more passengers over a variety of terrain. More particularly, some ATVs and UVs may include side-by-side seating, in which a passenger may be seated next to the driver at the front of the vehicle. Side-by-side vehicles also may include a rear seating area to accommodate additional passengers in the vehicle. A roll cage may be provided over the seating of the vehicle. Additionally, ATVs and UVs may provide a cargo area in the front and/or the rear of the vehicle in order to carry cargo. ATVs and UVs include ground-engaging members, which may be tires, tracks, skis, or any other device for moving the vehicle across the ground.

SUMMARY OF THE DISCLOSURE

[0004] Some embodiments of the present disclosure includes a tracked ATV comprising a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track. The tracked ATV further comprises a steering and drive assembly, which has a first hydraulic pump coupled to the tracks for large radius turns. The steering and drive assembly also has a second hydraulic pump coupled to the tracks for small radius turns.

[0005] A further embodiment of the present disclosure includes a tracked ATV comprising a frame and a track coupled to the frame. The tracked ATV further comprises a power source supported by the frame and drivingly coupled to the track. The tracked ATV also comprises a steering and drive assembly, which includes a drive gear assembly coupled to the track for driving the track and a steering gear assembly. The steering gear assembly includes a first hydraulic pump and a motor. The first hydraulic pump is driven by the drive gear assembly when the vehicle is moving.

[0006] Another embodiment of the present disclosure includes a tracked ATV comprising a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track. The tracked ATV further comprises a suspension system coupled to the frame and supporting the track. The suspension system comprises a plurality of control arms coupled at an upper end to the frame and at a lower end to a carrier roller. At least some of the carrier rollers move independently of the other carrier rollers.

[0007] According to another illustrative embodiment of the present disclosure, a tracked ATV is provided including a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track. The tracked ATV further includes a plurality of load sensors supported by the frame, and each load sensor is operative to detect a load on the frame. The tracked ATV further includes a display device operative to display an indication of payload distribution of the vehicle. The tracked ATV further includes a control unit in communication with the plurality of load sensors and the display device. The control unit is operative to calculate a payload distribution of the vehicle based on output from the plurality of load sensors and to determine a recommended payload adjustment based on the calculated payload distribution. The control unit is operative to transmit a signal to the display device representative of the recommend payload adjustment.

[0008] According to yet another illustrative embodiment of the present disclosure, a method of managing payload distribution of a tracked all-terrain vehicle (ATV) is provided. The method includes providing a tracked ATV including a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track. The method includes detecting, by a plurality of load sensors, at least one load on the frame. The method includes calculating, by a control unit, a payload distribution of the vehicle based on output from the plurality of load sensors. The method includes determining, by the control unit, a recommended payload adjustment based on the calculated payload distribution. The method further includes transmitting, by the control unit, a signal to a display device representative of the recommend payload adjustment.

[0009] Additional features and advantages of the present invention will become apparent to those skilled in the art upon consideration of the following detailed description of the illustrative embodiment exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The foregoing aspects and many of the intended advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in conjunction with the accompanying drawings.

[0011] FIG. **1** is a right front perspective view of an illustrative vehicle of the present disclosure;

[0012] FIG. **2** is a left side view of an alternative embodiment of the vehicle of FIG. **1**;

[0013] FIG. **3** is a left side view of an alternative embodiment of the vehicles of FIGS. **1** and **2**;

[0014] FIG. **4** is a right front perspective view of the vehicle of the present disclosure;

[0015] FIG. **5** is a front view of the vehicle of FIG. **4**;

[0016] FIG. **6** is a left rear perspective view of the vehicle of FIG. **4**;

[0017] FIG. **7**A is a left front perspective view of a frame assembly and a tub of the vehicle of FIG. **4**;

[0018] FIG. **7**B is a right rear perspective view of the frame assembly and the tub of FIG. **7**A;

[0019] FIG. **7**C is a rear cross-sectional view of a front portion of the frame assembly and the tub of FIG. **7**A;

[0020] FIG. **8** is a side view of the vehicle of FIG. **4**, showing a suspension assembly;

[0021] FIG. **9**A is a top rear perspective view of the suspension assembly of FIG. **8**;

[0022] FIG. **9**B is a detailed side view of the suspension assembly of FIG. **8**;

[0023] FIG. **9**C is a side view of an alternative embodiment of the suspension assembly of FIG. **9**A;

[0024] FIG. **9**D is a side view of a further alternative embodiment of the suspension assembly of FIG. **9**A;

[0025] FIG. **10** is a perspective view of a track of the vehicle of FIG. **4**;

[0026] FIG. **11** is right rear perspective view of an air intake assembly of the vehicle of FIG. **4**;

[0027] FIG. **12** is a right rear perspective view of an exhaust assembly of the vehicle of FIG. **4**;

[0028] FIG. **13** is a rear right perspective view of a powertrain system of the vehicle supported by the frame assembly;

[0029] FIG. **14** is a rear left perspective view of the powertrain system of FIG. **13**;

[0030] FIG. **15** is a perspective view of a steering and drive assembly of the powertrain system of FIG. **13** with an outer housing removed;

[0031] FIG. **16** is a rear left perspective view of the vehicle of FIG. **4** illustrating a turning operation;

[0032] FIG. **17** is a top perspective view of the vehicle of FIG. **4** illustrating a zero-speed turning operation;

[0033] FIG. **18** is a diagrammatic view of a hydraulic steering system of the vehicle of FIG. **4**;

[0034] FIG. **19** is a front right perspective view of the frame assembly, the powertrain, and the electrical system of the vehicle of FIG. **4**;

[0035] FIG. **20** is a block diagram illustrating a torque compensation function of an engine control unit of the vehicle of FIG. **4**;

[0036] FIG. **21** is a block diagram illustrating a hydraulic pump control function of the engine control unit;

[0037] FIG. **22** is a block diagram illustrating a forward/reverse drive function of the engine control unit;

[0038] FIG. **23** is a block diagram illustrating safety functions of the engine control unit;

[0039] FIG. **24** is a block diagram illustrating a load level notification system provided with the engine control unit; and

[0040] FIG. **25** is a front right perspective view of the vehicle of FIG. **4** according to an embodiment having a series hybrid drive configuration.

[0041] Corresponding reference characters indicate corresponding parts throughout the several views. Although the drawings represent embodiments of various features and components according to the present disclosure, the drawings are not necessarily to scale and certain features may be exaggerated in order to better illustrate and explain the present disclosure. The exemplifications set out herein illustrate embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE DRAWINGS

[0042] The embodiments disclosed below are not intended to be exhaustive or to limit the invention to the precise forms disclosed in the following detailed description. Rather, the embodiments are chosen and described so that others skilled in the art may utilize their teachings. While the present disclosure is primarily directed to a utility vehicle, it should be understood that the features disclosed herein may have application to other types of vehicles such as all-terrain vehicles ("ATV"), utility vehicles ("UV"), motorcycles, watercraft, snowmobiles, side-by-side vehicle ("S×S"), and golf carts.

[0043] Referring to FIG. **1**, an illustrative embodiment of a vehicle **10** is shown. As detailed further herein, vehicle **10** may be a tracked ATV that includes ground engaging members, illustratively a left side track member **12** and a right side track member **14**, a powertrain assembly **500** (FIG. **13**), a frame assembly **30**, a body or tub **40** (FIG. **4**), a roll cage assembly **50**, and a suspension assembly **70** (FIG. **4**). Vehicle **10** may be configured for military applications and is configured to travel through various terrains or surfaces. More particularly, vehicle **10** is configured for both land and amphibious operation. Additionally, vehicle **10** may be operated by remote control. In one embodiment, vehicle **10** may be configured to travel at speeds of approximately 50 mph during land operation.

[0044] As shown in FIG. **1**, frame assembly **30** is supported on track members **12**, **14**. In one embodiment, track members **12**, **14** may be comprised of a polymeric material (e.g., rubber) and may be approximately 12 inches in width (approximately 0.3 m). Frame assembly **30** also may support a plurality of body panels, for example a hood **16**, a front fender **17**, side fenders **18**, and a rear fender **19**. Front fender **17** and rear fender **19** are provided to protect components of vehicle **10** from dirt, mud, debris, and/or damage. Additionally, frame assembly **30** supports an operator area **20**, which includes an operator seat **22**, a passenger seat **24**, a dash board assembly **25** (FIG. **6**), and operator controls, as detailed further herein. Operator seat **22** and passenger seat **24** may be in a side-by-side arrangement and may include a seat back and a seat bottom. In the illustrative embodiment of vehicle **10** of FIG. **1**, operator seat **22** is adjacent to and is separate from passenger seat **24**. Alternatively, as shown in FIG. **4**, operator seat **22** may be coupled to passenger seat **24** such that the seat bottoms are configured as a bench seat and the seat backs are configured as a single back rest.

[0045] Side fenders **18** are laterally outward of operator area **20** and may be provided as support structure for ingress and egress with vehicle **10**. Hood **16** may support a front cargo area forward of operator area **20**, as detailed further herein. Frame assembly **30** also may support a rear cargo area **28** rearward of operator area **20**. Illustrative rear cargo area **28** may be a fixed cargo box. Alternatively, rear cargo area **28** may be a movable dump box configured to pivot upwardly and rearwardly for unloading cargo therefrom. In one embodiment, the base weight of vehicle **10** may be approximately 1750 lb (approximately 794 kg) and vehicle **10** may be configured to accommodate approximately 500 lbs (approximately 227 kg) of cargo. Vehicle **10** may be configured with features for distributing the weight of any cargo supported on vehicle **10** during land operation and amphibious operation. For example, the cargo weight may be distributed such that the combined center of gravity of vehicle **10** and the cargo is positioned approximately at a center point of vehicle **10**. As such, vehicle **10** may not bias forwardly or rearwardly in the water during amphibious operation. As described herein, vehicle **10** may include a load level notification system to alert the operator of payload distribution.

[0046] Referring to FIG. **2**, an alternative embodiment of vehicle **10** is shown as vehicle **10'**. Vehicle **10'** includes features similar to those of vehicle **10**, wherein like reference numbers indicate like components. Vehicle **10'** includes a frame assembly **30'** supported on at least one track member **12'**. Frame assembly **30'** also supports a hood **16'**, side fenders **18'**, and a rear fender **19'**. Hood **16'** may support a front cargo area **26'** forward of an operator area **20'** and a rear cargo area **28'** may be positioned rearward of operator area **20'**. Operator area **20'** supports an operator seat and a passenger seat. Side fenders **18'** are laterally outward of operator area **20'** and may be provided for ingress and egress with vehicle **10'**. Additionally, a side body panel **27'** may be supported on frame assembly **30'** and may include at least one step **29'** for facilitating ingress and egress from operator area **20'**. For example, when an operator or passenger is entering operator area **20'**, the

operator or passenger may use step **29'** in order to step onto side fender **18'**, which allows the operator or passenger to enter and leave operator area **20'**.

[0047] Referring to FIG. **3**, an alternative embodiment of vehicle **10** and vehicle **10'** is shown as vehicle **10"**. Vehicle **10"** includes features similar to those of vehicle **10** and vehicle **10'**, wherein like reference numbers indicate like components. Vehicle **10"** includes a frame assembly **30"** supported on at least one track member **12"**. Frame assembly **30"** also supports a hood **16"**, a front fender **17"**, side fenders **18"**, and a rear fender **19"**. Additionally, frame assembly **30"** supports an operator area **20"**, which includes an operator seat and a passenger seat. Side fenders **18"** are laterally outward of operator area **20"** and may be provided for ingress and egress with vehicle **10"**. Additionally, a side body panel **27"** may be supported on frame assembly **30"** and may include at least one step **29"** for facilitating ingress and egress from operator area **20"**. Hood **16"** may support a front cargo area **26"** forward of operator area **20"** and a rear cargo area **28"** may be positioned rearward of operator area **20"**. Illustratively, rear cargo area **28"** includes side bars or roll bars **124**.

[0048] Referring to FIGS. **4-6**, an embodiment of vehicle **10** is shown. In one embodiment, track members **12**, **14** may include PROSPECTOR II tracks available from Polaris Industries, Inc. located at 2100 Highway 55 in Medina, Minn. 55340. Illustrative track members **12**, **14** are configured to rotate about suspension assembly **70** and are independently turnable relative to each other, as detailed further herein. More particularly, track members **12**, **14** are supported by a plurality of guide or carrier rollers **72**, **73**, a plurality of load wheels **75**, and a plurality of drive units **590**, **592** of suspension assembly **70**. When vehicle **10** is operating on track members **12** and **14**, the operator and/or passenger may wear a safety harness, illustratively a seat belt **21**, when in operator area **20**.

[0049] In one embodiment, track members **12**, **14** extend forwardly and rearwardly of frame assembly **30** and tub **40** such that track members **12**, **14** define the full length of vehicle **10**. As shown in FIGS. **2** and **3**, by defining the forward-most and rearward-most ends of vehicle **10**, track members **12**, **14** are configured to contact an object before the object contacts tub **40** of vehicle **10**. As such, track members **12**, **14** may drive vehicle **10** over the object without damaging tub **40**, frame assembly **30**, front fender **17**, and/or rear fender **19**.

[0050] Referring now to FIGS. **7A-7C**, frame assembly **30** includes a plurality of lower longitudinal frame members **32**, a plurality of upper longitudinal frame members **33**, and a plurality of cross members **34**. Illustrative frame assembly **30** includes at least two lower longitudinal frame members **32**, at least two upper longitudinal frame members **33**, and five cross members **34**; however, frame assembly **30** may include varying quantities and arrangements of longitudinal frame members **32**, **33** and cross members **34**. Illustratively, upper longitudinal frame members **33** are supported at the top surface of tub **40** and may be coupled together and coupled to tub **40** with conventional fasteners, such as structural bonds, welds, rivets, bolts, and adhesive. Lower longitudinal frame members **32** and cross members **34** are supported on a bottom wall **45** of tub **40**. Lower longitudinal frame members **32** and cross members **34** may be coupled together and coupled to tub **40** with conventional fasteners, such as structural bonds, welds, rivets, bolts, and adhesive. In one embodiment, the longitudinal length of frame assembly **30** and tub **40** may be approximately 11.5 ft (approximately 3.5 m) and the width of frame assembly **30** and tub **40** may be approximately 6.5 ft (approximately 2.5 m).

[0051] Longitudinal frame members **32**, **33** and cross frame members **34** may be comprised of a metallic or polymeric material. Frame assembly **30** of FIGS. **7A-7C** may be comprised of an aluminum material, for example 6061-T6 Aluminum. Similarly, tub **40** may be comprised of an aluminum material, for example 5052-H32 Aluminum. Alternatively, at least a portion of frame assembly **30** and/or tub **40** may include ultra-high molecular weight polyethylene. Additionally, frame assembly **30** and/or tub **40** may include a marine-grade pourable urethane coating and/or foam material inserts in order to fill volume voids and resist water ingestion during amphibious operation. As such, frame assembly **30** and tub **40** are configured to minimize water accumulation within vehicle **10**. Flotation devices, such as inflatable units, may also be included and secured to vehicle **10** to further increase the buoyancy of vehicle **10** during amphibious operation. In one embodiment, vehicle **10** is configured to float at approximately 1,600 kg without any urethane materials, however, urethane materials may increase the buoyancy of vehicle **10** during amphibious operation.

[0052] As shown in FIGS. **7A** and **7B**, frame assembly **30** also includes a brace member **36** which is positioned above lower longitudinal frame members **32** and cross members **34**. Brace member **36** may be coupled to a seat frame member **38** extending in a forward direction from brace member **36**. Seat frame member **38** supports operator seat **22** and passenger seat **24** (FIG. **4**). Illustratively, brace member **36** and seat frame member **38** are supported on upper longitudinal frame members **33** at the top surface of tub **40** and may be coupled thereto and coupled to each other with conventional fasteners, such as welds, bolts, rivets, adhesive, and/or structural bonds. As with longitudinal frame members **32**, **33** and cross members **34**, brace member **36** also may be comprised of an aluminum material and may include a urethane material to prevent water ingestion and to increase the buoyancy of vehicle **10**.

[0053] Brace member **36** and tub **40** are configured to support roll cage assembly **50**. Roll cage assembly **50** is coupled to brace member **36** and upper longitudinal frame members **33** with conventional fasteners, such as welds, bolts, rivets, adhesive, and structural bonds. In one embodiment, roll cage assembly **50** is configured to be removed from brace member **36** and upper longitudinal frame members **33**. In a further embodiment, roll cage assembly **50** is permanently affixed to brace member **36** and upper longitudinal frame members **33**.

[0054] Referring still to FIGS. **7A** and **7B**, roll cage assembly **50** includes a plurality of upstanding front members **52**, a plurality of upstanding rear members **54**, a front cross member **56**, and a rear cross member **57**. Roll cage assembly **50** may be comprised of a steel material. Front members **52** may be coupled to upper longitudinal frame members **33** and support grab bars **64** on both the operator side and the passenger side of roll cage assembly **50**. Additionally, front members **52** are coupled to rear members **54** with couplers **58**. Couplers **58** may be integral with front members **52** and/or rear members **54** or may be coupled thereto with welds, adhesive, bolts, rivets, or other fasteners. Additional details of couplers **58** may be included in U.S. Provisional Patent Application Ser. No. 61/788,874, filed on Mar. 15, 2013, the complete disclosure of which is expressly incorporated by reference herein.

[0055] Front cross member **56** is coupled to front members **52** and may be integrally formed thereto. Similarly, rear cross member **57** is coupled to rear members **54** and may be integrally formed thereto. Alternatively, front cross member **56** and rear cross member **57** may be coupled to front members **52** and rear members **54**, respectively, with conventional fasteners, such as welds, rivets, bolt, adhesive, and/or structural bonds.

[0056] As shown in FIGS. **7**A and **7**B, illustrative roll cage assembly **50** includes four rear members **54** coupled to brace member **36** of frame assembly **30** and rear cross member **57**. A plurality of rear braces **60** extend between two rear members **54**. More particularly, two rear braces **60** are positioned behind operator seat **22** (FIG. **4**) and are generally parallel to each other and coupled to two rear members **54**. Similarly, two rear braces **60** are positioned behind passenger seat **24** (FIG. **4**) and are generally parallel to each other and coupled to two rear members **54**. The outermost rear members **54** also may support bolster bars **62** on both the operator side and the passenger side of roll cage assembly **50**.

[0057] Front members **52**, rear members **54**, and cross members **56**, **57** may have a profiled cross-section in a figure-eight or hourglass configuration. As such, front members **52**, rear members **54**, and cross members **56**, **57** include recessed portions for receiving accessories, such as windows, doors, a front windshield, a rear windshield, and/or a roof, which may enclose operator area **20**. The recessed portions of roll cage assembly **50** may include sealing members in order to sealingly enclose operator area **20**. Additional details of the profiled configuration of front members **52**, rear members **54**, and cross members **56**, **57**, as well as the enclosing accessories (e.g., doors, windshields, windows, and/or a roof) are disclosed in U.S. Patent Application Publication No. 2013/0033070, filed on Jun. 8, 2012, the complete disclosure of which is expressly incorporated by reference herein. If operator area **20** is enclosed, operator area **20** may be configured to supply heat, defrost, and/or air conditioning, as well as other accessories, for the comfort and convenience of the operator and the passenger.

[0058] Referring still to FIGS. **7**A-**7**C, tub **40** includes a rear wall **41**, a front wall **43**, bottom wall **45**, and side walls **48**. Front wall **43**, rear wall **41**, bottom wall **45**, and side walls **48** may be integrally coupled together or may be welded, riveted, bolted, adhered, or otherwise fastened together. As shown in FIG. **5**, bottom wall **45** may have an inverted "U" shape such that the center portion **49** of bottom wall **45** is elevated relative to the lower outer edges or a perimeter **47** of bottom wall **45**. In one embodiment, bottom wall **45** of tub **40** has a ground clearance of approximately 6-15 inches (approximately 15-38 cm).

[0059] The inverted "U" shape of bottom wall **45** is designed to direct any water in tub **40** toward perimeter **47** of bottom wall **45**. As shown in FIG. **19**, vehicle **10** may include a plurality of pumps, for example bilge pumps **630**, positioned around perimeter **47** of tub **40** in order to evacuate any water from tub **40**. In one embodiment, vehicle **10** may include four pumps **630** coupled to bottom wall **45** at perimeter **47** (i.e., adjacent side walls **48**) of tub **40**. Pumps **630** may be configured for automatic operation upon the detection of water in tub **40** and/or may be manually operated. Vehicle **10** also may be configured to support a jet pump and/or propeller member to assist with amphibious operation, as detailed further herein.

[0060] Rear and front walls **41**, **43** may include latches **42** which provides vehicle **10** with towing capabilities. Additional tie-downs, latches, hooks, or other members may be provided for attaching additional cargo or assisting with towing capacity. Illustrative vehicle **10** may have a towing capacity of approximately 500-1000 lbs (approximately 227-450 kg).

[0061] Side walls **48** of tub **40** include a plurality of openings. For example, side walls **48** include a plurality of axle openings **44** adjacent front wall **43**. Axle openings **44** are configured to receive a front axle assembly **532** (FIG. **13**), as detailed further herein. Additionally, side walls **48** include a plurality of openings **46**, which may be configured to support additional components of vehicle **10** and/or may be used to drain water from tub **40** if water enters tub **40** during amphibious operation.

[0062] Referring now to FIGS. **8**, **9**A, and **9**B, suspension assembly **70** includes a plurality of lower guide or carrier rollers **72**, a plurality of upper carrier rollers **73**, drive units **590**, **592**, at least one idler wheel **79**, and a plurality of load wheels **75**. Carrier rollers **72** and **73**, drive units **590**, **592**, idler wheel **79**, and/or load wheels **75** may be comprised of metallic and/or polymeric materials. For example, as shown in FIGS. **9**A and **9**B, at least one load wheel **75** is configured as a non-pneumatic tire while carrier rollers **72**, **73** and idler wheel **79** are configured as spoked wheels. In one embodiment, these spoked wheels are made of a polymer. Non-pneumatic tires may be comprised of a polymeric material and may be used to increase the compliance of suspension assembly **70** and track members **12**, **14** during operation of vehicle **10**.

[0063] Carrier rollers **72**, **73**, drive units **590**, **592**, and load wheels **75** are in contact with track members **12**, **14** and are supported on side walls **48** of tub **40**. In one embodiment, idler wheels **79** are connected to suspension members. Drive units **590**, **592** may be supported by front axle assembly **532**. Drive units **590**, **592** are profiled to engage track members **12**, **14**, as detailed further herein. Upper carrier rollers **73** may be fixed to side walls **48** of tub **40**. Upper carrier rollers **73** and idler wheel **79** are configured to maintain the tension in track members **12**, **14**. In one embodiment, for example on vehicle **10"** of FIG. **3**, at least one of upper carrier rollers **73** may be partially covered with a shroud **122**. Shroud **122** may be integrally formed with side fender **18"** or may be coupled thereto and/or to side body panel **27"** with conventional fasteners.

[0064] Lower carrier rollers **72** and load wheels **75** may be operably coupled to side walls **48** of tub **40** with a plurality of shafts **76** and a plurality of control arms **78**. As shown in FIGS. **4**, **6**, **8**, **9**A, and **9**B, shafts **76** are coupled to side walls **48** with conventional fasteners (e.g., welds, rivets, bolts, adhesive) and an upper end of control arms **78** may be pivotally coupled to shafts **76**. Lower ends of control arms **78** are operably coupled to lower carrier rollers **72** and load wheels **75**. Load wheels **75** include a front load wheel **75***a* and a rear load wheel **75***b* and are configured to support the majority of the load of vehicle **10**. Lower carrier rollers **72** are configured to support a portion of the load of vehicle **10** and also are configured to guide track members **12**, **14** to prevent derailment. For example, load wheels **75** may support approximately 75% of the load of vehicle **10** while lower carrier rollers **72** may support approximately 25% of the load of vehicle **10**.

[0065] In one embodiment, as shown in FIG. **9**C, shock absorbers **126** also may be supported on shafts **76**. Illustratively, shock absorbers **126** have a generally vertical travel component and are coupled to control arms **78** of lower carrier rollers **72** and front load wheel **75***a*. Shock absorbers **126** may be positioned intermediate side walls **48** and control arms **78** such that shock absorbers **126** may be outboard of tub **40**. Alternatively, shock absorbers **126** may be positioned inboard of tub **40**. Shock absorbers **126** may be any linear force element. For example, shock absorbers **126** may be hydraulically operated and include springs. In one embodiment, shock absorbers **126** are adjustable coil-over damper type shock absorbers having a vertical travel of approximately 2-6 inches (approximately 5-16 cm).

[0066] As shown in FIG. **9**C, an alternative embodiment of suspension **70** includes a rear shock absorber **128** operably coupled to rear load wheel **75***b* through a scissor link **130**. Scissor link **130** is pivotably coupled to control arm **78** of rear load wheel **75** and is coupled to a movable end **142** of rear shock absorber **128**. A fixed end **144** of rear shock absorber **128** may be coupled to tub **40** such that illustrative rear shock absorber **128** has a generally horizontal travel component. In one embodiment, rear shock absorber **128** is inboard of tub **40**.

[0067] Alternatively, as shown in FIG. **9**D, suspension assembly **70** may include a carriage **132** operably coupled to front load wheel **75***a*, lower carrier rollers **72**, rear load wheel **75***b*, and idler wheel **79**. Carriage **132** extends in a generally horizontal direction and may be generally parallel with a portion of track members **12**, **14**. Lower carrier rollers **72** are pivotably coupled to carriage **132** through shafts **76** and control arms **78**. As such, lower carrier rollers **72** are configured to pivot or otherwise move independently relative to carriage **132** and each other in order to envelope an object on the ground or other surface during operation of vehicle **10**. Additionally, all lower carrier rollers **72** are configured to move together with carriage **132**, as detailed further herein, in order to maintain the tension in track members **12**, **14**. In one embodiment, each roller **72** may be biased downwardly from carriage **132** with a biasing member, such as with shock absorbers, for example.

[0068] As shown in FIG. **9**D, carriage **132** also is operably coupled to rear shock absorber **128** through control arm **78** coupled to rear load wheel **75***b* and scissor link **130**. Additionally, control arm **78** coupled to rear load wheel **75***b* is coupled to a pivot link **134**. Pivot link **134** is pivotably coupled to carriage **132** and control arm **78**. As such, as carriage **132** moves during operation of vehicle **10**, pivot link **134**, control arm **78** and scissor link **130** are configured to adjust movable end **142** of rear shock absorber **128**. As detailed herein, rear shock absorber **128** is positioned inboard of tub **40**.

[0069] Referring still to FIG. **9**D, the alternative embodiment of suspension assembly **70** also includes a front shock absorber **136** operably coupled to carriage **132** through a torque arm **138** and a scissor link **140**. Illustratively, front shock absorber **136** may have a generally horizontal travel component and may be positioned inboard of tub **40**. More particularly, a fixed end **148** of front shock absorber **136** may be coupled to an inner surface of side wall **48** of tub **40**. Scissor link **140** is operably coupled to a moveable end **146** of front shock absorber **136** and is pivotably coupled to torque arm **138**.

[0070] In operation, suspension assembly **70** of FIG. **9**D is configured to move upwardly and rearwardly when track members **12**, **14** encounter objects on the ground. The combined upward and rearward movement of carriage **132** also moves lower carrier rollers **72** in an upward and rearward direction which maintains the tension in track members **12**, **14**. Additionally, because each lower carrier roller **72** is separately coupled to carriage **132**, each lower carrier roller **72** is configured for independent movement which allows lower carrier rollers **72** to envelope objects on the ground or other surface for increase ride and handling characteristics of vehicle **10**.

[0071] Referring to FIG. **10**, track members **12**, **14** are defined by an outer surface **80** which includes a plurality of lugs **84** and an inner surface **82** which includes a plurality of guide members **88** and a plurality of drive members **86**. Lugs **84** on outer surface **80** contact the ground and other objects when vehicle **10** is operating. Drive members **86** and guide members **88** on inner surface **82** contact carrier rollers **72**, **73**, drive units **590**, **592**, and load wheels **75** in order to secure and maintain the alignment of track members **12**, **14** on carrier rollers **72**, **73**, drive units **590**, **592**, and load wheels **75**. Additionally, the raised profile of drive members **86** and guide members **88** is configured to compliment the profile of at least drive units **590**, **592** in order to drive track members **12**, **14** from front axle assembly **532**.

[0072] In operation, each control arm **78** and the corresponding lower carrier roller **72** coupled thereto moves independently of the other control arms **78** and lower carrier rollers **72**. As such, each lower carrier roller **72** is able to move in its own path when traversing objects or terrain. More particularly, because each lower carrier roller **72** is configured for independent movement, each lower carrier roller **72** and track members **12**, **14** may envelope or generally surround an object on the ground.

[0073] Additionally, as lower carrier rollers **72** and load wheels **75** contact the ground and other objects during operation of vehicle **10**, lower carrier rollers **72** and load wheels **75** move upwardly and rearwardly. Because track members **12**, **14** are secured on carrier rollers **72**, **73**, load wheels **75**, and drive units **590**, **592**, the upward and rearward movement of lower carrier rollers **72** and load wheels **75** maintains the tension in track members **12**, **14** when suspension assembly **70** moves relative to tub **40**.

[0074] Referring now to FIG. **6**, a cooling assembly **90** is shown. Cooling assembly **90** includes a radiator **92** and a fan **94**. Illustratively, cooling assembly **90** is positioned rearward of operator area **20** and forward of rear cargo area **28**. Cooling assembly **90** may be elevated relative to track members **12**, **14** such that amphibious operation of vehicle **10** does not submerge or otherwise affect cooling assembly **90**. Cooling assembly **90** is illustratively elevated above cargo area **28**. Additionally, cooling assembly **90** may be positioned in an angular configuration. Alternative arrangements of cooling assembly **90** may be positioned at other locations of vehicle **10**.

[0075] As shown in FIG. **11**, vehicle **10** also includes an air intake assembly **100** illustratively partially positioned below rear cargo area **28**. Air intake assembly **100** includes an air intake port **102**, a filter box **104**, a hose **106**, and an air box **108**. Air intake assembly **100** is positioned rearward of operator seat **22** and passenger seat **24** and is operably coupled to powertrain assembly **500**. Illustratively, air intake port **102** is elevated relative to bottom wall **45** of tub **40** and relative to

tops of track members **12**, **14** such that air intake port **102** is not submerged or otherwise affected during amphibious operation of vehicle **10**. In one embodiment, air intake port **102** may have a built-in snorkel for drawing in air from above the water line during amphibious operation of vehicle **10**. Air intake port **102** is coupled to filter box **104**, which includes a filter (not shown) sealed by a housing **103**. Filter box **104** is fluidly coupled to air box **108**. Air box **108** is sealingly coupled to throttle bodies **120** of an engine **502** of powertrain assembly **500** in order to supply air to engine **502**.

[0076] Referring to FIG. **12**, vehicle **10** also includes an exhaust assembly **110**. Exhaust assembly **110** includes a manifold **112**, an exhaust pipe **114**, a muffler **116**, and a tail pipe **118**. Illustratively, manifold **112** is coupled to engine **502** and to exhaust pipe **114**. Exhaust pipe **114** extends between manifold **112** and muffler **116**. Tail pipe **118** is coupled to muffler **116** in order to exhaust gases from vehicle **10**. In one embodiment, exhaust assembly **110** is elevated relative to bottom wall **45** of tub **40** such that amphibious operation of vehicle **10** does not submerge or otherwise affect exhaust assembly **110**. Tail pipe **118** is elevated above track members **12**, **14**, as illustrated in FIG. **16**.

[0077] Referring to FIGS. **13** and **14**, a powertrain system **500** is supported by frame assembly **30** for driving tracks **12**, **14** of vehicle **10**. Powertrain system **500** includes an engine **502**, a transmission **504** coupled to an output of engine **502**, and a drive shaft **506** coupled to an output of transmission **504**. Powertrain system **500** further includes a steering and drive assembly **508** coupled to an opposite end of drive shaft **506**. Engine **502** and transmission **504** are positioned in a rear portion of vehicle **10** behind operator seat **22**, and steering and drive assembly **508** is positioned in a front portion of vehicle **10** in front of operator seat **22**. In an exemplary embodiment, engine **502** is an internal combustion engine having an electronically controlled throttle valve controlled by an engine control unit (ECU) **520** (FIG. **20**). An exemplary engine control system is detailed further herein and in U.S. patent application Ser. No. 13/153,037, filed on Jun. 3, 2011, titled "ELECTRONIC THROTTLE CONTROL," the entire disclosure of which is incorporated by reference herein. Engine **502** is detailed further in U.S. patent application Ser. No. 13/242,239, filed on Sep. 23, 2011, titled "ENGINE," the entire disclosure of which is incorporated by reference herein.

[0078] In the illustrated embodiment, transmission **504** includes an electrically controlled continuously variable transmission (CVT), as detailed further in U.S. patent application Ser. No. 13/652,253, filed on Oct. 15, 2012, the complete disclosure of which is incorporated by reference herein. Transmission **504** is controlled by ECU **520** (FIG. **20**) or by another suitable controller, such as a transmission control unit. The output of transmission **504** is operably coupled to a gearbox **510** (FIG. **14**), and the output of gearbox **510** is drivingly coupled to drive shaft **506**. In one embodiment, gearbox **510** includes a sub-transmission geared to provide selectable operating gears. For example, gearbox **510** may shifted to a high gear, a low gear, a reverse gear, a neutral gear, and a park configuration. High gear provides a higher top speed of vehicle **10** than the top speed of low gear, and low gear provides greater low end torque. In one embodiment, a shift lever positioned in the operator area of vehicle **10** is operably coupled to gearbox **510** for shifting gearbox **510** between operating gears. Fewer or additional sub-transmission gears may be provided.

[0079] As illustrated in FIG. **14**, gearbox **510** drives an attachment shaft **511** for transferring engine torque to an attachment or implement (e.g., a work tool) attached to vehicle **10**. Attachment shaft **511** illustratively extends outwardly from a backside of gearbox **510** opposite drive shaft **506** and towards the back of vehicle **10** (e.g., through an aperture of the tub) for attaching the external implement. In one embodiment, attachment shaft **511** provides a power take-off for driving the implement with engine **502**. In one embodiment, gearbox **510** selectively engages attachment shaft **511** based on an operator input. For example, the shift lever may be actuated to engage attachment shaft **511** to power the implement coupled to vehicle **10**. In one embodiment, a clutch assembly is selectively engaged by the operator to engage attachment shaft **511** via gearbox **510**. The clutch assembly may be hydraulically or electronically operated. In one embodiment, attachment shaft **511** is used to drive a jet pump and/or propeller member to assist in propelling vehicle in water during amphibious operation.

[0080] Drive shaft **506** illustratively extends through the center of frame assembly **30** in the tub **40** below the operator seat **22**. In one embodiment, drive shaft **506** extends through a tunnel provided below seat **22**. As illustrated in FIG. **14**, drive shaft **506** includes a first portion **522** coupled to gear box **510**, a second portion **524** drivingly coupled to an input shaft **530** of steering and drive assembly **508**, and a u-joint **526** coupling first portion **522** to second portion **524**. A support bracket **528** is configured to couple to frame **30** to rotatably support drive shaft **506**. Support bracket **528** includes an internal bearing surface that receives drive shaft **506**.

[0081] Referring to FIGS. **13** and **19**, an alternator **512** is coupled to engine **502** for charging one or more vehicle batteries **514** (FIG. **19**) and for providing electrical power to electronic components of vehicle **10**. In an exemplary embodiment, alternator **512** is a 24 volt, 110-amp alternator, and vehicle battery **514** includes two 12-volt wet-cell batteries. Alternator **512** illustratively is driven by a chain **516** (FIG. **19**) coupled to the crankshaft of engine **502**. Vehicle **10** further includes a battery equalizer **628**, such as a 24V/12V equalizer, coupled to batteries **514**. Equalizer **628** is operative to draw substantially equal power from each battery **514** when powering vehicle components. In one embodiment, ECU **520** communicates over a controller area network (CAN) bus with other electronic components of vehicle **10**. As illustrated in FIG. **19**, a bilge pump **630** is provided at each corner of tub **40** for pumping water out of tub **40**.

[0082] As illustrated in FIG. **13**, a front axle assembly **532** includes a pair of drive axles **534** coupled to steering and drive assembly **508** for transferring torque from engine **502** to tracks **12**, **14**. Axles **534** are coupled to front drive units **590**, **592** (FIG. **16**) for driving left and right tracks **12**, **14**, respectively, in a front-wheel drive configuration. In an alternative embodiment, steering and drive assembly **508** is coupled to rear drive units of vehicle **10** to provide a rear-wheel drive configuration. A brake **536** is coupled to each axle **534** for providing a braking force to each axle **534** and drive unit **590**, **592**. Brakes **536** are actuated via a brake pedal provided in the operator area of vehicle **10**. In the illustrated embodiment, brakes **536** are hydraulically controlled disc brakes. Brakes **536** are illustratively positioned outboard of tub **40**. In one embodiment, the positioning of brakes **536** outside of tub **40** facilitates air-cooling of brakes **536**.

[0083] A hydraulic pump assembly **518** is also coupled to engine **502** and is driven by the crankshaft of engine **502**. As

described herein, hydraulic pump assembly **518** is operative to drive hydraulic motor **552** of steering and drive assembly **508** to facilitate zero-speed turning and low-speed turning of vehicle **10**. In one embodiment, hydraulic pump assembly **518** includes a dual hydraulic pump in a dual stage configuration, i.e., a pair of hydraulic pumps coupled in a series relationship (see FIG. **18**, for example). Hydraulic lines are routed from hydraulic pump assembly **518** to hydraulic motor **552** of steering and drive assembly **508**. In one embodiment, hydraulic pump assembly **518** drives other hydraulic components of vehicle **10**.

[0084] In operation, to drive vehicle **10** straight forward, steering and drive assembly **508** applies power from engine **502** to both drive units **590**, **592** (FIG. **16**) such that both left and right tracks **12**, **14** rotate at the same speed. To steer the vehicle **10** based on the steering angle of steering wheel **529** (FIG. **8**), steering and drive assembly **508** applies a differential to the driving speeds of each drive unit **590**, **592** (FIG. **16**). The speed difference between the left and right drive units **590**, **592** is different depending on the desired corner radius that vehicle **10** is driven.

[0085] In one embodiment, the differential speed of the two driving units **590**, **592** is achieved by a controlled variation of the drive ratio between the two driving units **590**, **592**, and not by applying brakes **536**. As such, the distribution of the torque applied to drive units **590**, **592** is adjusted without changing the total torque applied. The torque reduced on the one side of vehicle **10** is applied to the other side of vehicle **10**. Based on this behavior, the vehicle **10** keeps a constant driving speed during steering. In an alternative embodiment, brakes **536** are actuated to assist with steering vehicle **10**.

[0086] As illustrated in FIGS. **13-15**, steering and drive assembly **508** includes a steering assembly **540** coupled to a drive assembly **542**. Steering assembly **540** includes a hydraulic pump **550** driven by drive shaft **506**, a hydraulic motor **552**, and a steering gear assembly **562**. In the illustrated embodiment, hydraulic pump **550** and hydraulic pump assembly **518** are provided on the same hydraulic circuit of vehicle **10** (see FIG. **18**) and are operative to drive hydraulic motor **552**. As described herein, the steering angle of steering wheel **529** controls a steering valve (FIG. **18**) to control the rotation of hydraulic motor **552** and thus the steering input to steering gear assembly **562** and drive assembly **542**.

[0087] As illustrated in FIG. **15**, steering assembly **540** includes an input shaft **530** that couples to second portion **522** (FIG. **14**) of drive shaft **506**. Input shaft **530** is drivingly coupled to a shaft **560** of drive assembly **542** via interacting angled gears **574**, **576**. Drive assembly **542** includes a differential gearbox having right and left planetary gear assemblies **564**, **566**, respectively, driven by shaft **560**. Each planetary gear assembly **564**, **566** includes a sun gear **578** coupled at each end of shaft **560** to provide driving input to drive axles **534**. Each planetary gear assembly **564**, **566** further includes planetary gears **570** and a ring gear **568**.

[0088] The steering angle of the steering input device, i.e., steering wheel **529** of FIG. **8**, defines the differential speed of the two drive axles **534** and therefore the turning radius of vehicle **10** depending on the vehicle speed. A greater vehicle speed results in a greater turning radius for a same steering input. The steering input is directed from hydraulic steering motor **552** through the steering gear assembly **562** to the ring gear **568** of the planetary gear assemblies **564**, **566**. Steering gear assembly **562** includes a steering gear train comprising a gear shaft **563** coupled to the output of motor **552** and a gear shaft **571** coupled to gear shaft **563** for driving ring gear **568** of planetary gear assembly **566**. Steering gear assembly **562** includes an intermediate gear shaft **572** coupled to gear shaft **571** for driving ring gear **568** of gear assembly **564**.

[0089] When vehicle **10** is driving straight in the forward or reverse direction without steering input, the output of motor **552**, steering gear assembly **562**, and ring gear **568** are stationary, and drive axles **534** coupled to planetary gear assemblies **564**, **566** rotate at the same speed. Depending on the steering angle of steering wheel **529**, hydraulic motor **552** is driven faster or slower in one or the other direction based on the turning direction requested. The hydraulic motor **552** thus drives the ring gear **568** through the steering gear assembly **562**. Rotation of the ring gear **568** changes the gear ratio of the planetary gear assembly **564**, **566** and results in the differential speed of the two drive axles **534**.

[0090] In one embodiment, to keep a constant velocity of vehicle **10** during a turning operation, the outer side drive axle **534** (relative to the turning direction) is driven faster than a neutral vehicle speed (i.e., the requested speed of the vehicle **10**), and the inner side drive axle **534** is driven the same amount slower than the neutral vehicle speed. In the illustrated embodiment, intermediate shaft **572** of steering gear assembly **562** is operative to invert the rotational direction of the ring gear **568** of planetary gear assembly **564** relative to the rotational direction of ring gear **568** of planetary gear assembly **566**. As such, the steering input provided with hydraulic motor **552** causes one drive axle **534** to drive faster and one drive axle **534** to drive slower relative to the neutral vehicle speed to provide the turning effect.

[0091] An operation of a drive assembly **542**, hydraulic motor **552**, and steering gear assembly **562** based on the steering input is detailed further in U.S. patent application Ser. No. 11/965,165, filed Dec. 27, 2007, titled "SKID STEERED ALL TERRAIN VEHICLE," the entire disclosure of which is incorporated by reference herein.

[0092] Referring to FIG. **18**, an exemplary hydraulic steering system **600** is illustrated. Engine **502** drives a first hydraulic pump **602** and a second hydraulic pump **604** of hydraulic pump assembly **518**. A control valve **606**, **608** is coupled at the output of each pump **602**, **604**, respectively. Gearbox **510** drives drive shaft **506** to drive hydraulic pump **550** of steering and drive assembly **508**, and a control valve **610** is coupled at the output of pump **550**. The hydraulic components of FIG. **18** are coupled together view hydraulic hoses or lines as illustrated. Exemplary pump displacements, pressure values, pump speeds, and other values are shown in FIG. **18** to illustrate an exemplary embodiment of hydraulic steering system **600**, and other suitable values and specifications may be provided depending on system configuration.

[0093] A priority flow control valve **612** controls the flow volume from pumps **518**, **550** to a steering valve **614** such that the pressure drop over the steering valve **614** is substantially constant. Steering wheel **529** is coupled to steering valve **614** and switching valve **618** to control the fluid flow to motor **552**. Steering valve **614** serves as an adjustable orifice to control the amount of fluid flow to motor **552** and thus the amount of rotation of motor **552** and the amount of steering of vehicle **10**. The flow direction to motor **552** is switched with switching valve **618** based on the direction that steering wheel **529** is turned. As such, steering valve **614** and switching valve **618** cooperate to control the direction and volume of fluid flow to hydraulic motor **552** to control the rotational direction of motor **552** based on steering wheel **529** being turned to the left

or right (for a corresponding left or right vehicle turn). As such, the steering angle of steering wheel **529** is operative to control the volume and direction of flow to motor **552**.

[0094] A hydraulic switch, illustratively switching valve **616** is provided between motor **552** and the output of steering valve **614** to further control the direction of flow to the hydraulic motor **552** based on the operating gear of vehicle **10**. In particular, in a forward gear of gearbox **510**, switching valve **616** controls the fluid flow to rotate motor **552** in one direction. In a reverse gear of gearbox **510**, switching valve **616** is operative to reverse the flow direction to motor **552**, thereby allowing the steering direction of vehicle **10** to be independent of the forward or reverse movement of vehicle **10** based on a same steering angle of steering wheel **529**. Switching valve **616** may be controlled electrically or mechanically based on the selection of a forward or reverse gear of gearbox **510**.

[0095] Hydraulic fluid which is not used for steering may be either used to drive any other working hydraulic units of vehicle **10** or returned over a return line to the oil reservoir **622**. The operation of priority control valve **612**, steering valve **614**, switching valve **616**, and switching valve **618** of FIG. **18** is detailed further in U.S. patent application Ser. No. 11/965,165, filed Dec. 27, 2007, titled "SKID STEERED ALL TERRAIN VEHICLE," the entire disclosure of which was previously incorporated by reference herein.

[0096] In one embodiment, steering wheel **529** includes a position sensor **640** (FIGS. **20-21**) in communication with ECU **520** (or another vehicle controller) for detecting a steering angle of steering wheel **529**. In this embodiment, based on the detected steering angle, ECU **520** routes a control signal to steering valve **614** and switching valve **616**. Steering wheel **529** may alternatively be mechanically or hydraulically coupled to steering valve **614** and switching valve **616**.

[0097] Hydraulic pump **550** and hydraulic pump assembly **518** are operative to drive hydraulic motor **552** based on the operating condition of vehicle **10**. In the illustrated embodiment, hydraulic pump **550** drives motor **552** for steering operations when vehicle is moving. In particular, hydraulic pump **550** is driven by drive shaft **506** via gears **556**, **558** (FIG. **15**). As such, movement of vehicle **10** across the ground causes drive shaft **506** to rotate to thereby drive pump **550**. Thus, hydraulic pump **550** provides power to hydraulic motor **552** when pump **550** is driven by drive shaft **506**.

[0098] In the illustrated embodiment, when engine **502** is disabled, but tracks **12**, **14** are moving to rotate drive shaft **506**, hydraulic pump **550** is operative to drive motor **552** to provide vehicle steering. Such a configuration may serve as a control feature for steering vehicle **10** when vehicle **10** is not powered but is coasting or moving down a hill, for example. In the illustrated embodiment, pump **550** is mechanically coupled to drive shaft **506** such that pump **550** rotates when drive shaft **506** rotates. In the illustrated embodiment, both forward and reverse movement of vehicle **10** is operative to drive pump **550** to power motor **552**.

[0099] Hydraulic pump assembly **518** is operative to drive motor **552** to turn vehicle **10** when vehicle **10** is stopped or below a minimal threshold speed (e.g., 5 mph, 3 mph, etc.) or when ECU **520** determines that additional hydraulic power is required to drive hydraulic motor **552**. Hydraulic pump **518**, driven by engine **502**, provides hydraulic power to motor **552** such that vehicle **10** is operative to turn when at a zero vehicle speed based on an operator turning steering wheel **529** and without operator input to the vehicle accelerator. As such, in one embodiment, hydraulic pump assembly **518** is operative to drive motor **552** for small radius turns, including a zero radius turn, and hydraulic pump **550** is operative to drive motor **552** for larger radius turns (i.e., when tracks **12**, **14** are moving).

[0100] In one embodiment, vehicle **10** must be traveling at a speed less than a threshold vehicle speed before hydraulic pump assembly **518** is actuated by ECU **520** to drive motor **552**. For example, vehicle **10** includes a speed sensor **642** (FIGS. **20-21**) operative to detect a speed of tracks **12**, **14** and/or drive shaft **506**. Upon the detected speed decreasing to below the speed threshold, ECU **520** activates hydraulic pump assembly **518** to drive hydraulic motor **552**. In one embodiment, ECU **520** or another suitable controller controls the activation of hydraulic pump assembly **518** based on the vehicle speed and/or other inputs. In one embodiment, zero-radius turning is activated by ECU **520** when gearbox **510** is in a neutral operating gear, although it may be activated in other operating gears (e.g., reverse or forward). In one embodiment, ECU **520** further controls hydraulic pump assembly **518** to assist with steering when hydraulic pump **550** provides inadequate power to motor **552** (e.g., low vehicle speeds).

[0101] For example, referring to FIG. **16**, an exemplary right turn steering operation is illustrated as controlled by hydraulic pump **550** for when tracks **12**, **14** are moving. Due to the movement of vehicle **10** and thus the rotation of drive shaft **506**, hydraulic pump **550** provides hydraulic power to rotate motor **552**. Based on the steering angle of steering wheel **529**, hydraulic motor **552** provides steering input to steering gear assembly **562** to cause a differential speed between drive units **590**, **592**, as described herein. In FIG. **16**, drive unit **592** is driven slower than the neutral vehicle speed, and drive unit **590** is driven faster than the neutral vehicle speed to cause the vehicle to turn right.

[0102] Referring to FIG. **17**, an exemplary zero radius steering operation is illustrated as controlled by hydraulic pump assembly **518** for when vehicle **10** is stationary. With drive shaft **506** not rotating, hydraulic pump **550** does not provide hydraulic input to motor **552**. Rather, engine **502** drives hydraulic pump assembly **518** to power motor **552** when vehicle **10** is stationary. Based on the steering angle of steering wheel **529**, hydraulic motor **552** provides steering input to steering gear assembly **562** to cause a differential speed between drive units **590**, **592** such that vehicle **10** turns at a zero radius or a minimal radius. In FIG. **17**, tracks **12**, **14** are driven at the same speed but in opposite directions to cause vehicle **10** to turn at the zero radius.

[0103] In one embodiment, the steering system described herein is operative to control vehicle **10** at low to high vehicle speeds, including speeds up to and over 60 mph, for example. Vehicle **10** includes an accelerator pedal including a position sensor **650** (FIG. **23**) in communication with ECU **520** for providing a throttle request to engine **502**.

[0104] In one embodiment, ECU **520** (FIGS. **20-23**) is operative to enable and disable the zero-speed steering functionality provided with hydraulic pump assembly **518** based on the detection of an operator in seat **22**. Seat **22** includes a seat switch or sensor **652** (FIG. **21**) for detecting the presence of an operator, as detailed further in U.S. patent application Ser. No. 13/650,697, filed on Sep. 4, 2012, the entire disclosure of which is incorporated by reference herein. ECU **520** enables operation of hydraulic pump assembly **518** to enable zero-speed turning upon detection of an operator in seat **22**

and disables operation of hydraulic pump assembly **518** when an operator is not detected in seat **22**. In one embodiment, ECU **520** is further operative to enable and disable power to the attachment via attachment shaft **511** based on detection of an operator in operator seat **22**. In this embodiment, when an operator is not detected at seat **22**, ECU **520** disengages attachment shaft **511** to stop and/or to prevent the delivery of power from engine **502** to the attachment. As such, engine **502** may be controlled to provide power to the attachment when an operator is seated and not when an operator is off the seat. In one embodiment, ECU **520** delays deactivating hydraulic pump assembly **518** after detecting seat **22** is in an unoccupied state for a predetermined time lapse, such as for one second or any other suitable time lapse.

[0105] ECU **520** includes at least one processor that executes software and/or firmware stored in memory of ECU **520**. The software/firmware contains instructions that, when executed by the processor, causes ECU **520** to perform the functions described herein. ECU **520** may alternatively include one or more application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), digital signal processors (DSPs), hardwired logic, or combinations thereof. In one embodiment, the processor of ECU **520** includes both engine control logic operative to control engine **502** and CVT control logic operative to control CVT **504**. ECU **520** may alternatively include multiple control units or processors functioning together to perform the functions of ECU **520** described herein.

[0106] Referring to FIG. **20**, ECU **520** is operative to provide torque compensation during a steering event. Due to the hydraulic system using some engine power to steer vehicle **10** and/or to power other components of vehicle **10**, ECU **520** controls engine **502** to deliver additional torque when engine **502** power is being consumed by the hydraulic system. As such, the likelihood of stable vehicle speed is increased without any corrections made by the operator (e.g., further actuation of accelerator). ECU **520** receives as sensor inputs the hydraulic pressure on steering valve **614** (FIG. **18**) from a hydraulic pressure sensor **644**, the vehicle speed (e.g., the rotational speed of input shaft **530** (FIG. **15**) or drive shaft **506**) from speed sensor **642**, the steering angle of steering wheel **529** (FIG. **8**) from steering angle sensor **640**, and the selected operating gear of sub-transmission gearbox **510** (e.g., high, low, reverse, neutral, park) from a gear selector **646**. Based on these inputs, ECU **520** automatically adjusts the speed of engine **502** by controlling the throttle valve to compensate for the torque consumed by the hydraulic system to power the steering assembly or other hydraulic components. Additional detail for engine torque compensation is provided in U.S. patent application Ser. No. 11/965,165, filed Dec. 27, 2007, titled "SKID STEERED ALL TERRAIN VEHICLE," the entire disclosure of which was previously incorporated by reference herein.

[0107] Referring to FIG. **21**, ECU **520** is operative to control the activation of hydraulic pumps (e.g., pumps **602**, **604** of FIG. **18**) of hydraulic pump assembly **518**. Based on the detected vehicle speed from speed sensor **642**, the detected steering angle of steering wheel **529** from sensor **640**, and the detected engine speed from an engine speed sensor **648**, ECU **520** is operative to selectively active pumps **602**, **604** of hydraulic pump assembly **518**. As described herein, ECU **520** activates one or more pumps of hydraulic pump assembly **518** based on the vehicle speed decreasing to below the threshold speed. As such, hydraulic pump assembly **518** is used to drive hydraulic motor **552** of steering and drive assembly **508** (FIG. **15**) at low or zero vehicle speeds, as described herein. ECU **520** monitors the vehicle speed and steering angle to determine if pump assembly **518** requires activation at speeds greater than the threshold, such as if additional steering power is required. In one embodiment, ECU **520** monitors the engine speed and increases the engine speed upon determining, based on the steering demand, vehicle speed, and engine speed, that additional power is required for driving the pumps of hydraulic pump assembly **518**. In one embodiment, hydraulic pump assembly **518** includes at least two hydraulic pumps coupled in series. FIG. **21** illustrates hydraulic pump assembly **518** having three pumps in series. In one embodiment, when an operator is not detected in seat **22** based on output from seat sensor **652**, ECU **520** disables operation of hydraulic pump assembly **518**, as described herein.

[0108] Referring to FIG. **22**, ECU **520** is operative to control the forward and reverse drive of vehicle **10** based on a signal from a gear selector **646** (e.g., shift lever, buttons, or other suitable operator input device) and/or a signal from gearbox **510**. Upon detecting a forward gear, ECU **520** controls switching valve **616** (FIG. **18**) to rotate motor **552** in a first direction such that vehicle **10** turns in a direction corresponding to the direction demanded with steering wheel **529**. Upon detecting a reverse gear, ECU **520** controls switching valve **616** to switch the flow direction to motor **552** to thereby reverse the direction of motor **552**. As such, vehicle **10** turns in a direction corresponding to the direction demanded with steering wheel **529** when vehicle **10** is moving in reverse.

[0109] FIG. **23** illustrates several inputs that ECU **520** uses to control engine **502** and components coupled to engine **502** (e.g., hydraulic pump assembly **518**, attachment shaft **511**, etc.) to provide control functionality to vehicle **10**. ECU **520** receives sensor inputs corresponding to the hydraulic pressure on steering valve **614** (FIG. **18**) from hydraulic pressure sensor **644**, the vehicle speed from sensor **642**, the steering angle of steering wheel **529** from sensor **640**, the hydraulic oil level in reservoir **622** (FIG. **18**) from a hydraulic level sensor **656**, the hydraulic oil temperature from a temperature sensor **658**, the throttle pedal position (throttle demand) from accelerator position sensor **650**, and the occupied or unoccupied state of seat **22** from seat sensor **652**. As described herein, ECU **520** implements various control features based on the signals. For example, ECU **520** disables the zero-speed turning feature upon an operator not being detected in seat **22**. In one embodiment, the disabling of the zero-speed turning feature is in response to a detected unoccupied state of the seat **22**, no or minimal throttle demand being detected, and no or minimal vehicle speed being detected by ECU **520**. ECU **520** further disables components of the hydraulic circuit and/or reduces vehicle speed based on a low oil level, a high oil temperature, or a low/high oil pressure detection.

[0110] Referring to FIG. **24**, ECU **520** is further operative to detect and to notify the operator of a payload distribution of vehicle **10**. For example, the distribution of payload (e.g., cargo, operator, other loads) may affect the stability of vehicle **10** more when vehicle **10** is in buoyancy mode in water than when vehicle **10** is on dry land. If vehicle **10** has been loaded unevenly, vehicle operation may become unstable upon vehicle **10** transitioning into water. ECU **520** is operative to provide an indication to the operator via a signal to a gauge **676** of an optimal or recommended distribution of the payload.

[0111] Vehicle **10** includes a network of load sensors in communication with ECU **520**, illustratively load sensors **670** mounted in the front cargo area **26** and load sensors **672** mounted in the rear cargo area **28**. Additional load sensors may be provided in other areas of vehicle **10**. Load sensors **670**, **672** may include weight or pressure sensors or other suitable sensors for detecting a load and providing a signal representative of the detected load to ECU **520**. In one embodiment, load sensors **670**, **672** are integrated into mounting bolts that are coupled to a respective structure (e.g., floor panel) of front and rear cargo areas **26**, **28**. Other suitable weight or pressure sensor apparatuses fit for the environment and necessary output levels may be provided.

[0112] The output of sensors **670**, **672** are read by ECU **520** to determine the weight or pressure at each location of sensors **670**, **672**. Based on the readings, ECU **520** determines the load differential between the different sensor mounting locations to determine the payload distribution of vehicle **10**. ECU **520** communicates the status of the payload distribution to a display or gauge **676** to notify the operator of the payload distribution and to alert the operator when weight differentials exceed threshold limits. If the threshold limits are exceeded, ECU **520** alerts the operator that the payload should be shifted to obtain improved vehicle stability. ECU **520** may also notify the operator when a maximum total vehicle payload has been exceeded, or a maximum rear or front total payload has been exceeded. In one embodiment, the threshold limits may be calibrated. In one embodiment, ECU **520** may implement or modify vehicle controls when the payload threshold limits are exceeded. For example, ECU **520** may limit the maximum speed or maximum torque of the engine via electronic throttle control, or other suitable control measures may be taken by ECU **520**. ECU **520** may also sound an audible alarm when the limits are exceeded.

[0113] An exemplary gauge **676** is illustrated with gauge **678** of FIG. **24**. Gauge **678** provides a graphical representation of vehicle **10**, including a top-down representation **680** of rear cargo area **28** and a top-down representation **682** of front cargo area **26** of vehicle **10** within an outline of the outer perimeter of vehicle **10**. Representations **680**, **682** may include a picture or other rendering coupled to dashboard **25** (FIG. **6**) or may include graphical data displayed by ECU **520** on a display screen. Multiple indicators A through H are provided in representations **680**, **682** to represent the physical locations of the sensors **670**, **672** on vehicle **10**. For example, indicators A, B, C, and D are at the corners of representation **680** to represent sensors **672** mounted at the corners of rear cargo area **28**, and indicators E, F, G, and H are at the corners of representation **682** to represent sensors **670** mounted at the corners of front cargo area **26**. Sensors **670**, **672** may be mounted at other suitable locations of cargo areas **26**, **28**. In one embodiment, indicators A through H are illuminated with different colors to indicate the sensor status and therefore the payload status. Indicators A-H may include light emitting diodes (LEDs), graphical data provided on a display screen, or other suitable devices controlled by ECU **520** for indicating the sensor status.

[0114] For example, an individual indicator is illuminated green indicates the load point is "acceptable", solid amber indicates the load point is "cautionary" and too light compared to another load point, flashing amber indicates the load point is "highly cautionary" and too light compared to another load point, solid red indicates the load point is "cautionary" and too heavy compared to another load point, and flashing red indicates the load point is "highly cautionary" and too heavy compared to another load point. Further, all indicators are illuminated red as "cautionary" when a first recommended total payload limit of vehicle **10** is exceeded and flashing red as "highly cautionary" when a second (higher) recommended payload limit of vehicle **10** is exceeded. Other colors and behavior of indicators may be implemented to indicate load status.

[0115] The following table provides examples of key sensor mounting location relationships with reference to gauge **678**:

TABLE 1

Key Sensor Mounting Location Relationships

VEHICLE REAR	VEHICLE FRONT	TOTAL VEHICLE
A-B	E-F	A-F
A-C	E-G	A-H
A-D	E-H	C-F
B-C	F-G	C-H
B-D	F-H	
C-D	G-H	

As illustrated in Table 1, gauge **678** may be used to monitor the loads between different combinations of sensor mounting locations to thereby determine payload differentials between mounting locations or regions at the rear portion of vehicle **10**, the front portion of vehicle **10**, and the overall vehicle **10**. ECU **520** may provide calibratable limits for each location differential to set load differential at which the payload distribution transitions from acceptable to cautionary to highly cautionary. For example, ECU **520** may broadcast the status of each sensor **670**, **672** via indicators A-H as follows:

TABLE 2

Load Sensor Status (A-H)
WEIGHT/PRESSURE SENSOR STATUS (A-H)

STATES	DESCRIPTION	POSSIBLE INDICATOR STATUS
000	Acceptable Differentials	Indicator Solid Green
001	Cautionary (Differential indicates this needs MORE weight)	Indicator Solid Amber
010	Highly Cautionary (Differential indicates this needs MORE weight)	Indicator Flashing Amber
011	Cautionary (Differential indicates this needs LESS weight)	Indicator Solid Red
100	Highly Cautionary (Differential indicates this needs LESS weight)	Indicator Flashing Red
110	Error	Indicator Flashes Alternating Red and Amber
111	Not Available	Indicator Flashes Alternating Red and Amber

wherein each state is illustratively represented by a three-bit code. As shown in Table 2, each indicator A-H may be illuminated with a different color to indicate the load status. In the illustrated embodiment, solid green indicates an acceptable status, solid amber and solid red each indicate cautionary status (more or less weight needed at location, respectively), flashing amber and flashing red indicates highly cautionary status (more or less weight needed at location, respectively),

and alternating flashing red and amber indicates an error with the load detection system or that load information is not available.

[0116] ECU **520** may also implement calibratable limits for indicating when the total vehicle payload transitions from acceptable to cautionary to highly cautionary. This may be indicated with a separate gauge or with gauge **678**. For example, to provide this indication with gauge **678**, the following status indicators may be provided:

TABLE 3

TOTAL PAYLOAD STATUS

STATES	DESCRIPTION	POSSIBLE INDICATOR STATUS
000	Acceptable Differentials	Defaults to Current Weight/ Pressure Sensor Status
001	Cautionary (First Payload Calibration Limit Exceeded, but Below Next Limit)	Indicators All Solid Red
010	Highly Cautionary (Next Payload Calibration Limit Exceeded)	Indicators All Flashing Red
110	Error	Indicator Flashes Alternating Red and Amber
111	Not Available	Indicator Flashes Alternating Red and Amber

For example, when the total vehicle payload is acceptable, the indicators A-H default to the current individual load sensor statuses described above with Table 2. Indicators A-H are all solid red to indicate a cautionary status when a first total payload limit has been exceeded. Indicators A-H are all flashing red to indicate a highly cautionary status when a second, higher total payload limit has been exceeded. Indicators A-H alternately flash red and amber to indicate an error with load detection system or load information not available.

[0117] In one embodiment, the calibratable threshold limits for the payload at each individual sensor and the overall payload may be pre-determined based on real-world data collection and/or stability simulation.

[0118] As one example, if indicators F and H of gauge **678** of FIG. **24** are solid red, indicators E and G are solid amber, and indicators A, B, C, and D are all solid green, gauge **678** indicates to an operator that cargo in the front cargo area **26** of vehicle **10** should be shifted towards the center of vehicle **10**. Once the appropriate amount of weight has been shifted towards the center of vehicle **10**, indicators E, F, G, and H all turn green when the payload balance is acceptable.

[0119] In an alternative embodiment, vehicle **10** includes a series hybrid drive configuration as illustrated in FIG. **25**. Referring to FIG. **25**, a hybrid electric drive system **700** of exemplary vehicle **10** includes a gas engine generator **702**, a bank of batteries **704** charged by generator **702**, an inverter **710**, and a pair of electric motors **706** configured to drive tracks **12**, **14**. Each electric motor **706** drives tracks **12**, **14** via a gear reduction box **708** coupled to the corresponding drive unit **590**, **592**. In one embodiment, disk brakes are coupled off gear boxes **708** either inboard or outboard of tub **40**. Vehicle **10** of FIG. **27** further includes a catalytic converter **720** and an exhaust silencer **722** coupled to the exhaust of engine **702**. A fuel tank **724** and a radiator and fan **726** are positioned inboard of tub **40**.

[0120] In operation, the gas engine **702** serves as a generator to supply electric power to inverter **710**, which charges batteries **704**. Independent operation of electric motors **706** may be commanded electronically via drive-by-wire from the ECU to provide the speed/torque differential between tracks **12**, **14** for turning vehicle **10**. Electric motors **706** may also be counter rotated at low ground speeds to provide a zero-radius turn. When batteries **704** require additional power to drive tracks **12**, **14**, engine **702** is commanded to run to charge batteries **704** until batteries **704** have sufficient power and engine **702** is shut down. The series hybrid drive configuration is further detailed in U.S. patent application Ser. No. 13/441,537, filed Apr. 6, 2012, titled "ELECTRIC VEHICLE WITH RANGE EXTENDER," the entire disclosure of which is incorporated by reference herein

[0121] In one embodiment, vehicle **10** is adapted to be remotely controlled. For example, a remote control electronic device may be used to control vehicle **10** wirelessly without an operator being positioned in the vehicle **10**. In one embodiment, vehicle **10** is operative to drive autonomously without human input.

[0122] The entire disclosure of U.S. patent application Ser. No. 11/035,925, filed Jan. 14, 2005, titled "TRACKED ATV," is incorporated by reference herein.

[0123] The term "logic" or "control logic" as used herein may include software and/or firmware executing on one or more programmable processors, application-specific integrated circuits (ASICs), field-programmable gate arrays (FPGAs), digital signal processors (DSPs), hardwired logic, or combinations thereof. Therefore, in accordance with the embodiments, various logic may be implemented in any appropriate fashion and would remain in accordance with the embodiments herein disclosed.

[0124] While this invention has been described as having an exemplary design, the present invention may be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains.

What is claimed is:

1. A tracked all-terrain vehicle (ATV), comprising:

a frame;

a track coupled to the frame;

a power source supported by the frame and drivingly coupled to the track; and

a steering and drive assembly, the assembly comprising a first hydraulic pump coupled to the tracks for large radius turns, and a second hydraulic pump coupled to the tracks for small radius turns.

2. The tracked ATV of claim **1**, wherein the second hydraulic pump is drivingly coupled to the power source.

3. The tracked ATV of claim **2**, wherein the second hydraulic pump comprises a dual hydraulic pump in a dual stage configuration.

4. The tracked ATV of claim **1**, wherein the power source is an internal combustion engine.

5. The tracked ATV of claim **1**, wherein the steering and drive assembly comprises a steering gear assembly and a drive gear assembly.

6. The tracked ATV of claim **5**, wherein the drive gear assembly is comprised of a differential drive assembly.

7. The tracked ATV of claim **6**, wherein the differential drive assembly comprises two planetary gear assemblies; a left planetary gear assembly coupled to a left track and a right

planetary gear assembly coupled to a right planetary gear assembly coupled to a right track.

8. The tracked ATV of claim **7**, further comprising an input shaft having a first end coupled to the differential drive assembly and a second end coupled to the power source.

9. The tracked ATV of claim **8**, wherein the first hydraulic pump is drivingly coupled to the input shaft.

10. The tracked ATV of claim **9**, wherein the steering gear assembly comprises a steering gear train coupled to the left and right planetary gear assemblies to operate the left and right tracks at differential speeds for steering.

11. The tracked ATV of claim **10**, further comprising a hydraulic motor coupled to the first hydraulic pump for providing driving input to the steering gear train.

12. The tracked ATV of claim **8**, wherein when the right and left tracks are moving, without input from the power source, the input shaft is driven and the coupling of the first hydraulic pump to the input shaft provides steering capabilities.

13. The tracked ATV of claim **5**, wherein the steering and drive assembly is positioned adjacent a front end of the vehicle and the power source is positioned adjacent a rear end of the vehicle.

14. The tracked ATV of claim **13**, further comprising a driveshaft extending from the power source to a front end of the vehicle.

15. The tracked ATV of claim **14**, wherein the frame includes an enclosed pan.

16. The tracked ATV of claim **15**, wherein the enclosed pan is sealed to provide an amphibious vehicle.

17. The tracked ATV of claim **1**, wherein the low radius turn includes a zero radius turn.

18. The tracked ATV of claim **1**, further comprising a speed sensor providing input to the second hydraulic pump, allowing the operation of the second hydraulic pump only under a selected speed range.

19. The tracked ATV of claim **1**, further comprising a gear box intermediate the power source and the steering and drive assembly, the gear box providing a forward and reverse direction for the tracked ATV.

20. The tracked ATV of claim **19**, further comprising a hydraulic motor coupled to the first hydraulic pump for providing driving input to the steering gear assembly.

21. The tracked ATV of claim **20**, wherein the hydraulic motor is bi-directional.

22. The tracked ATV of claim **21**, further comprising a hydraulic switch intermediate the first hydraulic pump and hydraulic motor, reversing the direction of flow to the hydraulic motor.

23. A tracked all-terrain vehicle (ATV), comprising:

a frame;

a track coupled to the frame;

a power source supported by the frame and drivingly coupled to the track; and

a steering and drive assembly, comprising:

a drive gear assembly coupled to the track for driving the track; and

a steering gear assembly including a first hydraulic pump and a motor, the first hydraulic pump being driven by the drive gear assembly when the vehicle is moving.

24. The tracked ATV of claim **23**, wherein the drive gear assembly is comprised of a differential drive assembly.

25. The tracked ATV of claim **24**, wherein the differential drive assembly comprises two planetary gear assemblies; a left planetary gear assembly coupled to a left track and a right planetary gear assembly coupled to a right track.

26. The tracked ATV of claim **25**, further comprising an input shaft having a first end coupled to the differential drive assembly and a second end coupled to the power source.

27. The tracked ATV of claim **26**, wherein the first hydraulic pump is drivingly coupled to the input shaft.

28. The tracked ATV of claim **27**, wherein when the power source is operating, the first hydraulic pump is driven by the input shaft coupled to the power source.

29. The tracked ATV of claim **27**, wherein when the power source is not operating, and the tracked ATV is moving, the first hydraulic pump is driven by the input shaft coupled to the differential drive assembly.

30. The tracked ATV of claim **27**, further comprising a steering gear train coupled to the left and right planetary gear assemblies to operate the left and right tracks at differential speeds for steering.

31. The tracked ATV of claim **28**, further comprising a hydraulic motor coupled to the first hydraulic pump for providing driving input to the steering gear train.

32. The tracked ATV of claim **28**, wherein when the right and left tracks are moving, without input from the power source, the input shaft is driven, and the coupling of the first hydraulic pump to the input shaft provides steering capabilities.

33. The tracked ATV of claim **23**, further comprising a hydraulic motor coupled to the first hydraulic pump for providing driving input to the steering gear assembly.

34. The tracked ATV of claim **33**, further comprising a second hydraulic pump drivingly coupled to the power source and coupled to the hydraulic motor.

35. The tracked ATV of claim **34**, wherein the second hydraulic pump comprises a dual hydraulic pump in a dual stage configuration, and drivingly coupled to the tracks for small radius turns.

36. The tracked ATV of claim **35**, wherein the small radius turn includes a zero radius turn.

37. The tracked ATV of claim **36**, further comprising a speed sensor providing input to the second hydraulic pump, allowing the operation of the second hydraulic pump only under a selected low speed range.

38. The tracked ATV of claim **34**, further comprising

an operator seat supported by the frame;

a seat sensor coupled to the operator seat for detecting a load on the operator seat;

a control unit operative to detect at least one of an occupied state and an unoccupied state of the operator seat based on output from the seat sensor, the control unit being operative to disable operation of the second hydraulic pump in response to detecting the unoccupied state of the operator seat.

39. The tracked ATV of claim **34**, further comprising

a speed sensor; and

a control unit operative to detect a speed of the vehicle based on output from the speed sensor, the control unit being operative to disable operation of the second hydraulic pump in response to the speed of the vehicle exceeding a threshold speed.

40. The tracked ATV of claim **23**, wherein the steering gear assembly is positioned adjacent a front end of the vehicle and the power source is positioned adjacent a rear end of the vehicle.

41. The tracked ATV of claim **23**, wherein the power source is an internal combustion engine.

42. The tracked ATV of claim **41**, further comprising a driveshaft extending from the power source to a front end of the vehicle.

43. The tracked ATV of claim **42**, wherein the frame includes an enclosed pan.

44. The tracked ATV of claim **43**, wherein the enclosed pan is sealed to provide an amphibious vehicle.

45. The tracked ATV of claim **23**, further comprising a gear box intermediate the power source and the steering and drive assembly, the gear box providing a forward and reverse direction for the tracked ATV.

46. The tracked ATV of claim **45**, further comprising a hydraulic motor coupled to the first hydraulic pump for providing driving input to the steering gear assembly.

47. The tracked ATV of claim **46**, wherein the hydraulic motor is bi-directional.

48. The tracked ATV of claim **47**, further comprising a hydraulic switch intermediate the first hydraulic pump and hydraulic motor, reversing the direction of flow to the hydraulic motor.

49. A tracked ATV, comprising:

a frame;

a track coupled to the frame;

a power source supported by the frame and drivingly coupled to the track; and

a suspension system coupled to the frame and supporting the track, the suspension system comprising a plurality of control arms coupled at an upper end to the frame, and at a lower end to a carrier roller, at least some of the carrier rollers moving independently of the other carrier rollers.

50. The tracked ATV of claim **49**, wherein the track is the furthest point forward of the tracked ATV.

51. The tracked ATV of claim **49**, wherein at least one of the carrier rollers is comprised of an inner web of resilient material, allowing the at least one carrier roller to deflect radially inwardly.

52. The tracked ATV of claim **49**, wherein the control arms and carrier rollers are mounted to a sub frame, which is coupled to the frame.

53. A tracked all-terrain vehicle (ATV), comprising:

a frame;

a track coupled to the frame;

a power source supported by the frame and drivingly coupled to the track;

a plurality of load sensors supported by the frame, each load sensor being operative to detect a load on the frame;

a display device operative to display an indication of payload distribution of the vehicle; and

a control unit in communication with the plurality of load sensors and the display device, the control unit being operative to calculate a payload distribution of the vehicle based on output from the plurality of load sensors and to determine a recommended payload adjustment based on the calculated payload distribution, the control unit being operative to transmit a signal to the display device representative of the recommend payload adjustment.

54. The tracked ATV of claim **53**, wherein the control unit is operative to compare the calculated payload distribution to a threshold payload distribution stored in memory accessible by the control unit to determine the recommended payload adjustment.

55. The tracked ATV of claim **53**, wherein the control unit is operative to determine payload distributions between a plurality of regions of a cargo portion of the vehicle corresponding to mounting locations of the plurality of load sensors.

56. The tracked ATV of claim **53**, further including a front cargo portion and a rear cargo portion each supported by the frame, wherein the plurality of sensors include a plurality of first sensors mounted to front cargo portion and a plurality of second sensors mounted to the rear cargo portion.

57. A method of managing payload distribution of a tracked all-terrain vehicle (ATV), the method comprising:

providing a tracked ATV including a frame, a track coupled to the frame, and a power source supported by the frame and drivingly coupled to the track;

detecting, by a plurality of load sensors, at least one load on the frame;

calculating, by a control unit, a payload distribution of the vehicle based on output from the plurality of load sensors;

determining, by the control unit, a recommended payload adjustment based on the calculated payload distribution; and

transmitting a signal to a display device representative of the recommend payload adjustment.

58. The method of claim **57**, further comprising comparing the calculated payload distribution to a threshold payload distribution stored in memory accessible by the control unit to determine the recommended payload adjustment.

59. The method of claim **57**, further comprising determining payload distributions between a plurality of regions of a cargo portion of the vehicle corresponding to mounting locations of the plurality of load sensors.

* * * * *

EXHIBIT K

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(54) **SIDE-BY-SIDE ALL TERRAIN VEHICLE**

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(60) Provisional application No. 61/442,071, filed on Feb. 11, 2011.

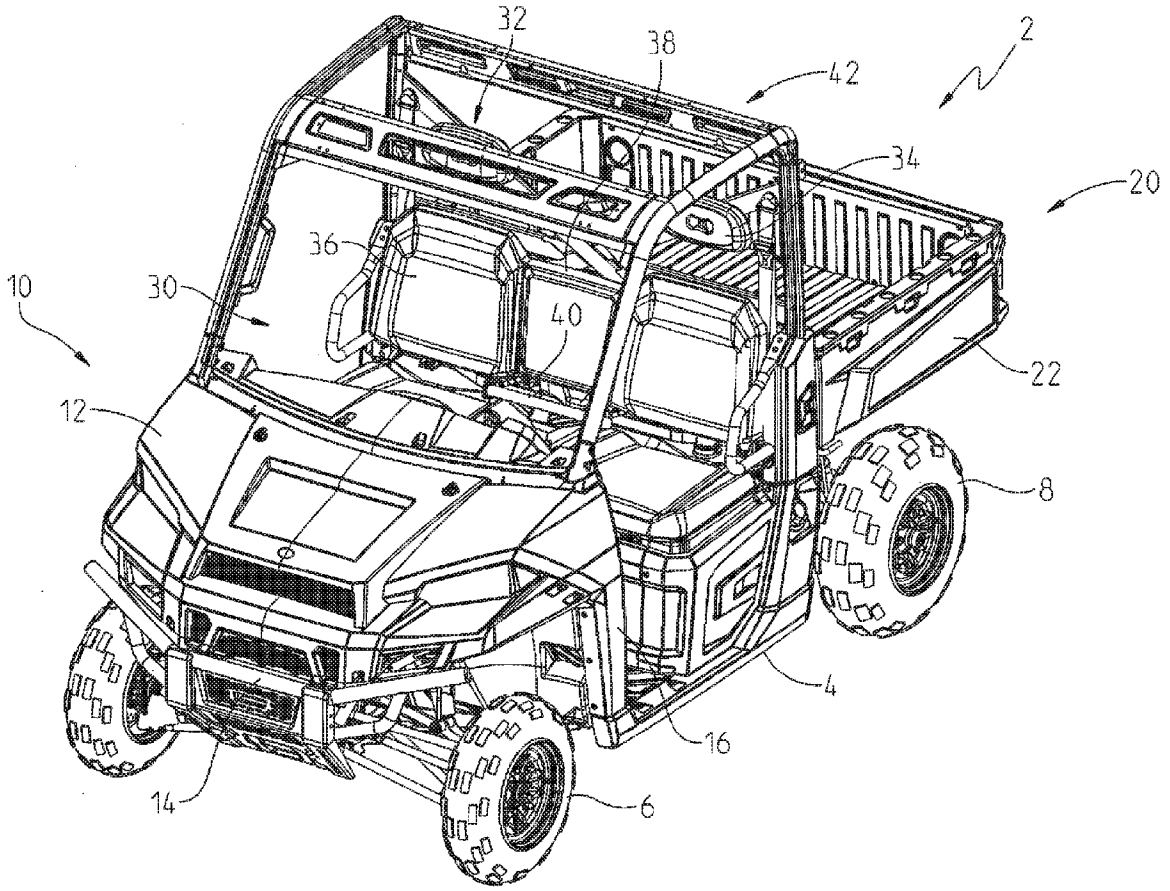
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(52) **U.S. Cl.** **296/190.03**

(57) **ABSTRACT**

A utility vehicle comprises a plurality of ground engaging members; a frame; and an operator area having an operator side and a passenger side. The utility vehicle further comprises a roll cage extending above the operator area; a front windshield coupled to the roll cage; and a rear windshield coupled to the roll cage. The utility vehicle further includes a roof latched to the roll cage, a first door hinged to the roll cage along the operator side, and a second door hinged to the roll cage along the passenger side. The couplings between the rear windshield and the roll cage, between the roof and the roll cage, and between the first and second doors and the roll cage each being free of a fastener. The front and rear windshields, the roof, and the first and second doors enclose the operator area.



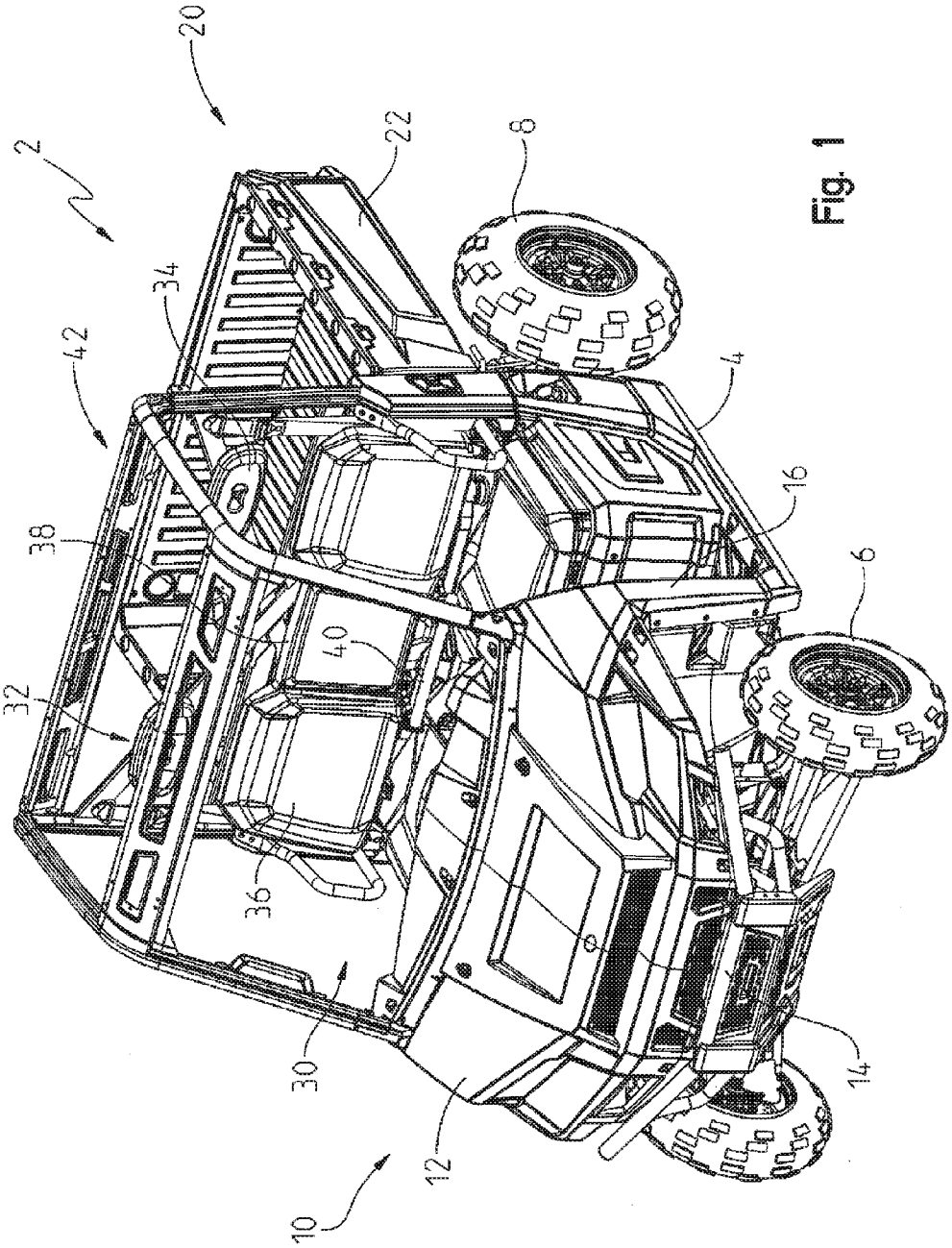


Fig. 1

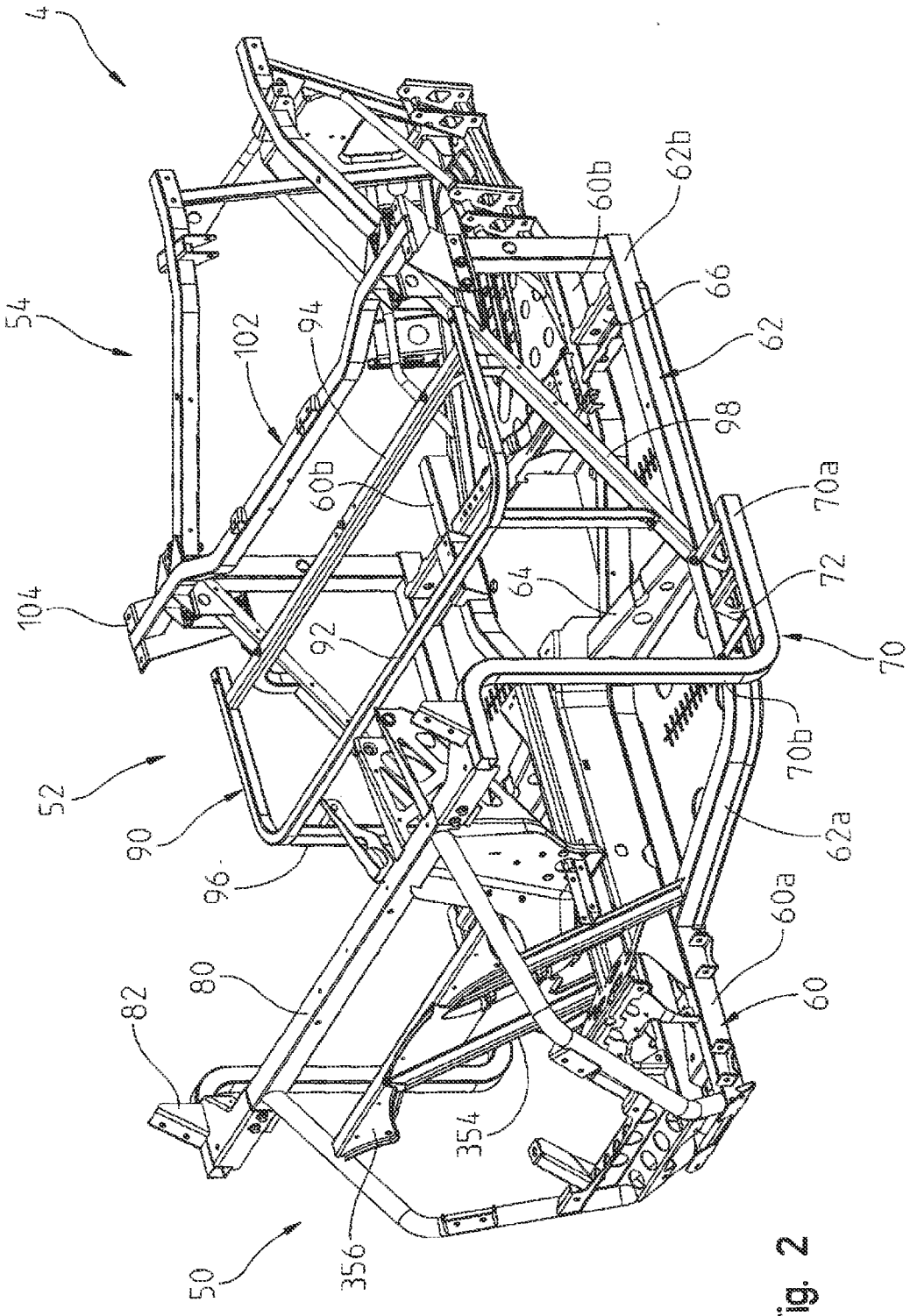

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Fig. 2

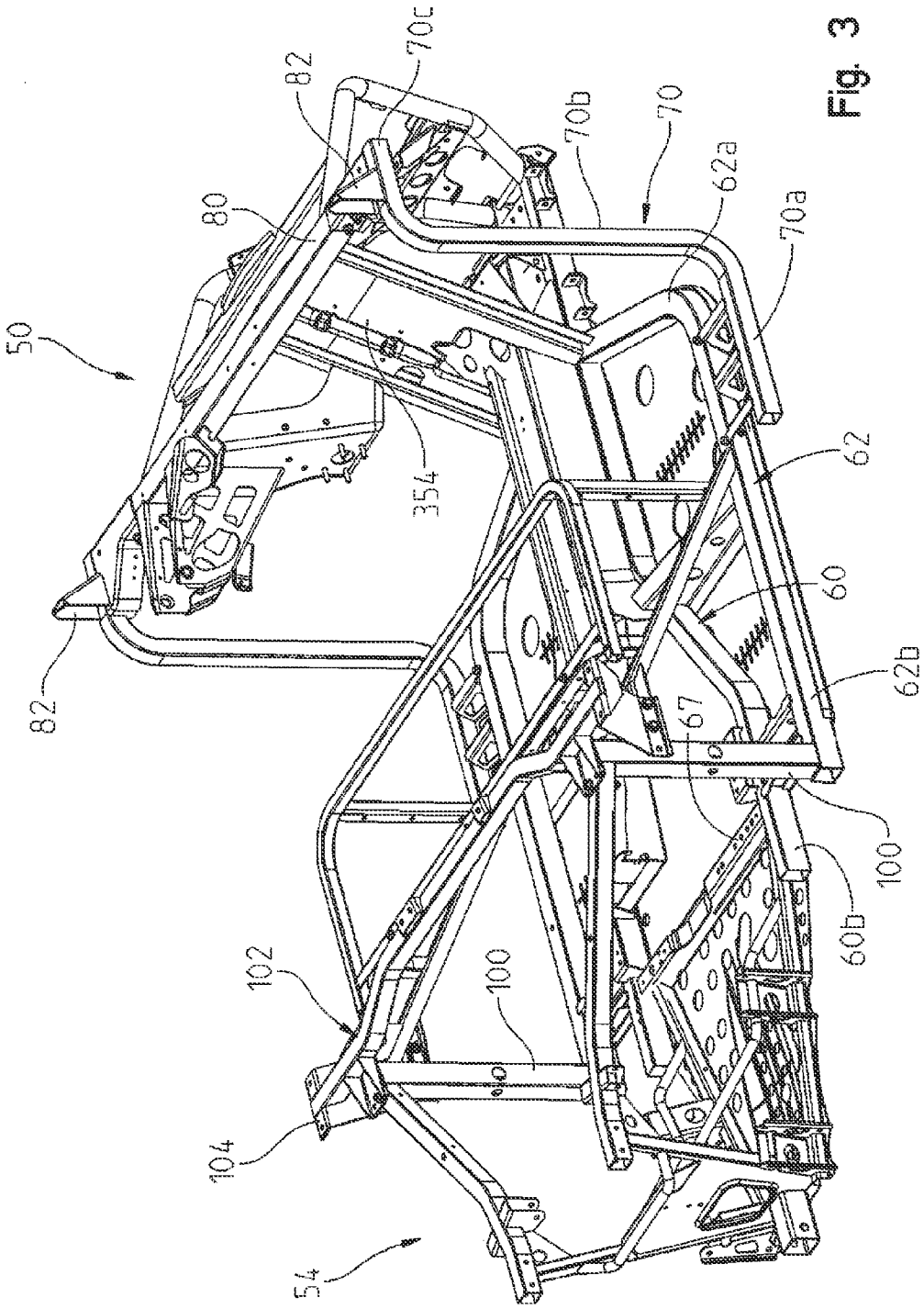

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Fig. 3

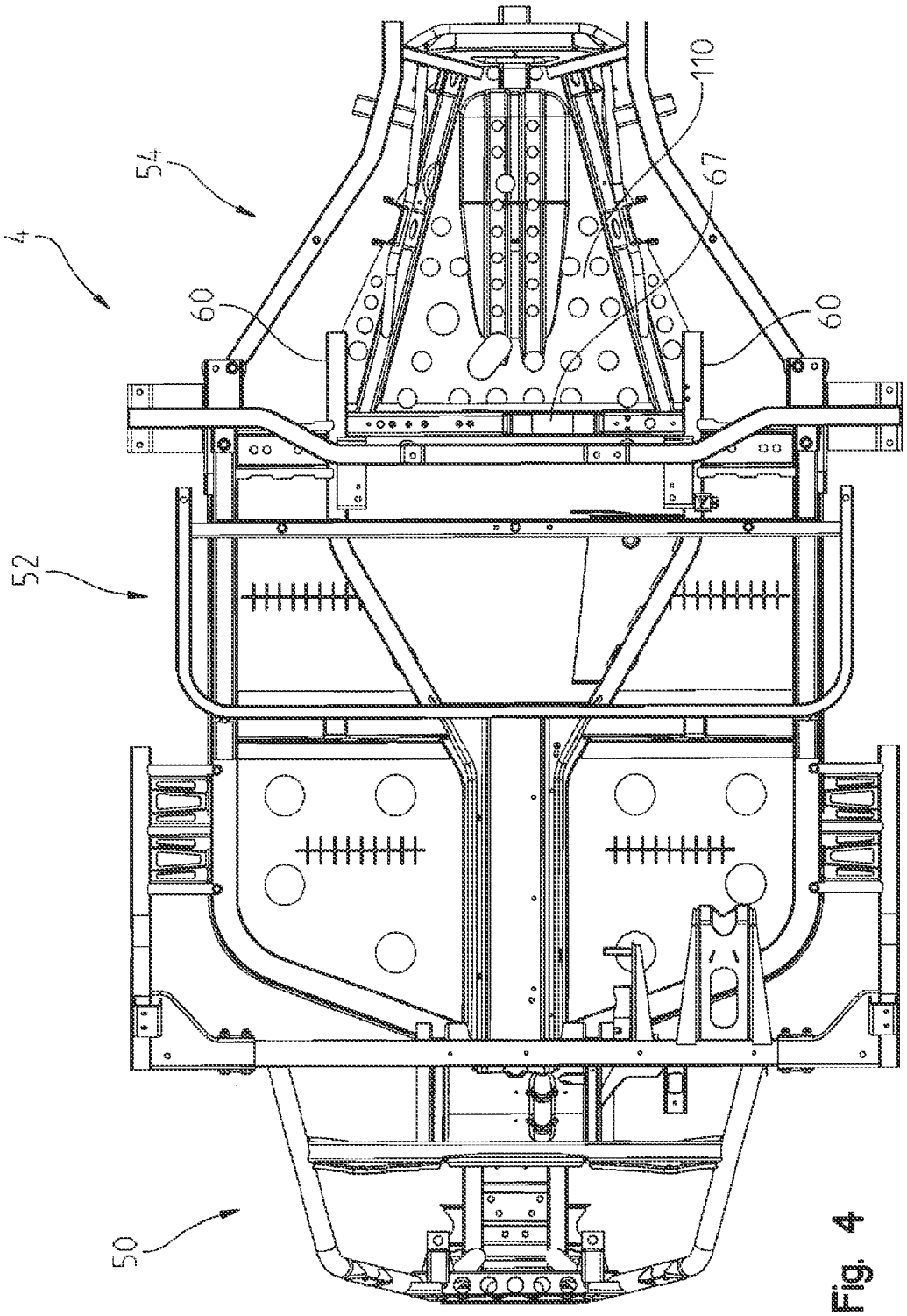


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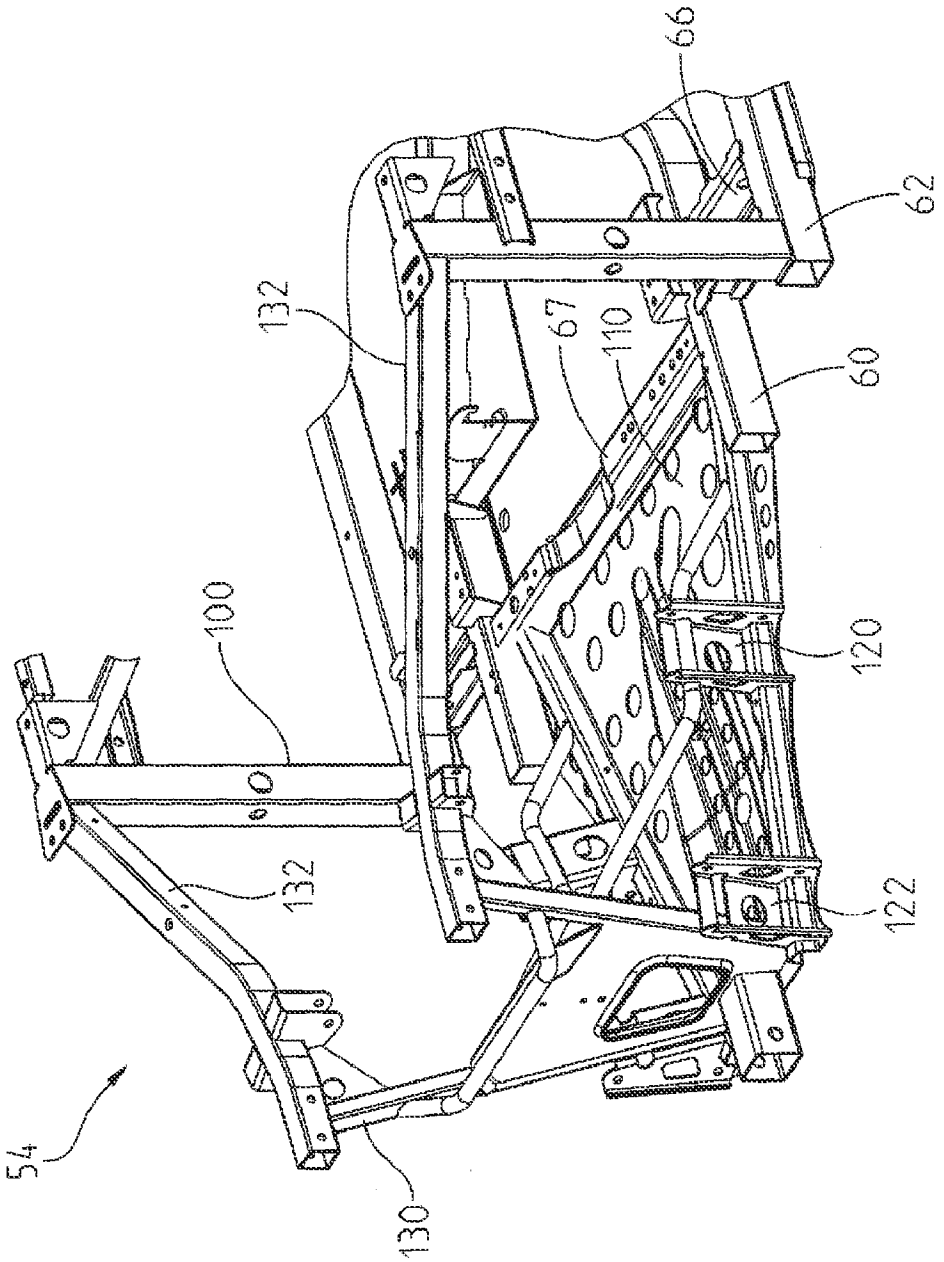


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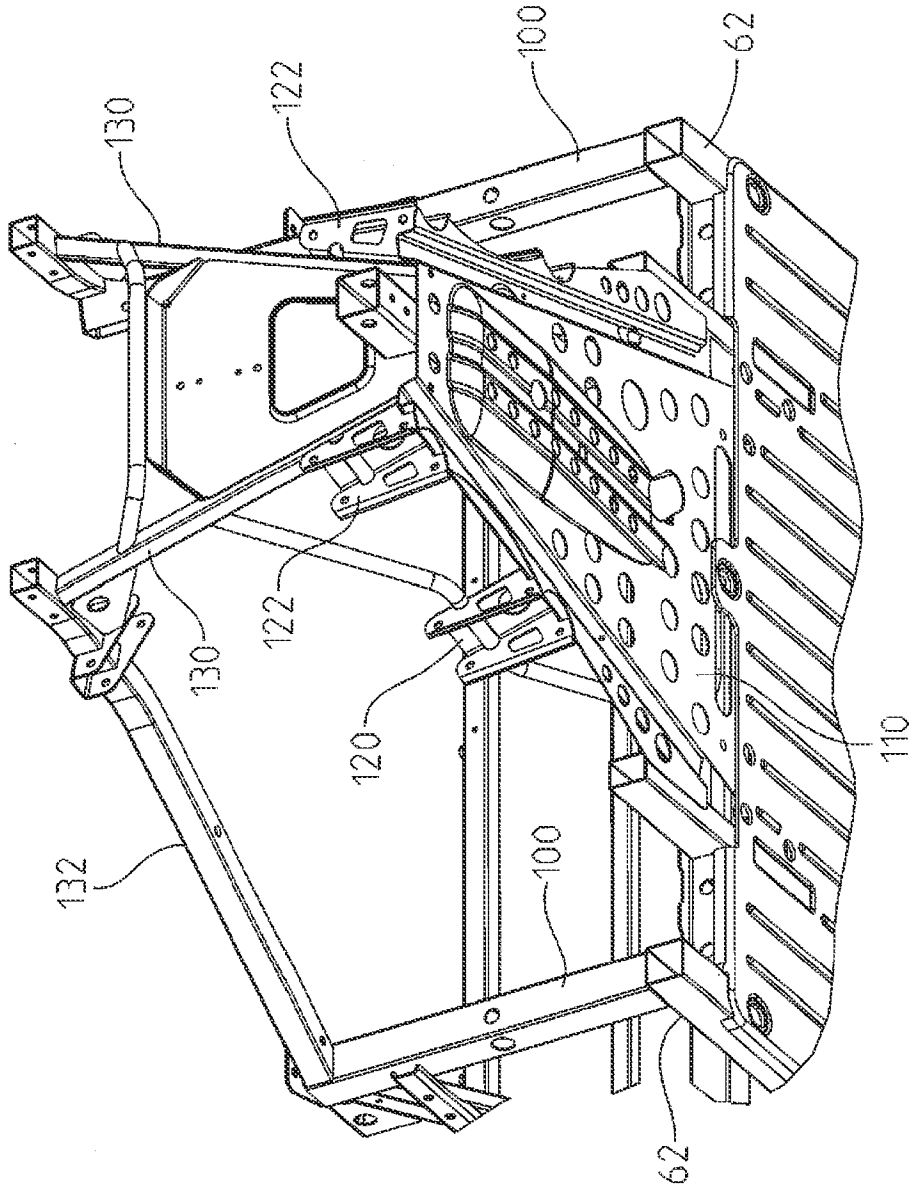


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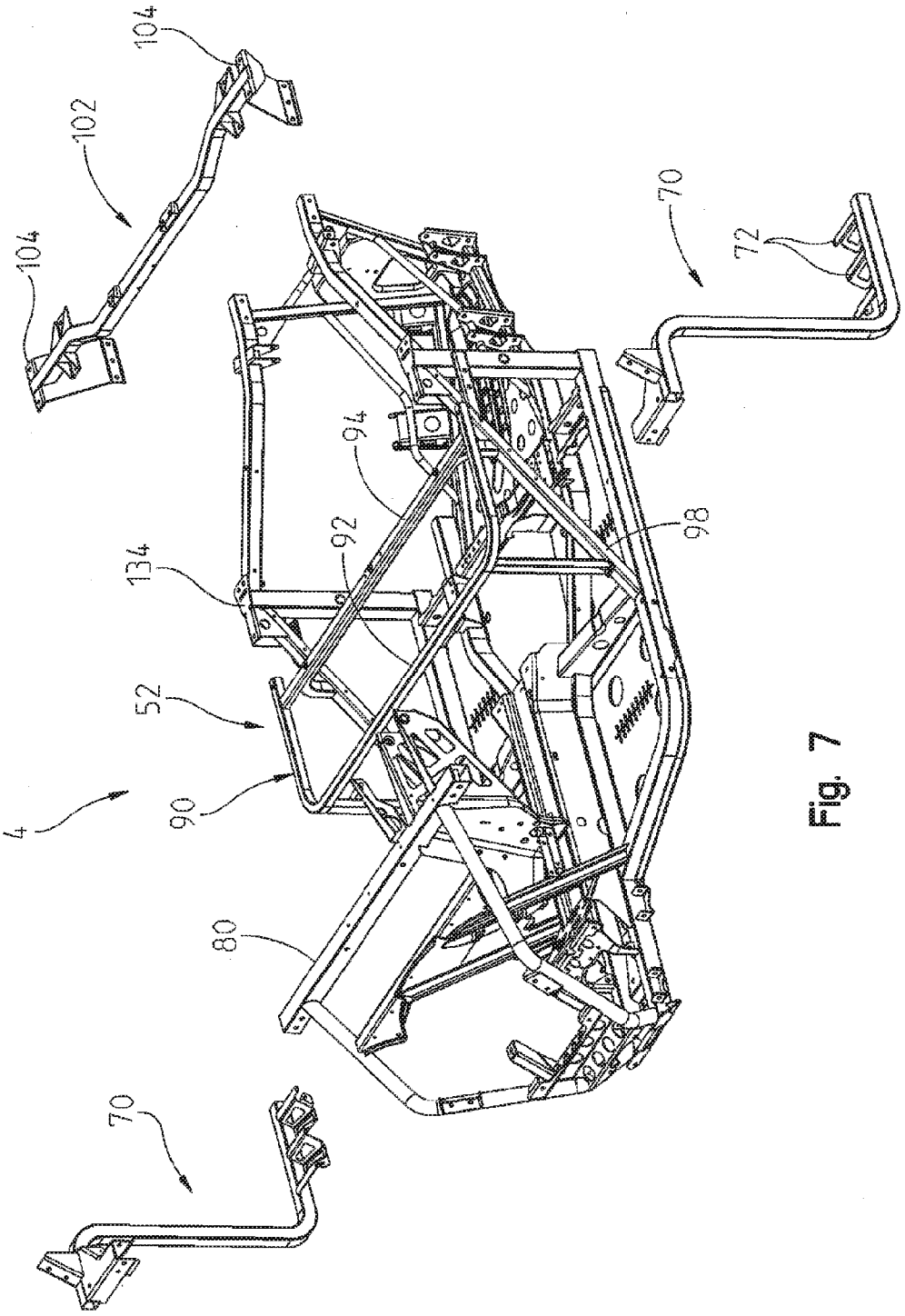


Fig. 7

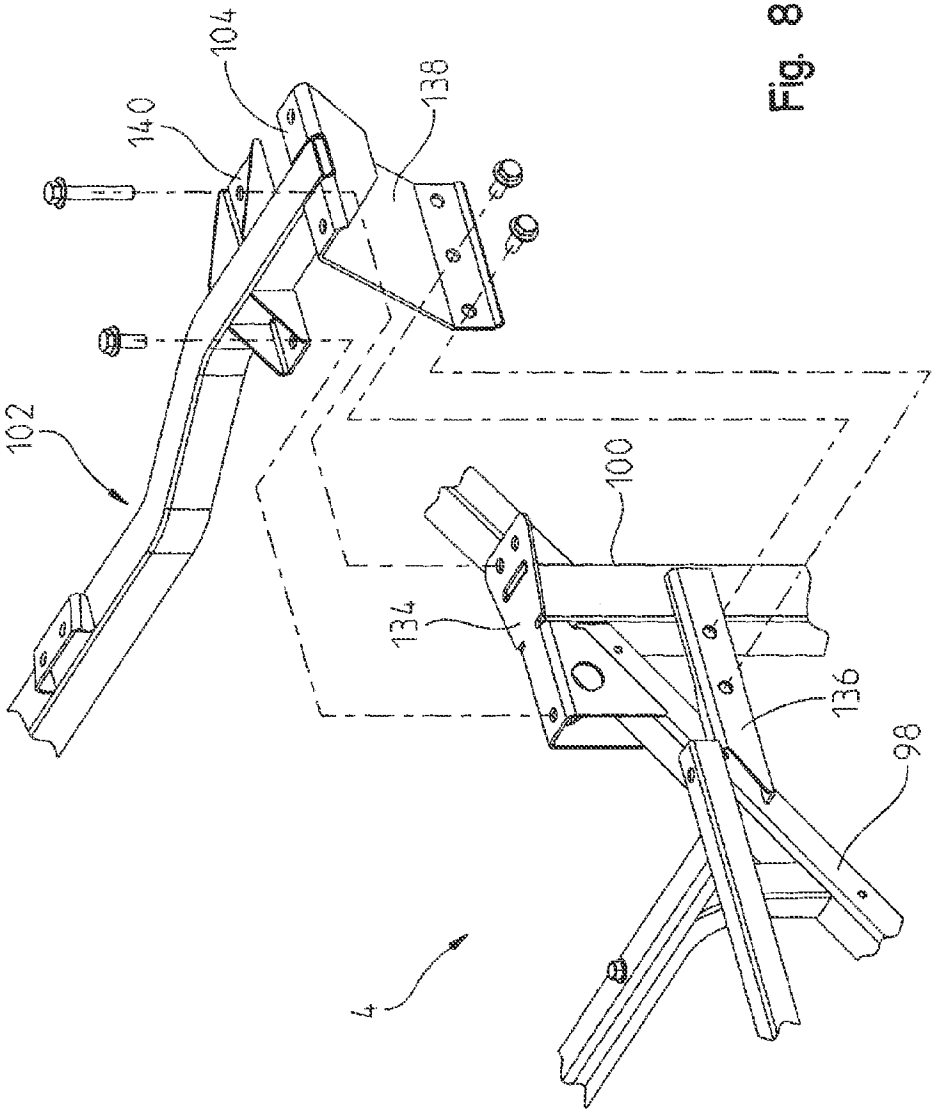


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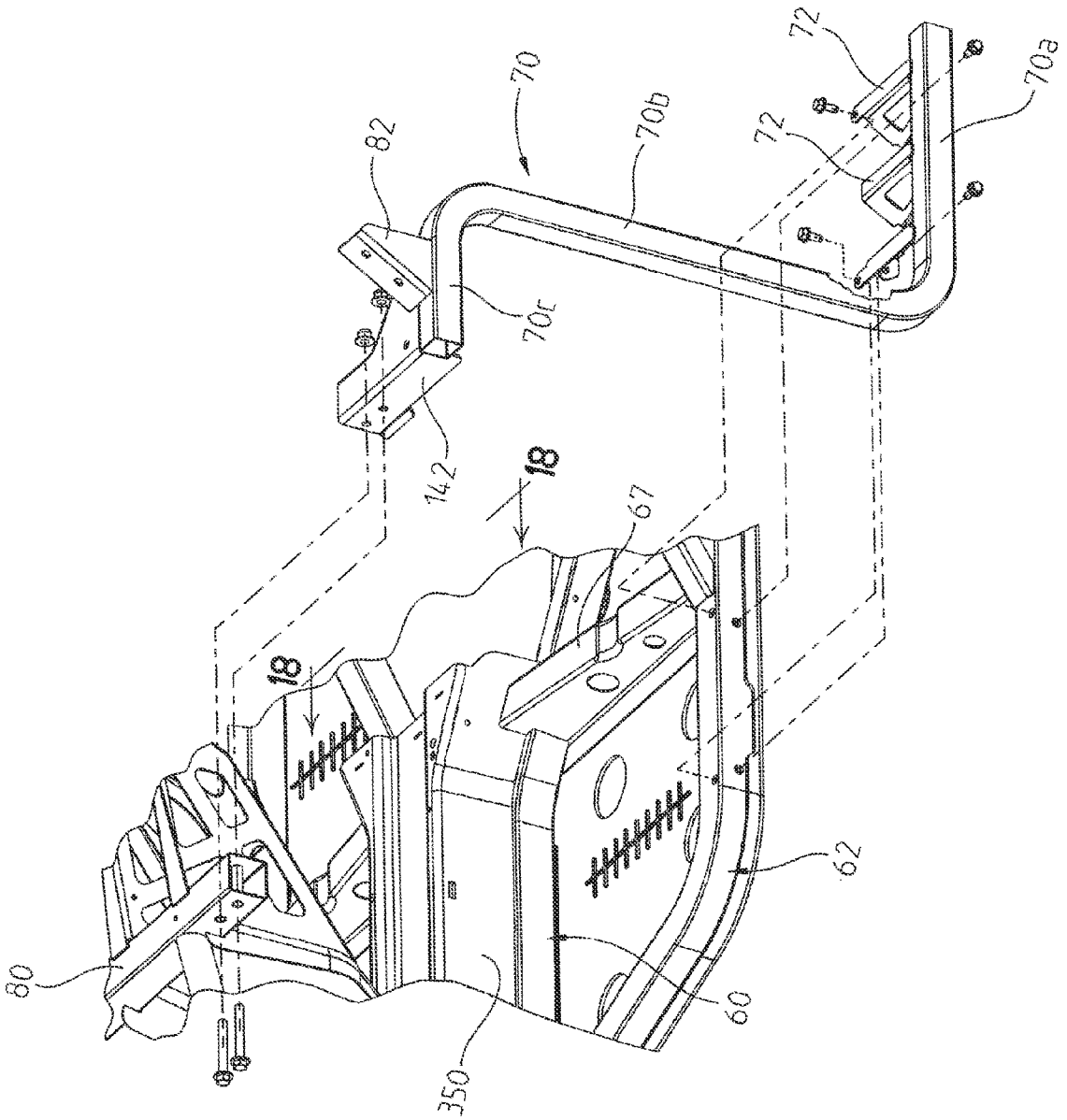


Fig. 9

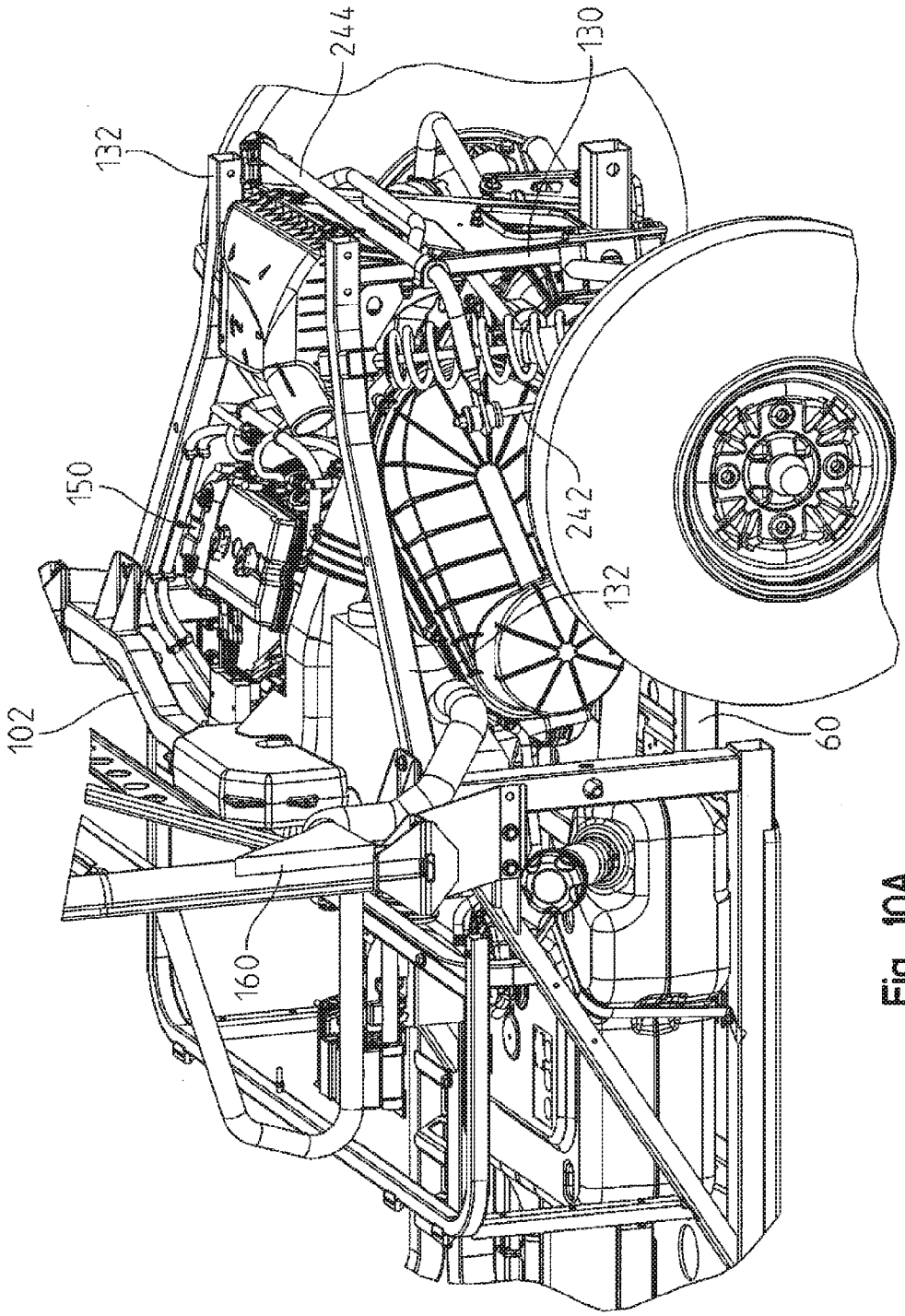


Fig. 10A

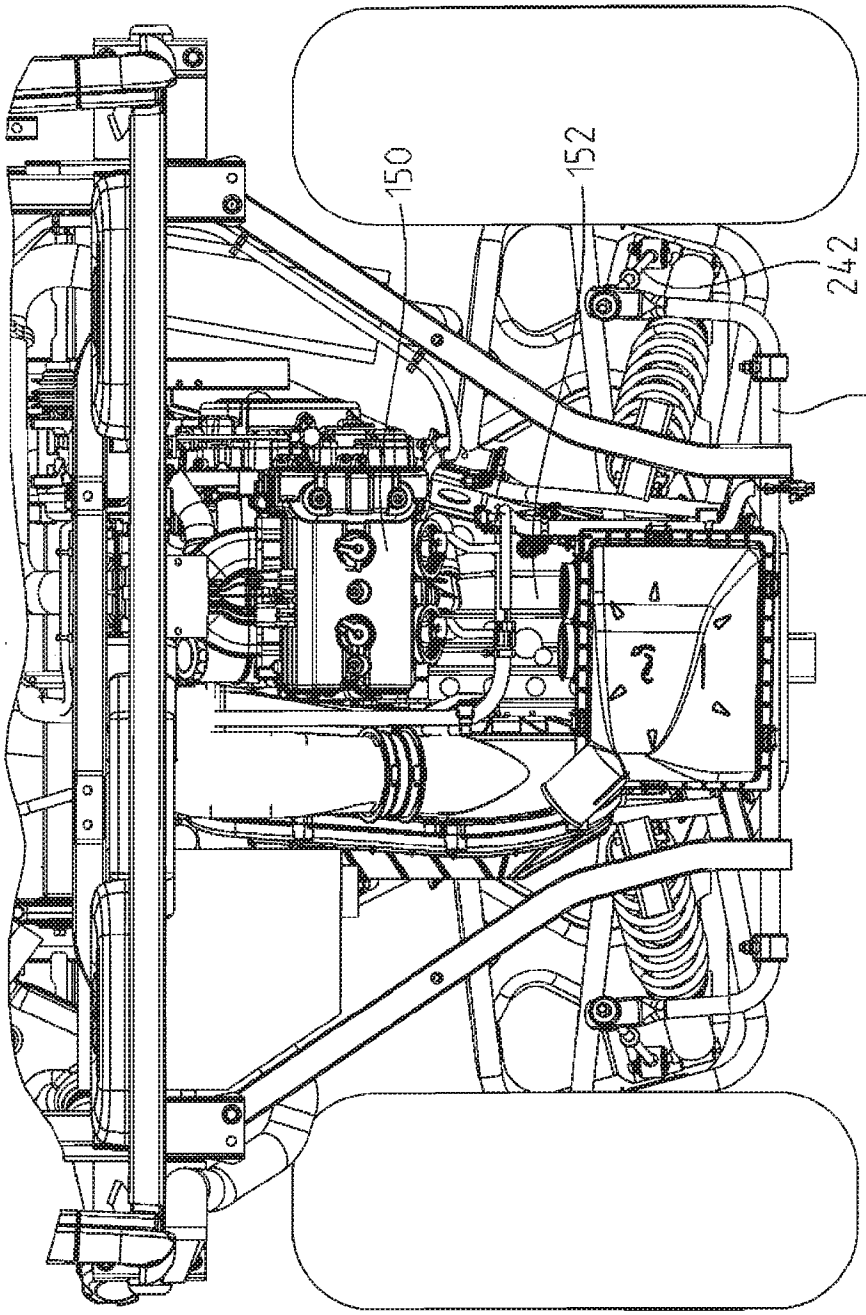


Fig. 10B

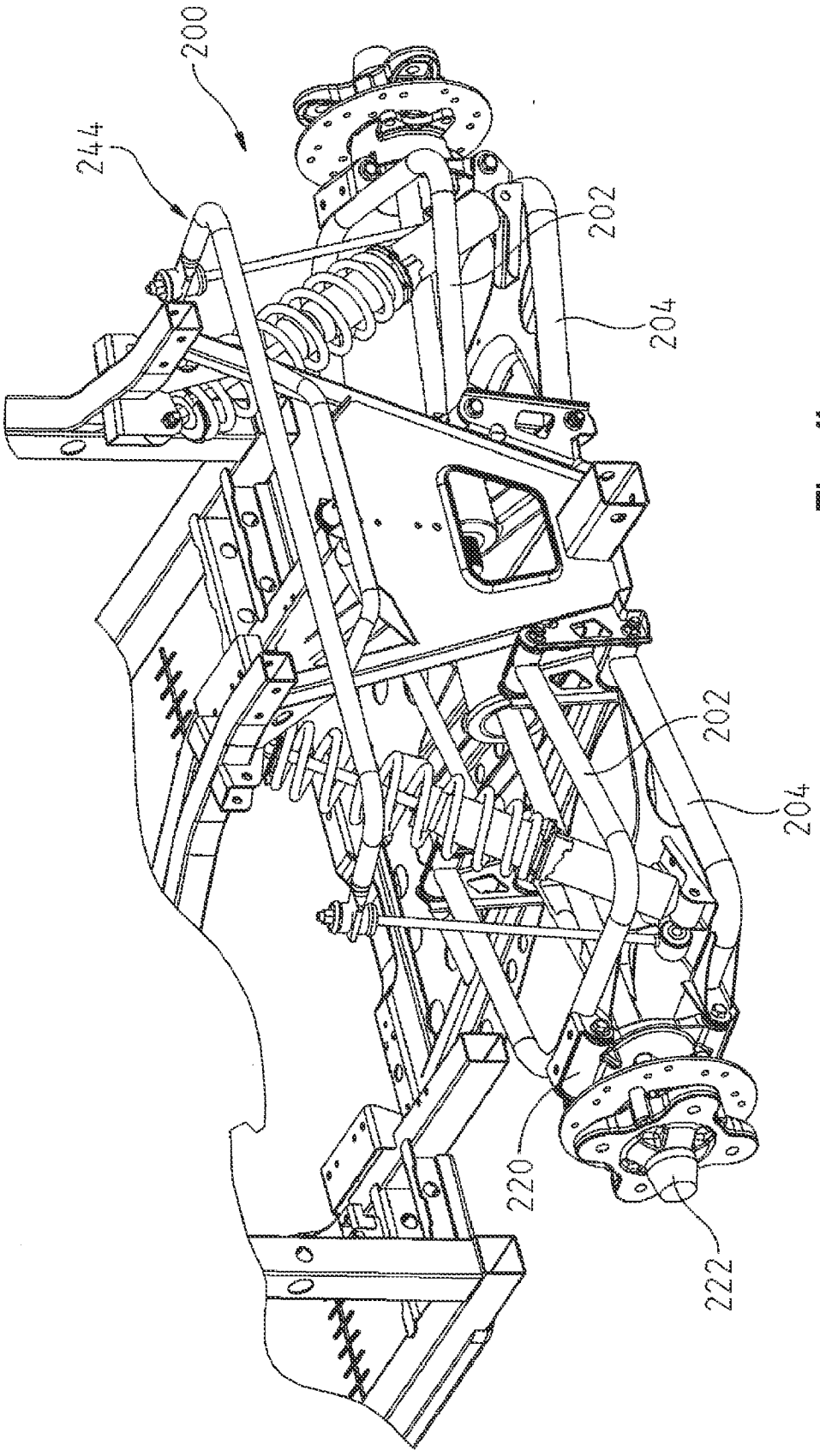


Fig. 11

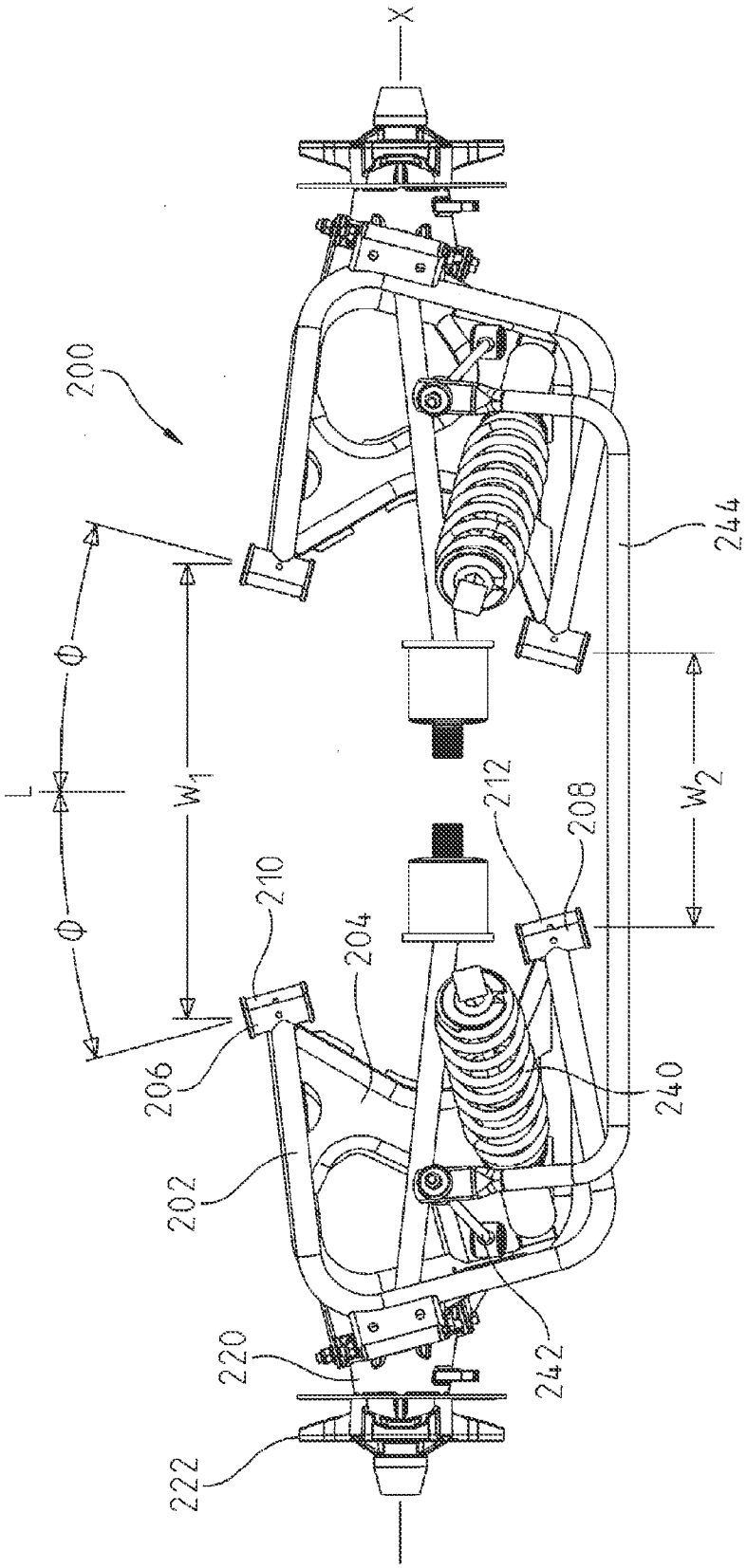


Fig. 12

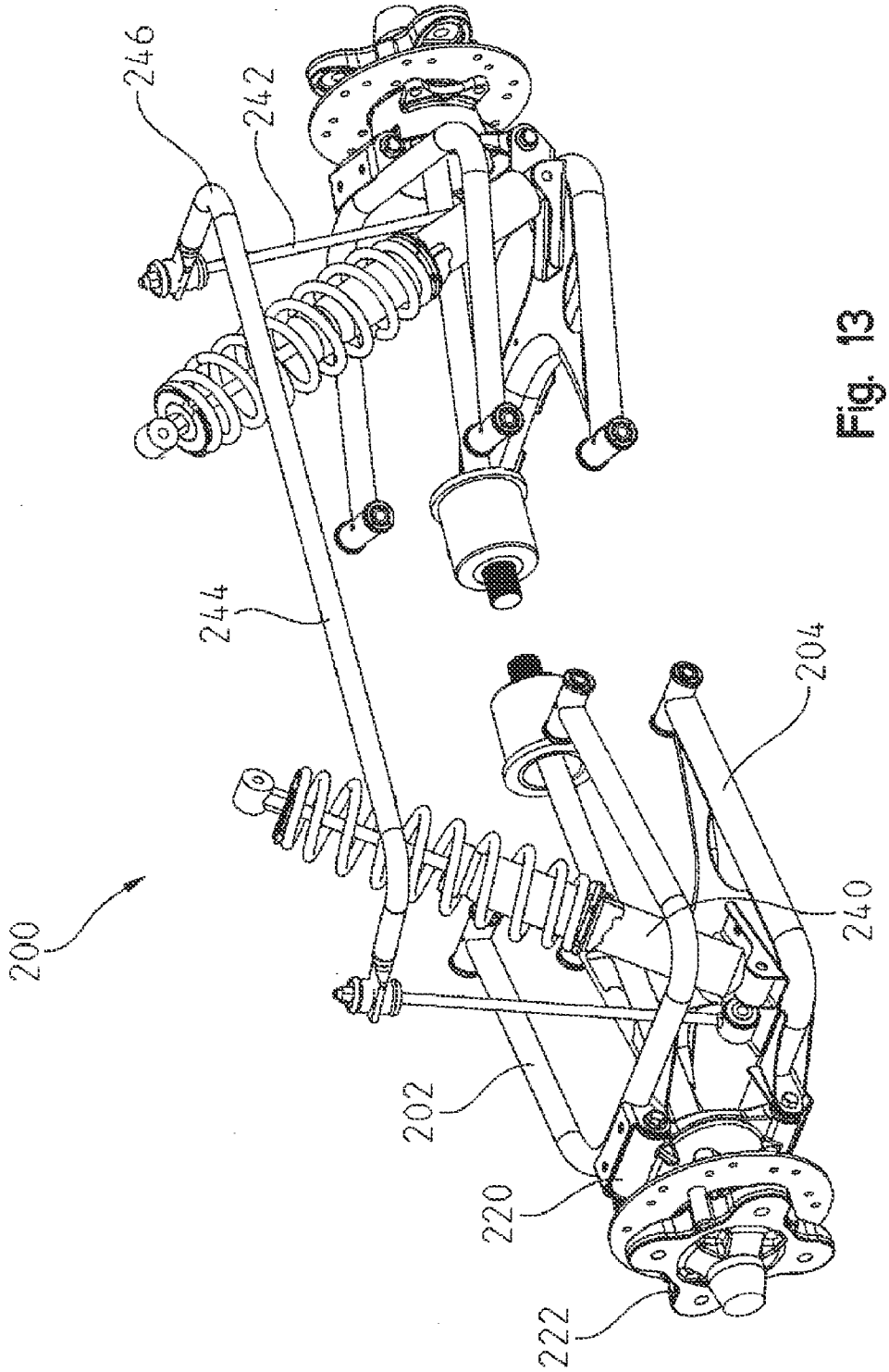


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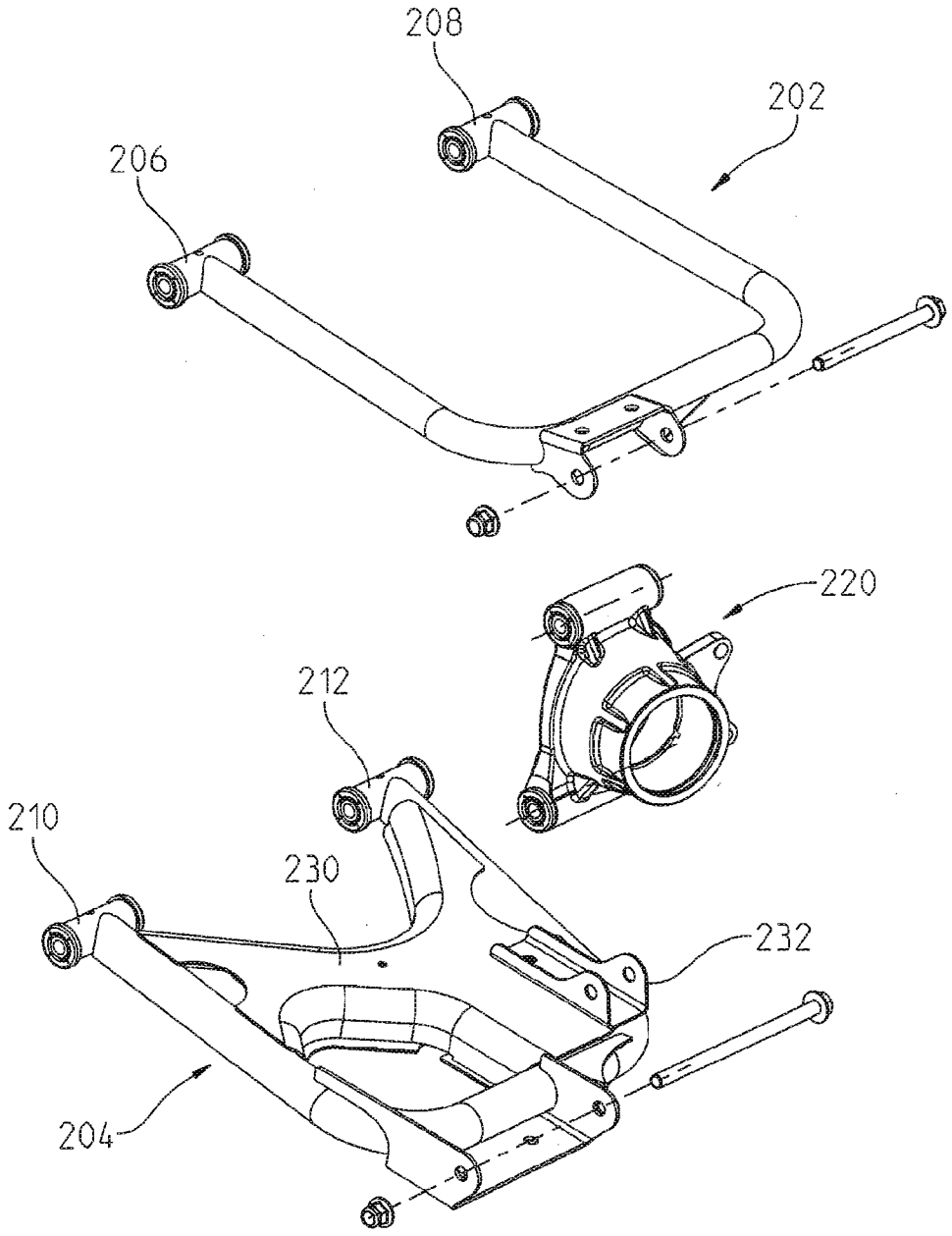


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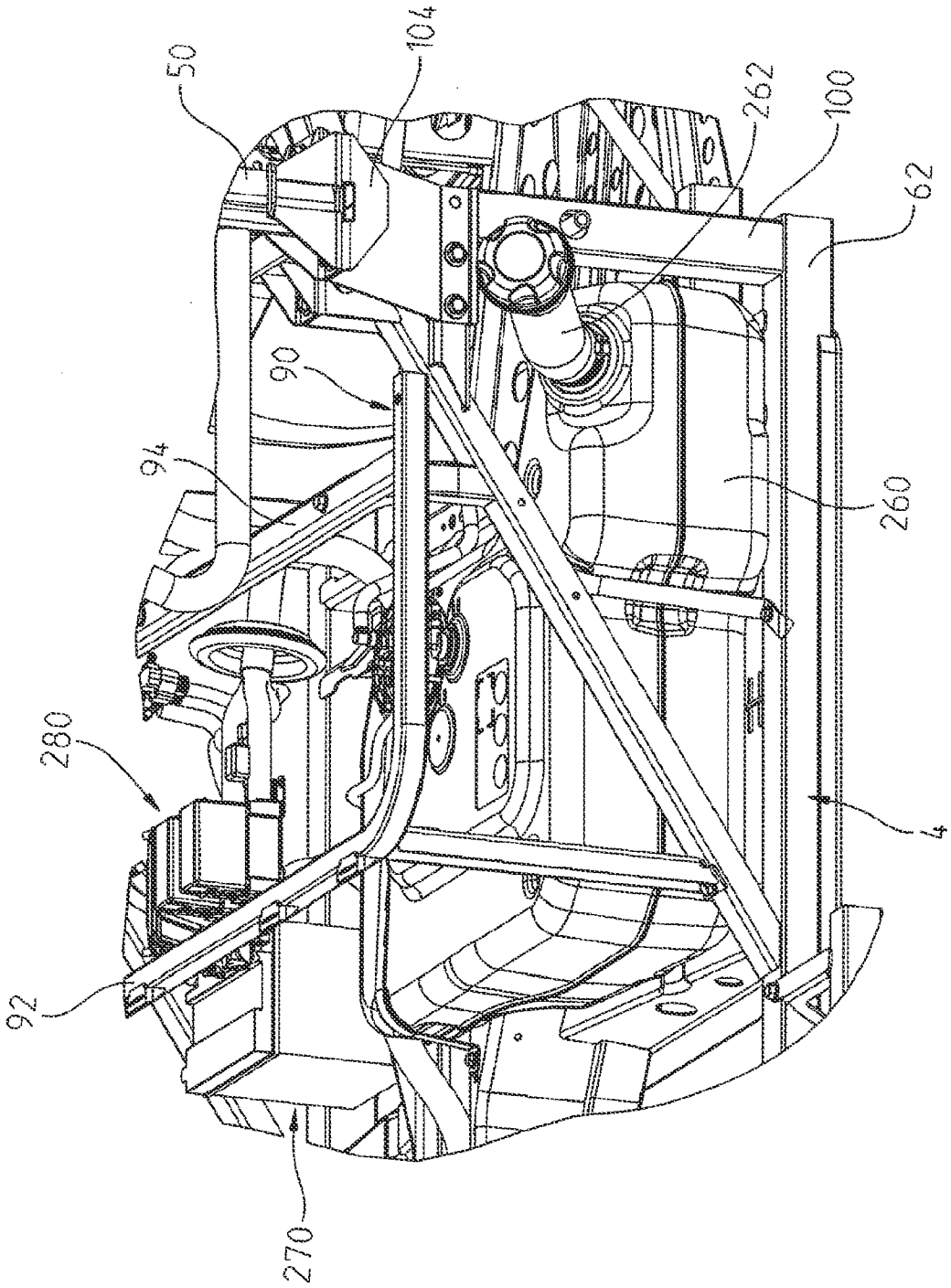


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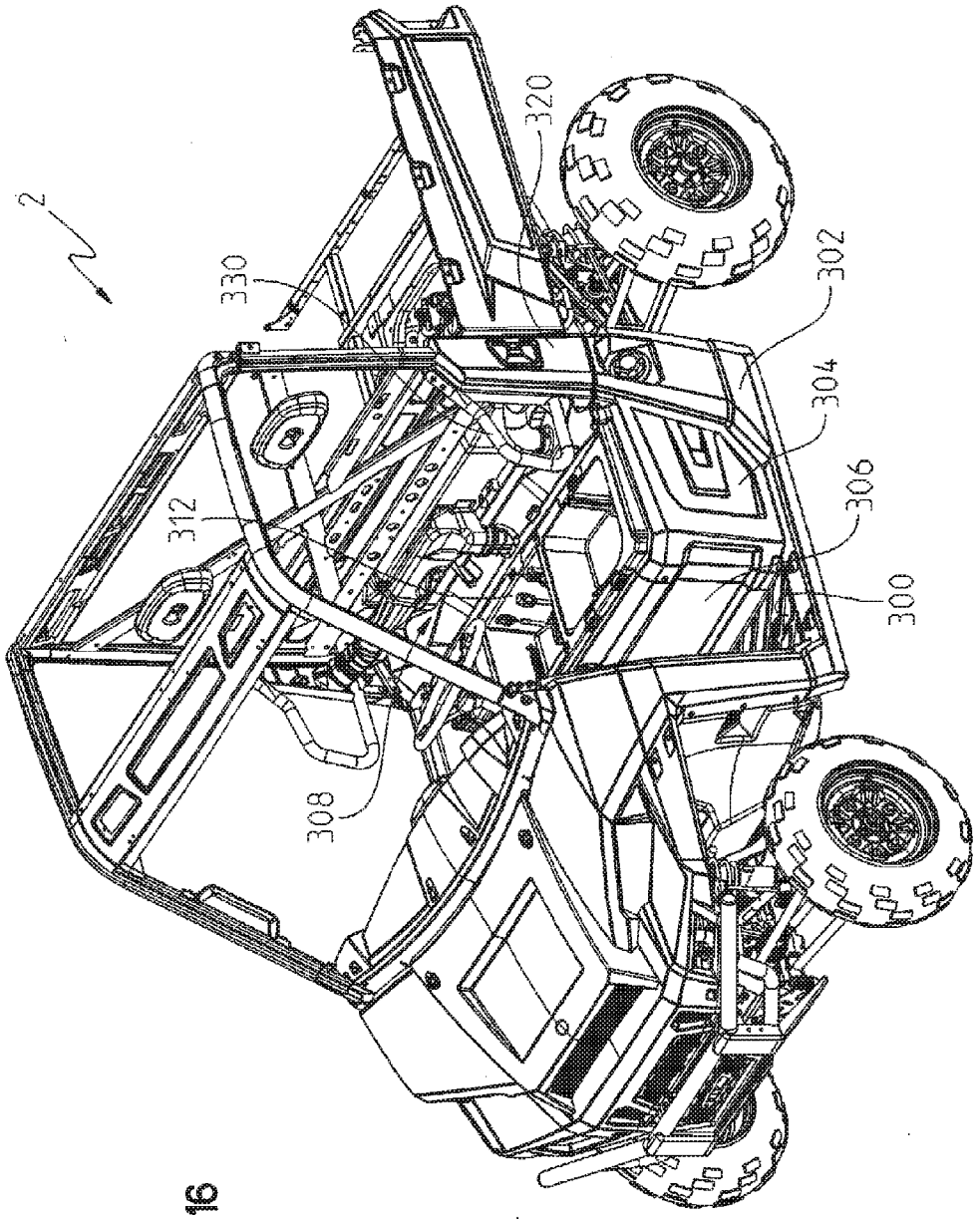


Fig. 16

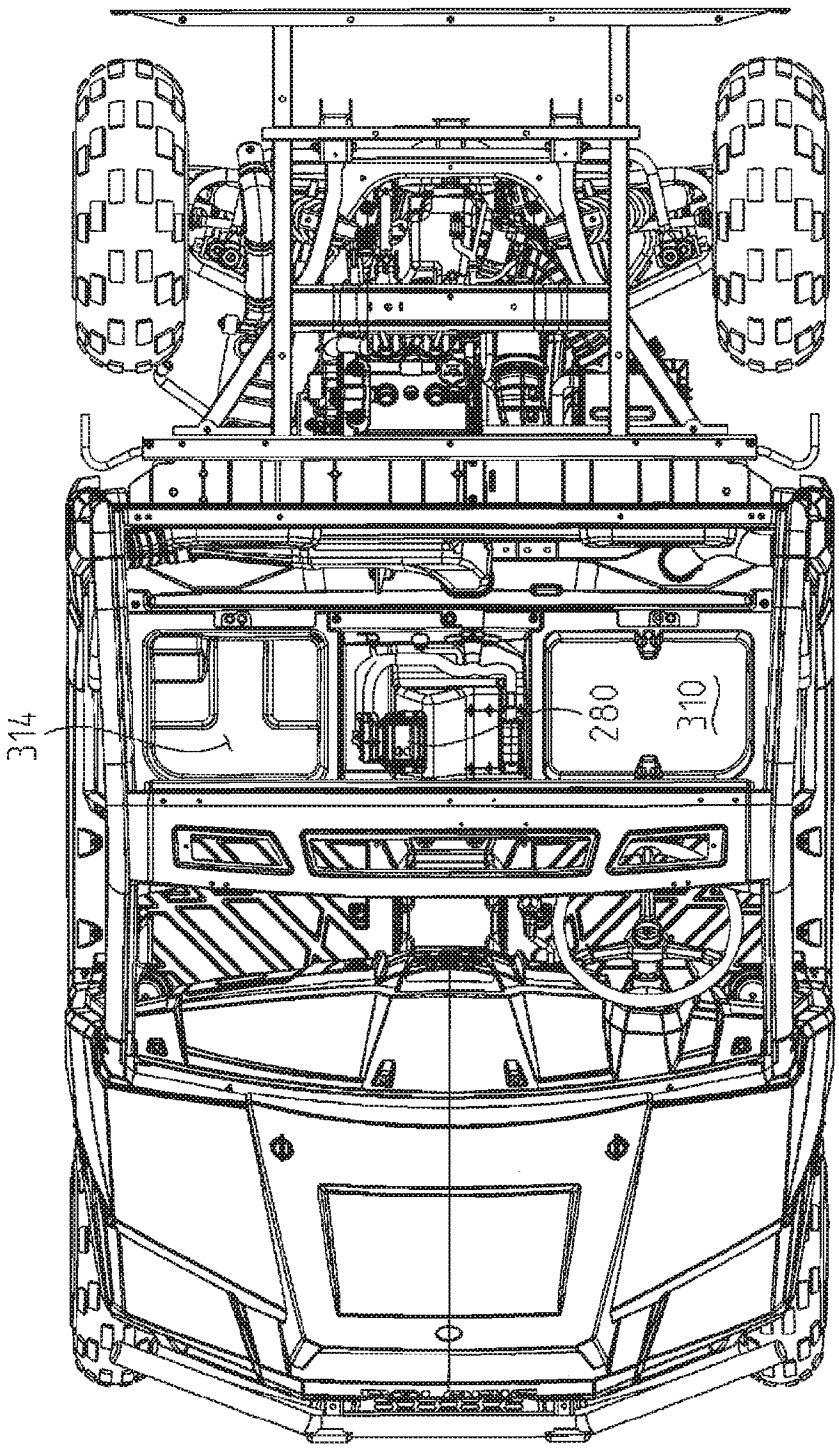


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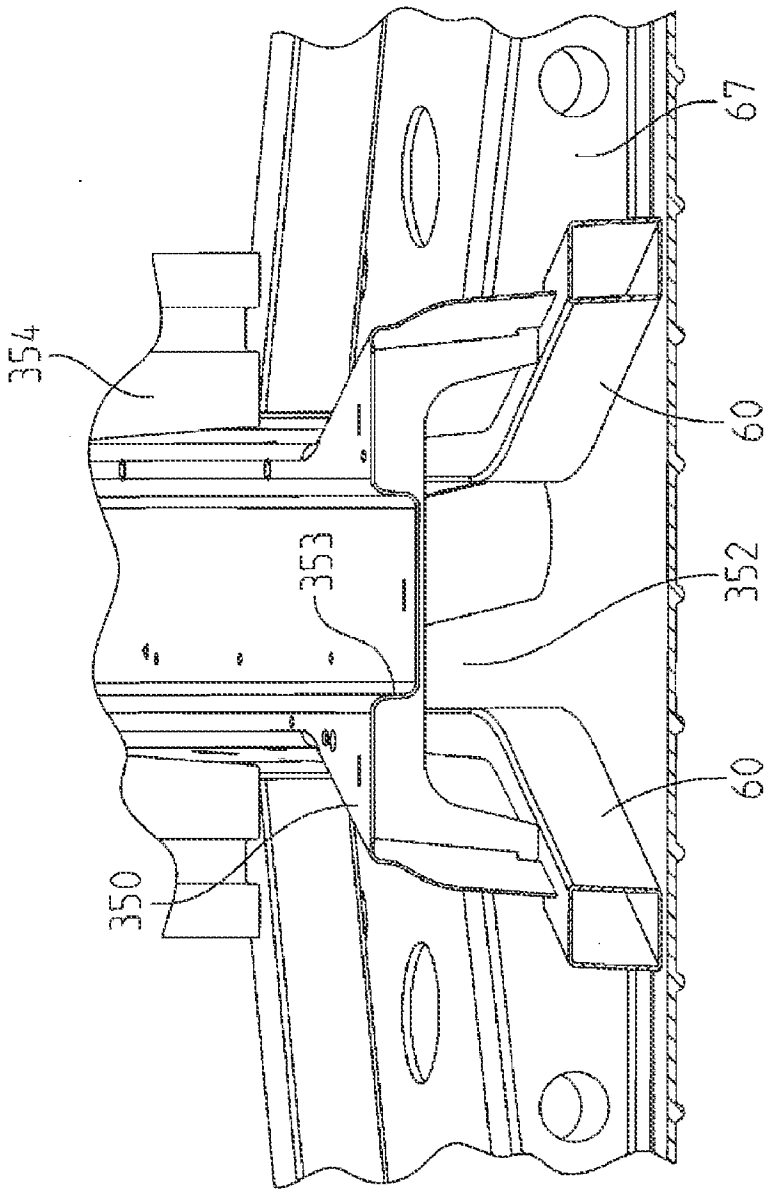


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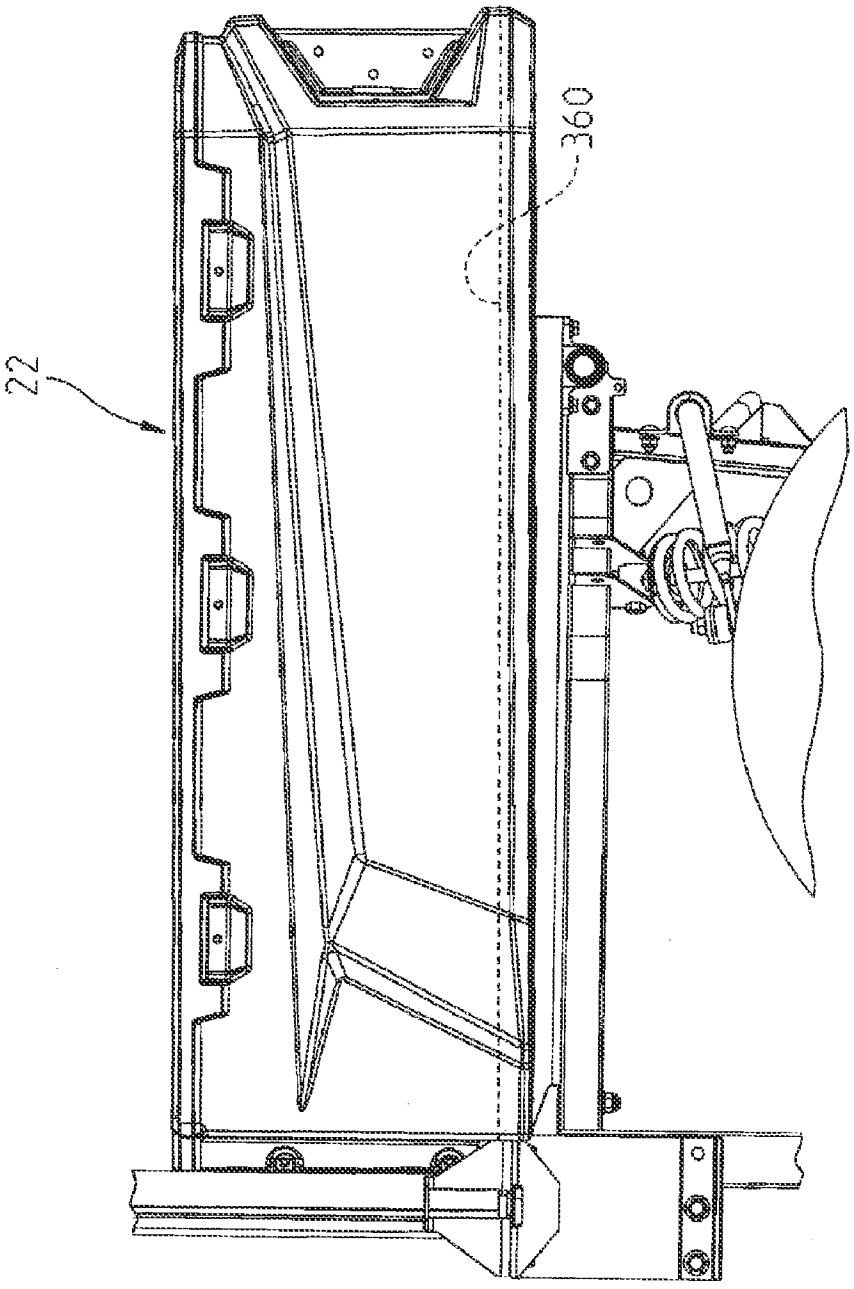


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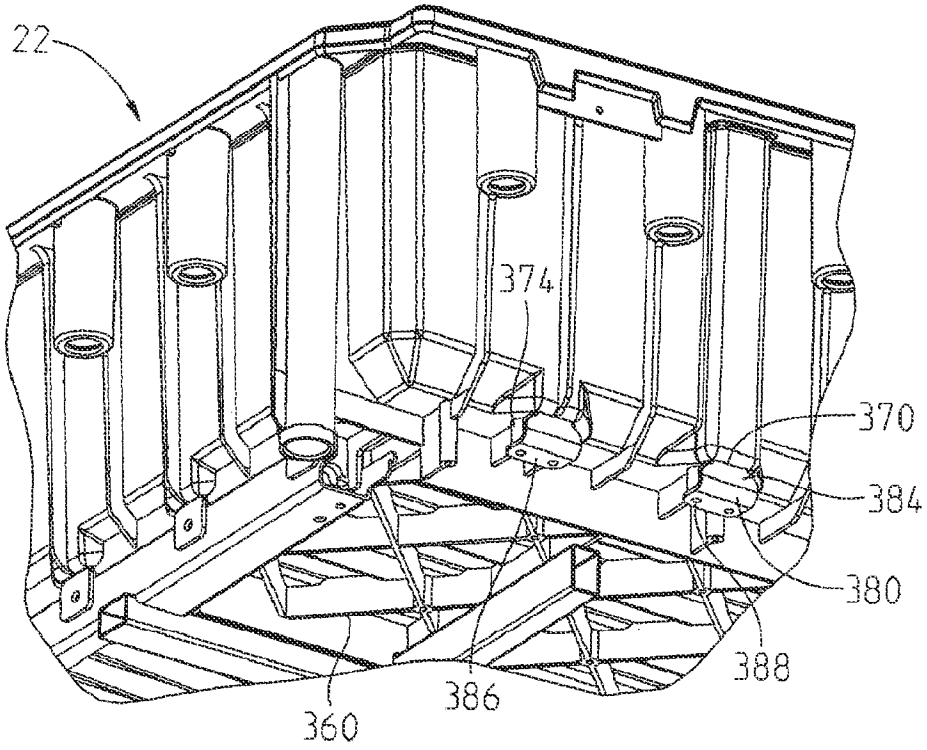


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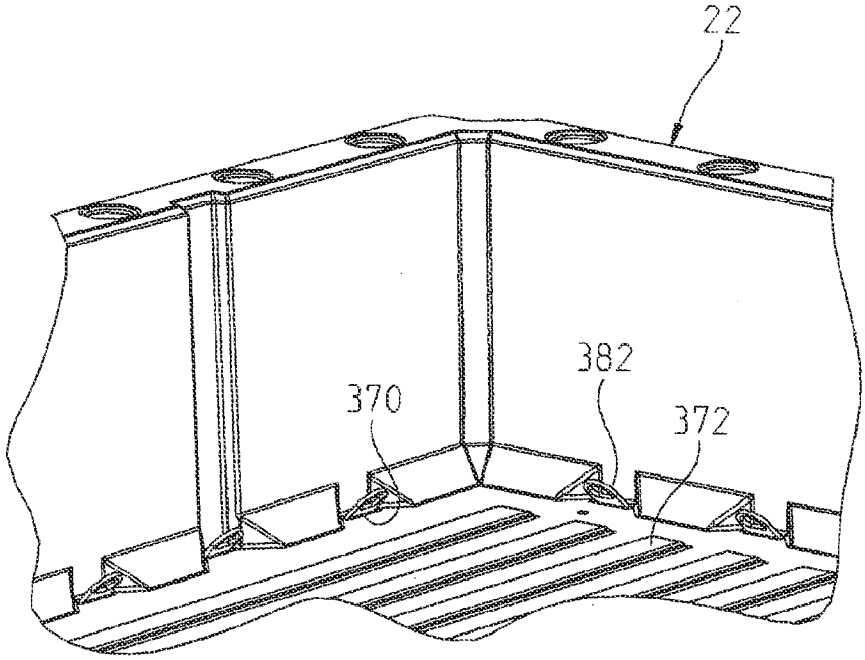


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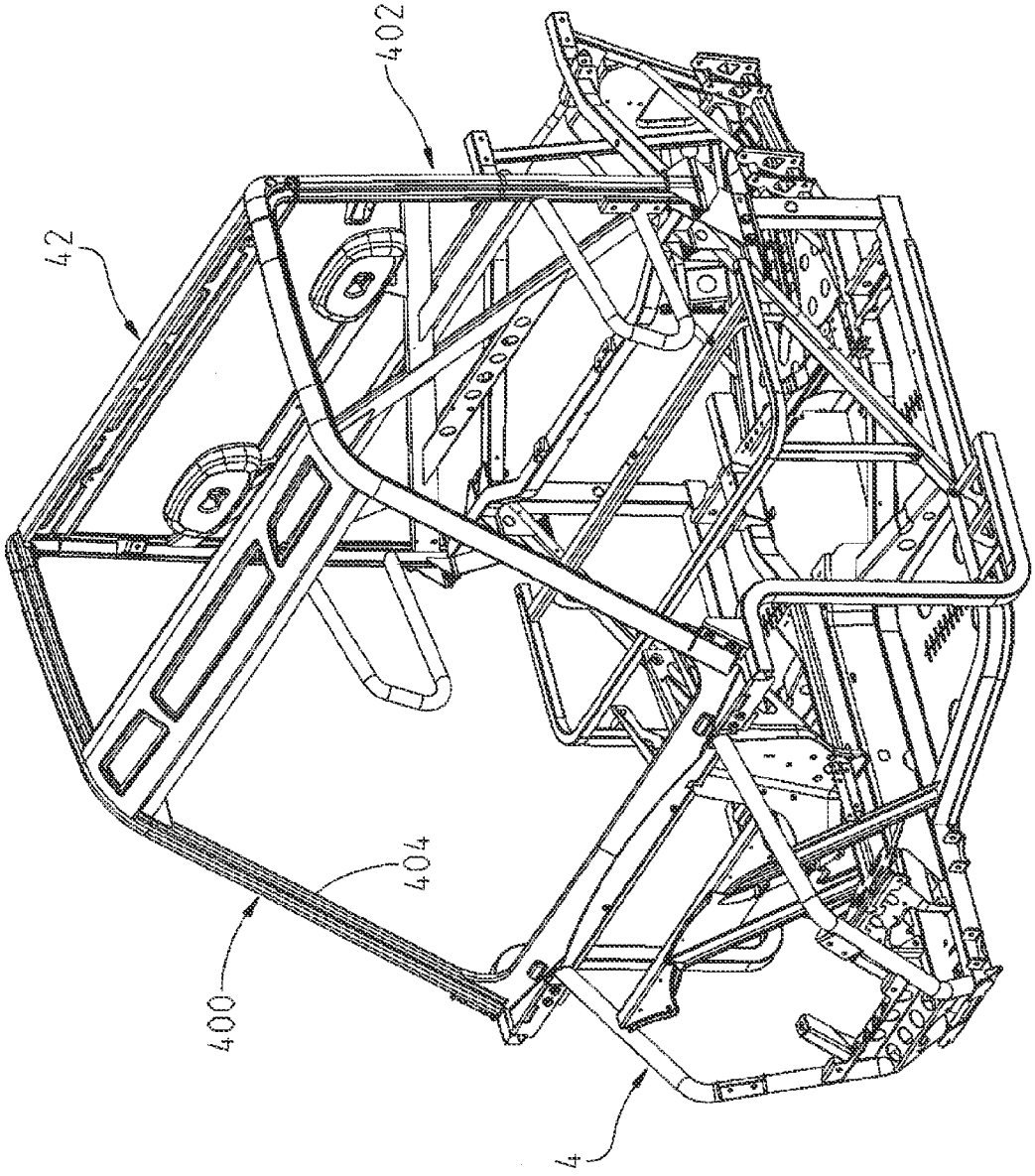


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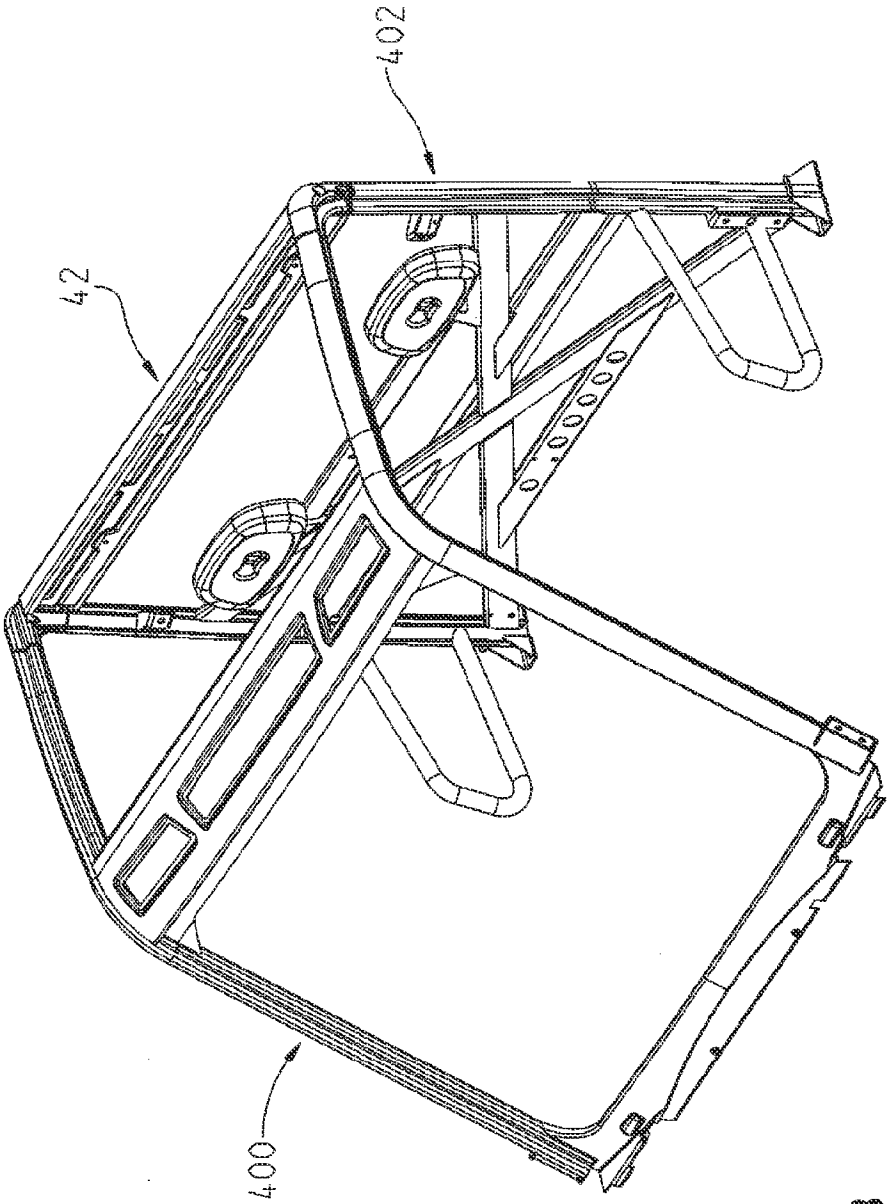


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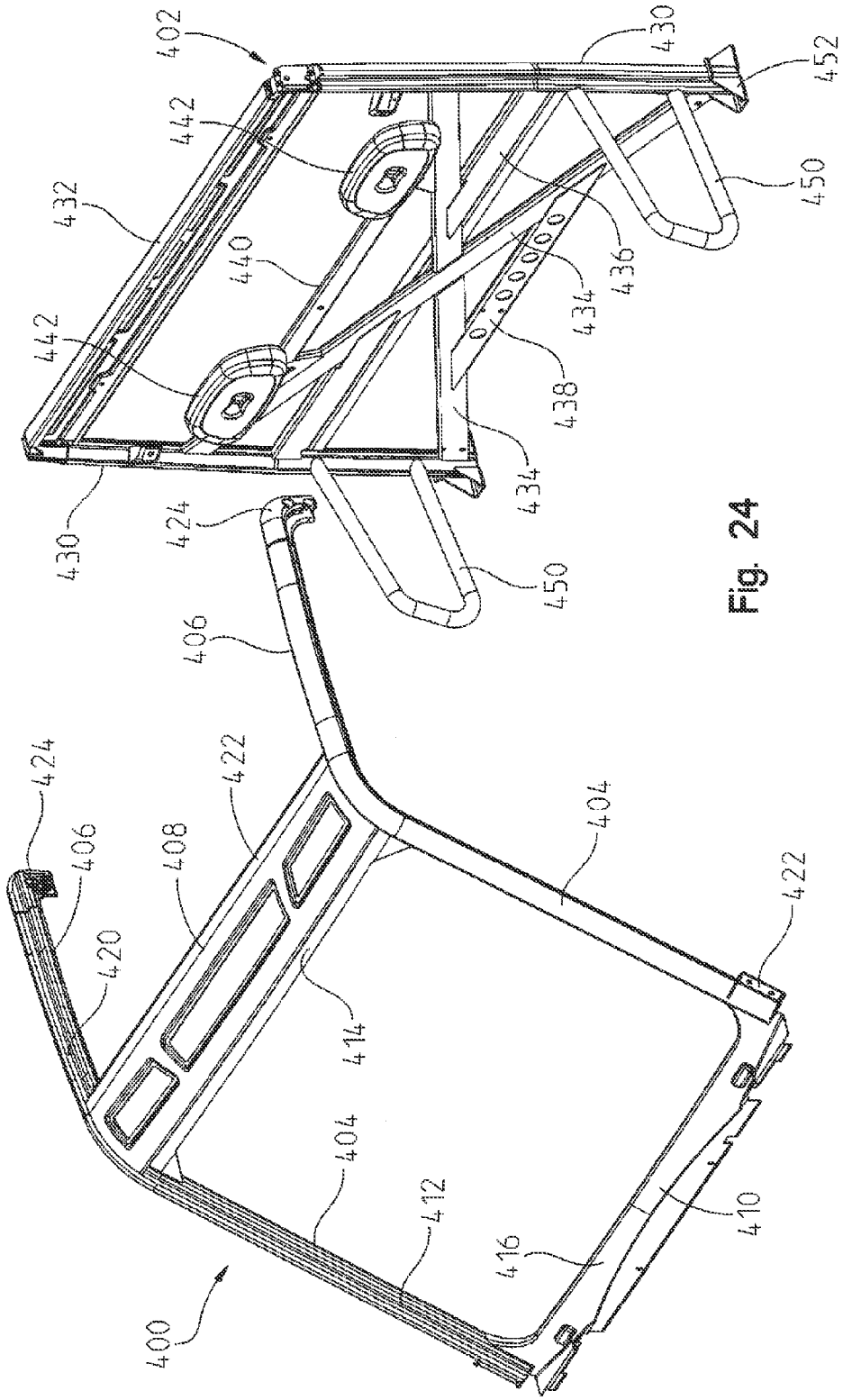

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Fig. 24

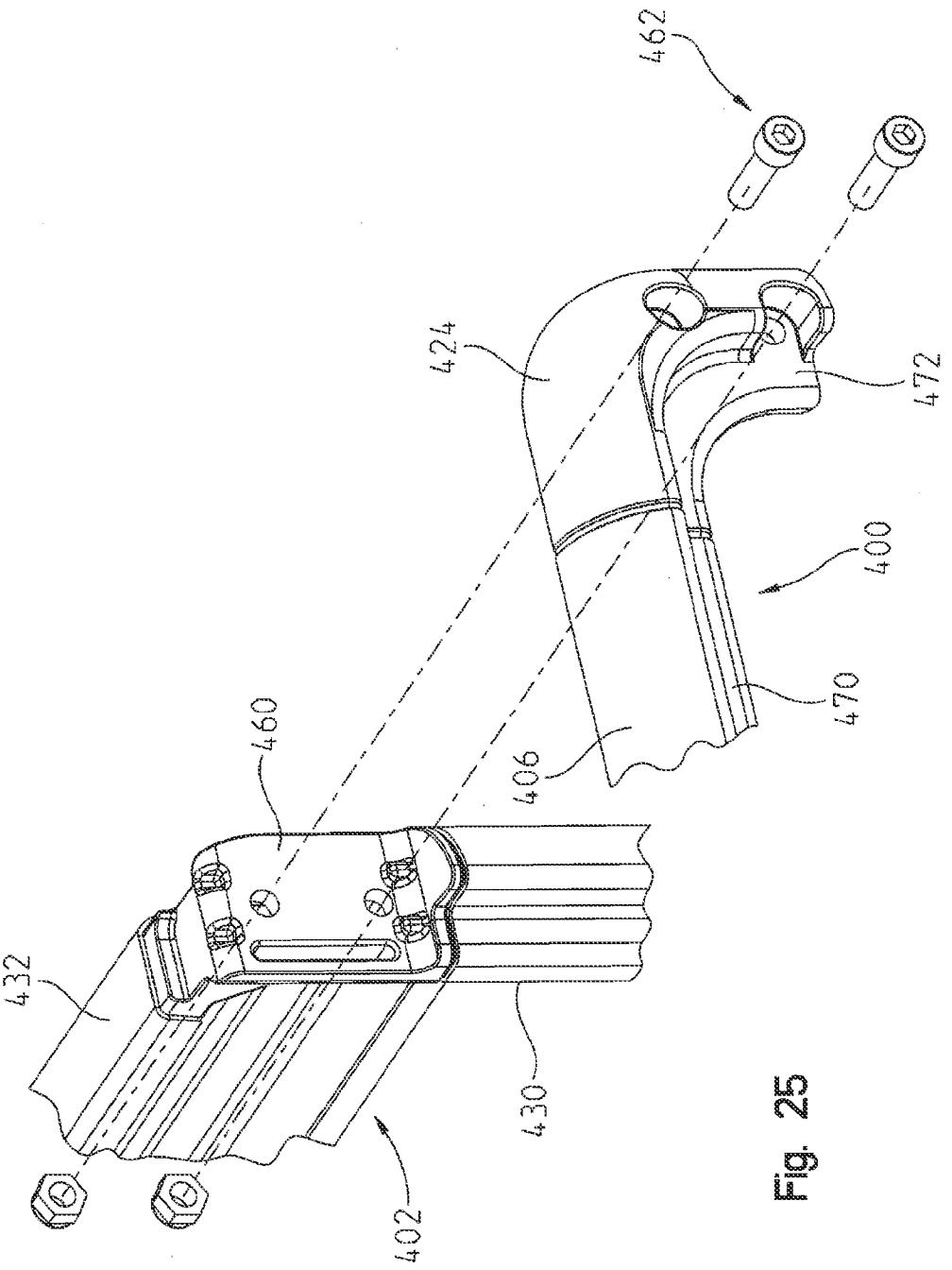


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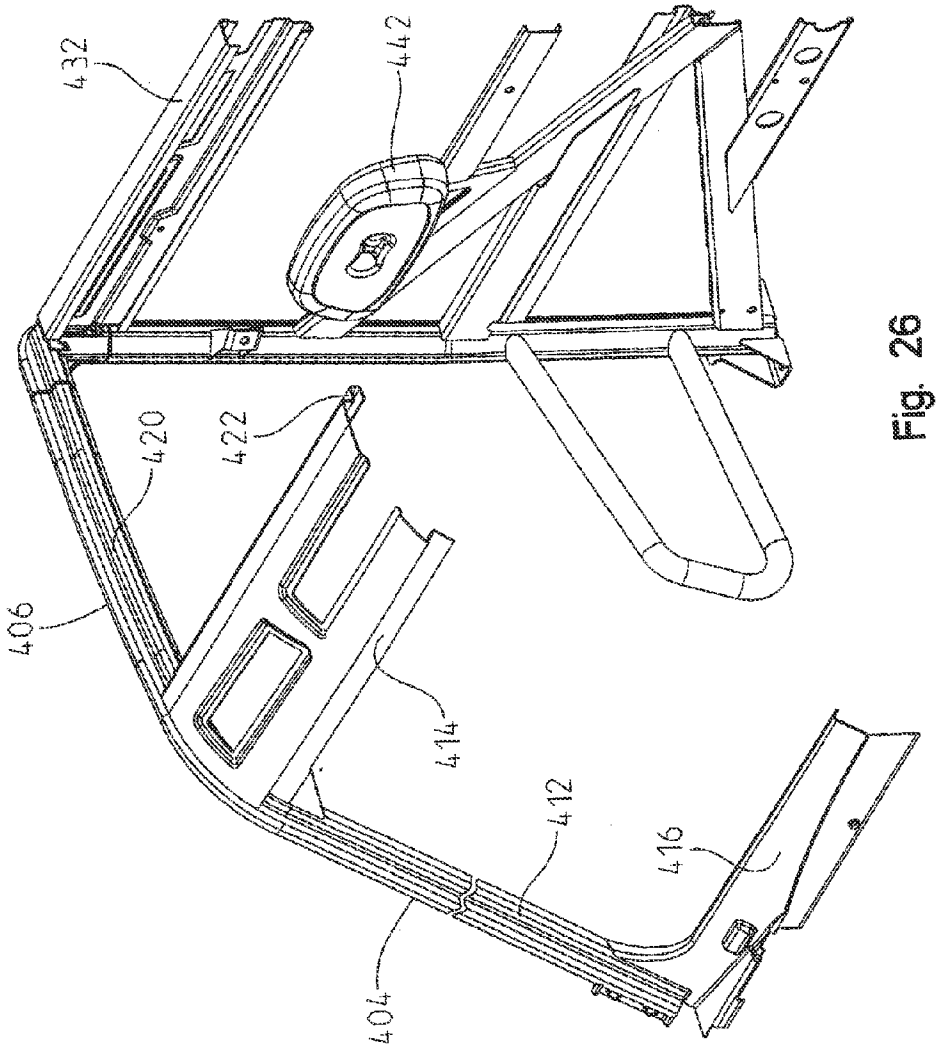


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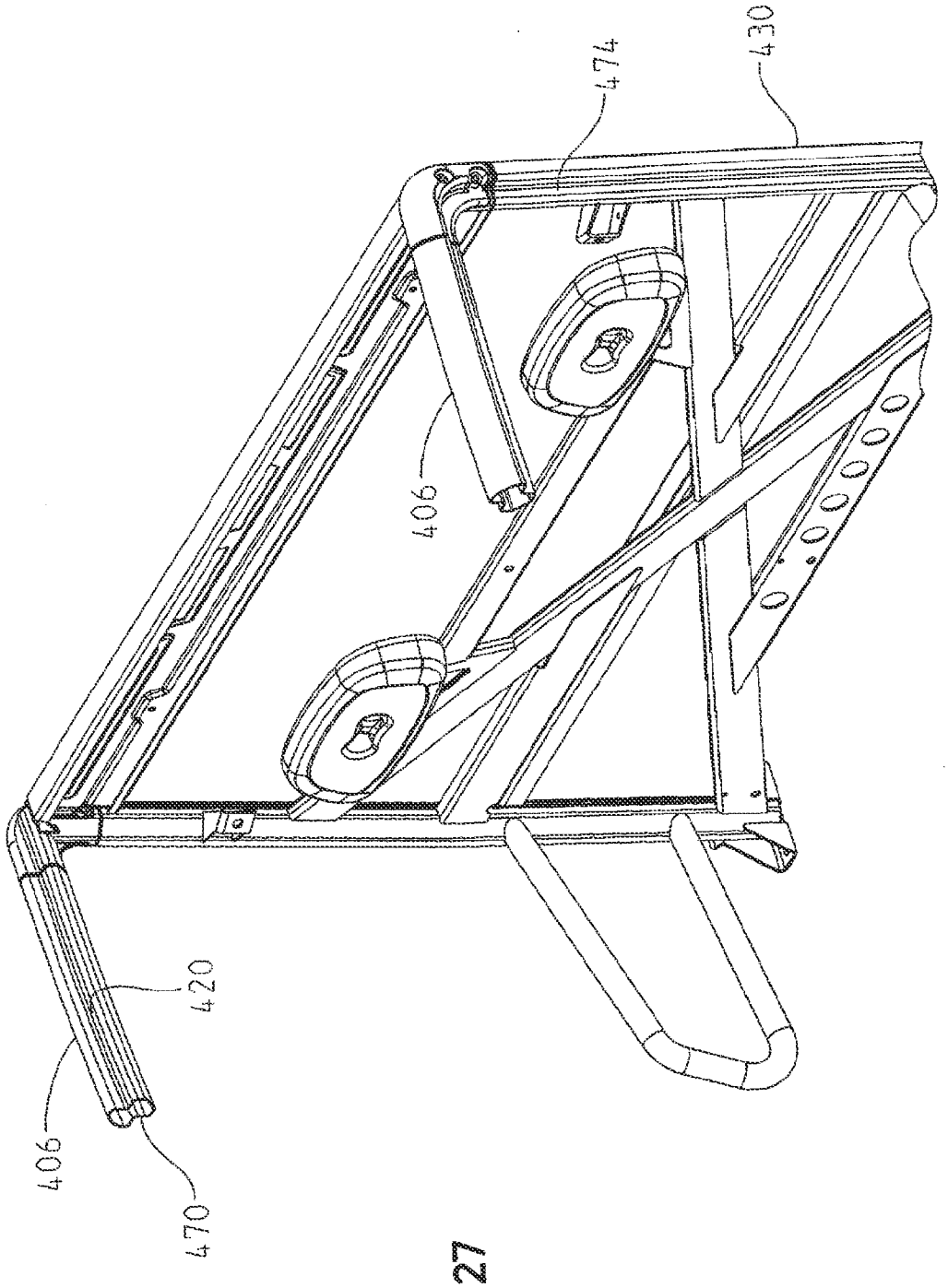


Fig. 27

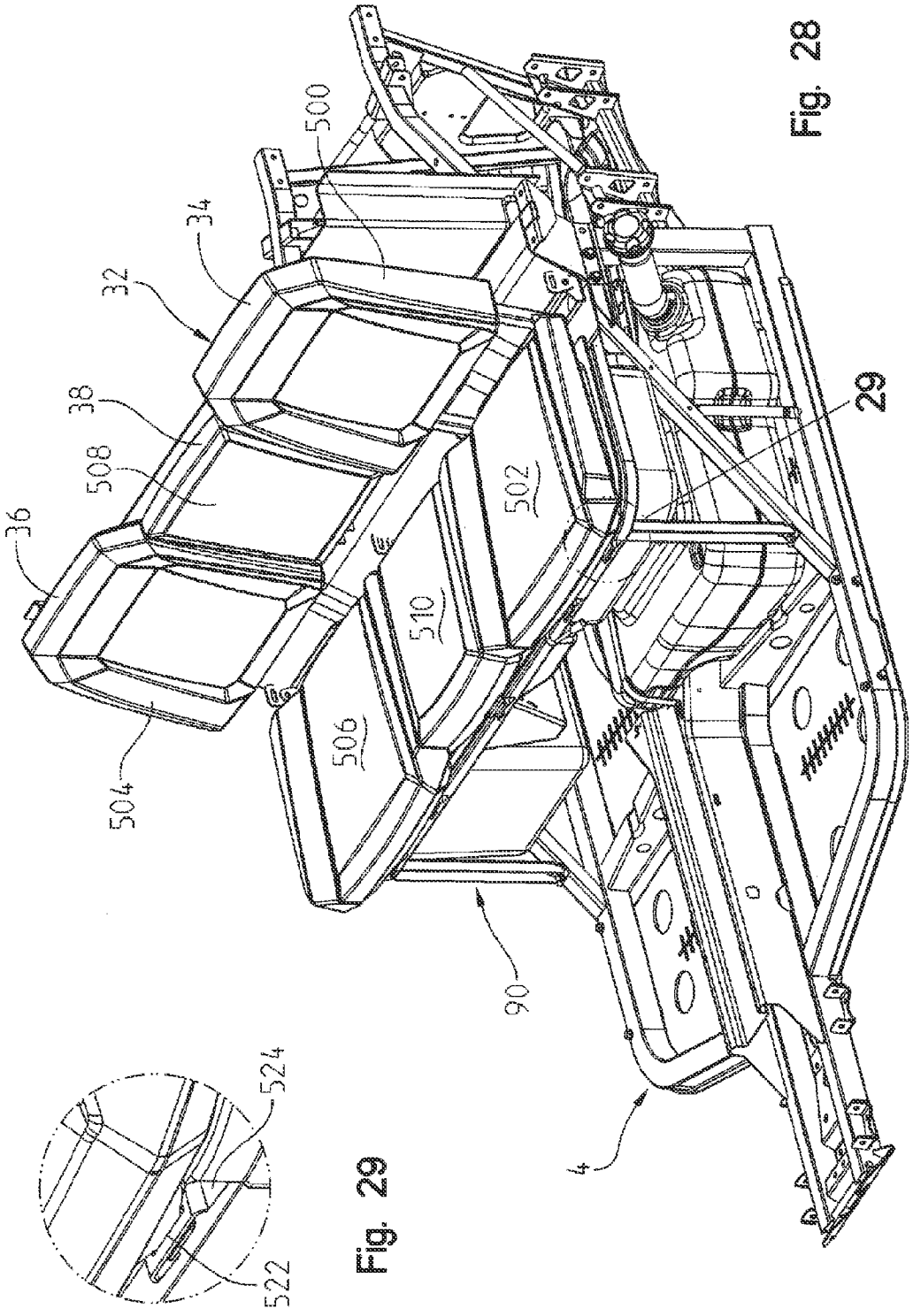


Fig. 28

Fig. 29

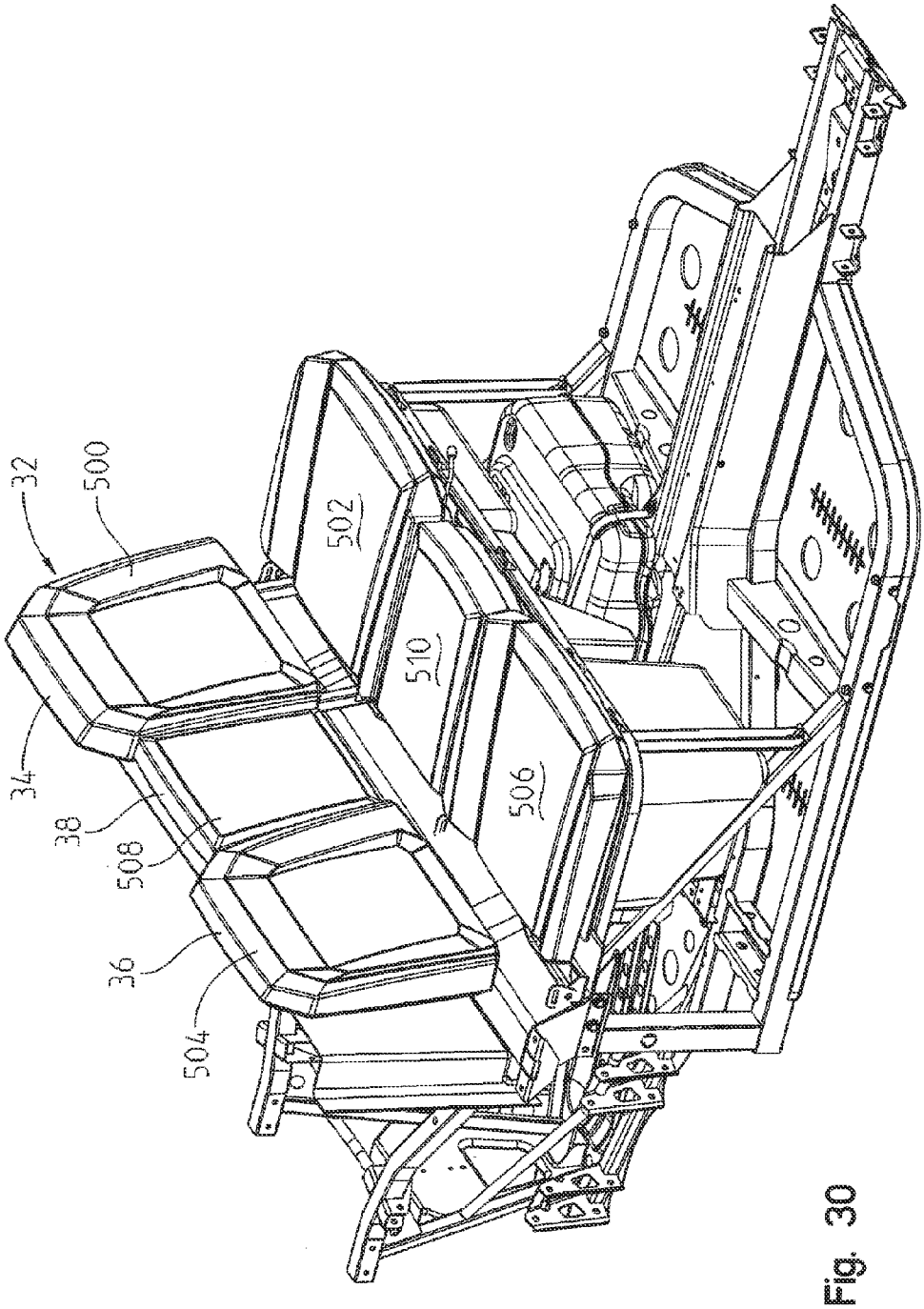


Fig. 30