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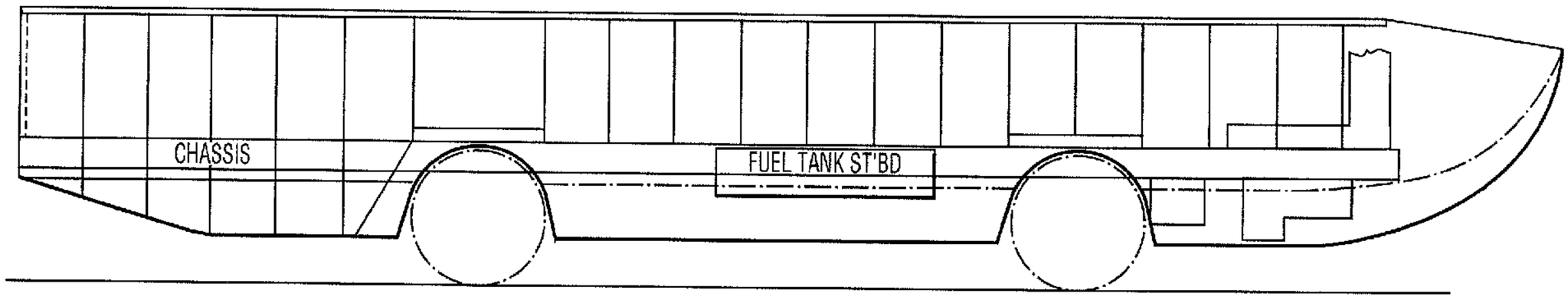


(57) Abrégé/Abstract:
The present invention provides an amphibious vehicle with improved vehicle movement means. Specifically, the invention provides an amphibious vehicle comprising a vehicle body which functions as a displacement hull during marine use, land motive means for providing land motive force which incorporates a front wheel drive system, marine motive means for providing marine motive force, an engine positioned within the vehicle and operatively connected to provide power to both said land motive means and said marine motive means, and a single power train for transmitting torque generated by said engine, wherein manual switching means is provided for selectively directing said torque to said land motive means and said marine motive means.

A DISPLACEMENT HULL AMPHIBIOUS VEHICLE USING A FRONT WHEEL DRIVE SYSTEM

ABSTRACT

The present invention provides an amphibious vehicle with improved vehicle movement means. Specifically, the invention provides an amphibious vehicle comprising a vehicle body which functions as a displacement hull during marine use, land motive means for providing land motive force which incorporates a front wheel drive system, marine motive means for providing marine motive force, an engine positioned within the vehicle and operatively connected to provide power to both said land motive means and said marine motive means, and a single power train for transmitting torque generated by said engine, wherein manual switching means is provided for selectively directing said torque to said land motive means and said marine motive means.

FIELD OF THE INVENTION

The present invention relates to a vehicle, more particularly, to an amphibious vehicle wherein the vehicle may operate on dry land and in the water.

BACKGROUND

There are two basic aspects to an amphibious vehicle; *a vehicle body* which is amenable to both land and water, wherein typically a displacement hull or a planing hull in used; and a *means of moving the vehicle body* on land as well as through water, wherein such means comprises propulsion means and steering means, in addition to special features that enable the movement means such that they will be able to function on land where weight of the vehicle is a challenge, in addition to within water where the land-based propulsion means can be affected by the aqueous environment. Amphibious vehicles that have been developed over the years tend to focus on optimizing one of these basic aspects, for example, by making the body more hydrodynamic or bouyant in the water or changing the orientation of the wheels to the body, or improving the propulsion system when the vehicle is in the water.

For example, U.S. Patent No. 5,687,669 describes an amphibious vehicle having a pontoon assembly including a pair of pontoons and a set of wheels operably attached to the pontoons which are pivotally coupled to a vehicle frame structure such that the pontoons are positionable between a raised position whereby the wheels are deployed for providing land travel and a lowered position whereby the pontoons are deployed for providing marine travel. The amphibious vehicle further includes an engine, a jet propulsion unit and a drive train for selectively transmitting torque generated by the engine to the wheels for propelling the amphibious vehicle during land use and to the jet drive for propelling the amphibious vehicle during marine use. This vehicle has a plurality of pivotal members and a complex method of transmitting torque to the appropriate propulsion system (land or marine) due to the rotation of the pontoons to which these propulsion systems are attached.

U.S. Patent No. 5,632,221 discloses an amphibious vehicle which includes a conventional hull, modified to mount a single steerable front wheel and two hydraulically driven rear wheels,

wherein the wheels are retractable between elevated positions above the hull waterline and lowered positions located below the hull.

U.S. Patent No. 5, 590,617 discloses an amphibious vehicle wherein the vehicle has retractable wheels and a single engine which powers both the land and marine propulsion systems. Furthermore, there are two distinct sets of operation parameters providing the functionality of this vehicle, with one set of parameters being directed to land use and the other set of parameters being directed to marine use. The transition process between land use and marine use also follows a particular set of parameters in order to determine the activation of the appropriate propulsion system and the extension or retraction of the wheels. This transition process is controlled by both the driver, by an operable switch and a plurality of sensors detecting pressures and water presence. The appropriate propulsion system will be activated and the wheels will be deployed or retracted depending on the above mentioned parameter. This particular amphibious vehicle is designed incorporating a planing hull and therefore the weight of the components of the vehicle, for example the engine and power train, is situated towards the rear of the vehicle, enabling the majority of the hull to travel over the surface of the water. Furthermore, with the power train and engine being situated in close proximity to the rear of the vehicle, there is limited space to install the components required to operate the vehicle drive systems. Thus the drive shafts, which operate the land propulsion system and the marine propulsion system, are required to be installed at steep angles. Due to the steep angle of operation of these drive shafts, the duration of operation of this vehicle will be limited. This amphibious device, while operable, is quite complex and thus difficult to construct and repair in addition to having a limited duration for operation. Thus there remains a need for an amphibious vehicle that is functionally simple and effective for both land and marine travel.

Other amphibious vehicles in the prior art have numerous controls to account for the transition between land travel and water travel, such as a pulling rod to actuate a clutch or engaging device. One difficulty encountered during the transition is that timely and precise manipulation of these controls is required of skilled and experienced operators. Additionally, the number and mechanical complexity of such controls is daunting. There remains a requirement for a

mechanically simple system which is relatively easy to operate and that allows a smoother transition from water to land and vice versa.

Still other prior art discloses an amphibious vehicle that is adapted from a standard rear wheel drive school bus chassis. This modified vehicle's propulsion system suffers from the mechanical complexity of controls that distinguish land and water operation. In such a vehicle, for example, there is a foot pedal used for land mode propulsion and a hand thruster for water mode propulsion. As well, two separate steering gear systems are used for each travel mode, a steering wheel that controls the front wheels and a separate rudder control to guide the vehicle in water. The two operation modes are additionally characterised by separate shafts, one to drive the rear double axle connected to the wheels and the other to drive the propeller using hydraulics. Similar to the original school bus design, the engine in the prior art modified vehicle is located ahead of the driver area thus occupying valuable space that could otherwise have been used for the transportation of additional passengers.

There remains therefore, a need for an efficient amphibious vehicle that is mechanically simple in terms of its propulsion and steering systems while maintaining good stability on the water and optimising passenger or cargo space.

This background information is provided for the purpose of making known information believed by the applicant to be of possible relevance to the present invention. No admission is necessarily intended, nor should be construed, that any of the preceding information constitutes prior art against the present invention.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a displacement hull amphibious vehicle using a front wheel drive system. In accordance with an aspect of the present invention, there is provided an amphibious vehicle comprising: a vehicle body, wherein said vehicle body functions as a displacement hull during marine use; land motive means for providing land motive force, wherein said land motive means incorporates a front wheel drive system; marine motive means

for providing marine motive force; an engine positioned within the vehicle and operatively connected to provide power to both said land motive means and said marine motive means; and a single power train, wherein said power train transmits torque generated by said engine, and wherein manual switching means is provided for selectively directing said torque to said land motive means and said marine motive means.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 provides a partial side elevation view of one embodiment of the present invention.

Figure 2A provides a partial top view of the present invention, with the upper half of the figure providing an above deck view and the lower half of the figure providing a below deck view, as indicated.

Figure 2B provides a cross-sectional view along axis A-A, as indicated in Figure 2A.

Figure 2C provides a cross-sectional view along axis B-B, as indicated in Figure 2A.

Figure 3 provides a cross-sectional view of the midship in Figure 2A, as would be seen from the stern of the vehicle.

Figure 4 provides a cross-sectional view of a typical buoyancy tank according to one embodiment of the present invention.

Figure 5 provides a schematic of the primary components of the propulsion system according to one embodiment of the present invention.

Figure 6 provides a schematic of the primary components of the steering system according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

The term "motive means" is used to define the means by which a vehicle is provided propulsion, for example, land motive means provides a means for the vehicle to move on land.

The term "land drive unit" is used to define a land propulsion system, for example a front drive steer axle, a rear drive axle or a track drive system.

The term "marine drive unit" is used to define a marine propulsion system, for example a propeller, jet pump, or any other device, which provides propulsion in a marine environment.

The term "switching means" is used to define a means for engaging and disengaging the operation of a motive means, for example a compressed air line, hydraulic fluid line or an electrical means, as would be known to a worker skilled in the art.

The term "steering means" is used to define devices operatively connected whose function is to guide the vehicle in the water or on land.

The term "marine steering means" is used to define a system, which enables the adjustment of the direction of the movement of the vehicle during marine operation, for example a rudder or a device for directing thrust generated in water by the marine drive unit.

The term "land steering means" is used to define a system, which enables the adjustment of the direction of the movement of the vehicle during land operation, for example a steer axle.

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

In order that the present invention may more readily be understood, the following description is given, merely by way of example with reference to the accompanying figures. One embodiment

of the present invention is illustrated in Figures 1 and 2A. The framing structure of the body of the amphibious vehicle is made of a sufficiently stiff and strong material, for example steel, stainless steel, carbon fibre or aluminium, such that said framing is able to resist the forces generated during use of the vehicle on both land and water. The framing structure is covered by a material appropriate for use in a marine environment, for example steel, aluminium, stainless steel, carbon fibre or fibreglass, enabling the sealing of the framing structure to withstand or resist the penetration of water. The framing structure is further attached to a hull forming the body for the present invention.

In one embodiment of the present invention, at least one front axle and one rear axle are required, with each axle supporting at least one pair of wheels, thus providing a means for said vehicle to travel over land. However, an amphibious vehicle constructed in accordance with the present invention can have multiple front and/or rear axles and multiple sets of wheels can be attached to any one axle. For example, Figure 2C depicts a front single axle with two wheels and Figure 2B depicts a rear single axle with 4 wheels. The corresponding tires would need to be of sufficient size to carry the vehicle's load and meet community standards.

Hydrodynamic Shape

An efficient hydrodynamic shape of a hull improves both the efficiency of the propulsion system and the stability of the vehicle in the water. The stability of the vehicle in the water is crucial to the safety of the vehicle by preventing capsizing of said vehicle and is critical to the comfort of the passengers by reducing the pitching and rolling of the vehicle in the water. Furthermore, by limiting and streamlining the components on the exterior of the hull, the resulting drag on the vehicle is reduced thus improving the efficiency of the propulsion system.

In one embodiment of the present invention the hull is designed as a displacement hull and thus the hull of the vehicle will remain in the water during marine operation. Furthermore, the weight of the vehicle, for example the engine and the power train, is evenly distributed along the length of a vehicle, maintaining longitudinal balance of the vehicle, which is advantageous for the operation of a vehicle employing a displacement hull.

The cross-sectional design of the hull in one embodiment of the present invention is in the form of a "claw" as illustrated in Figure 3. There are three regions in the cross-sectional profile of the "claw" shape, namely two side regions and one middle region, wherein the two side regions extend below the middle region forming an inverted channel between the side regions. This shape provides a means for improving the stability of the vehicle in the water compared with typical "U" or "V" shaped hull designs. In addition to the increased stability, the shape of the lower outer body and floor minimises the vehicle's overall drag in the water.

In one embodiment of the present invention and with reference to Figures 3 and 4, the side regions of the hull are sealed chambers, which can provide buoyancy to the vehicle during marine operation. These chambers can be filled with, for example, air, foam or any other material that has a density, which is lower than that of water, thus providing buoyancy to the vehicle. In one embodiment, these chambers are filled with air and a means is provided for draining any water, which may have penetrated the chamber during operation of the vehicle.

Optionally, ballast can be incorporated into the side regions providing a means for regulating the buoyancy of the vehicle and thus increasing the stability of the vehicle in the water. Placing the ballast within the side extremities of the cross-section of the hull provides an increase in the resistance to rocking of the vehicle compared with ballast positioned closer to the longitudinal centreline of the vehicle.

In order to streamline the profile of the hull of the vehicle, minimal components are exterior to the hull providing a means for reducing drag on the movement of the vehicle in the water. In one embodiment of the present invention, a single power train is exterior to the hull and provides a means for providing power to both the marine drive unit for water travel and the drive wheels for land travel. Furthermore, the number of additional structures, for example hydraulic fluid lines and compressed air lines, which can reduce the laminar flow of water to the marine drive unit, is minimised, or if required such structures are positioned in a manner that has a negligible or no adverse affect.

Furthermore, the partial protrusion of the wheels from outside the cross-section of the vehicle according to the present, results in a negligible contribution to overall drag of the vehicle, in part due to the increased water flow to the marine drive unit as directed by the lower outer body and floor. The advantage of a reduction in drag results in increased speed and reduced fuel costs for the vehicle during marine operation, in addition to other advantages.

As previously mentioned, the design of the hull in one embodiment is termed a "claw" shape with enclosed chambers as illustrated in Figures 3 and 4. Unlike flat bottom boats or vessels with keels, the shape of this embodiment's hull is characterised by a space along the centreline, in the form of an inverted channel. The inverted channel of the "claw" shape is wide enough and deep enough to permit adequate flow of water underneath the vehicle such that a sufficient amount of water reaches the marine drive unit, resulting in improved efficiency of the propulsion system. The open space in this embodiment, which allows sufficient water flow, is additionally not impeded by mechanical clutter, as there is a minimum amount of equipment in the space such as a single power train. This inverted channel along the length of the vehicle functions like an open bottom ballast tank and thus improves the stability of the vehicle during marine operation. The shape of the hull in this embodiment of the invention also contributes to the efficient operation of the vehicle, in addition to its stabilisation characteristics, as previously described.

Upon entry of the vehicle into the water and floatation of the vehicle being established, the wheels required for land movement, will translate vertically downward with respect to the hull. This results from the reduction of the vertical force being applied to these wheels, since the weight of the vehicle is being supported by the hull during marine operation. The vertical translation of the wheels will result in the lowering of the centre of gravity of the vehicle thus improving the stability of the vehicle during marine operation.

When designing an amphibious vehicle, a worker skilled in the art would consider hull shape parameters such as length, beam draft, prismatic coefficient, longitudinal centre of buoyancy and midship coefficient. These variables are interrelated and may change simultaneously when any one variable is changed. Another consequence of increased propulsion efficiency is a decrease in fuel consumption.

Efficient Mechanics

For purposes of illustration, the propulsion system and steering mechanism of the present invention have been separated. It is to be understood, however, that one embodiment of this invention combines the propulsion and steering functions in one system using means such as a thruster or other marine drive unit.

Propulsion

In one embodiment of the present invention, a front engine, front wheel drive vehicle, transmission and single power train provide an advantage to the amphibious vehicle. For example, front wheel drive power can provide a means for the vehicle to exit the water in a forward motion, for example on an inclined boat ramp. Furthermore, in an amphibious vehicle, which has an extended chassis, as the front wheels contact the exit ramp, the back or stern of the vehicle may still be afloat. In such a scenario, where the rear wheels may not be in contact with the exit ramp, a front wheel drive system would be advantageous for providing a means for the vehicle to exit the water.

With reference to Figure 5, the propulsion system of one embodiment of the present invention is described. The direction of the arrows around the drive shafts **50**, **90** and **110** are indicated for illustration purposes only. The torque generated by the engine **10** enters a clutch or torque converter **20**, which controls the engaging and disengaging of the transmission **30**. Typical transmissions are known to those skilled in the art such that they are used to increase or decrease the torque from the engine by varying gear ratios. The torque output from the transmission **30** is transferred by the primary drive shaft **50** which protrudes aft through an impermeable barrier **40**. The primary drive shaft **50** runs along the chassis to a transfer case **60**, which transfers the input from the primary drive shaft **50** into two outputs. One of said outputs is directed along the marine drive shaft **90** and the other is directed along the land drive shaft **100**. The marine drive shaft **90** is connected to a marine drive unit **80**, which provides a means for generating propulsion in water, for example a propeller or a jet pump. The land drive shaft **100** transmits the output from the transfer case **60** to the front drive steer axle **110**, which provides a means for generating propulsion and a means for steering the vehicle on land.

The above mentioned impermeable barrier is of sufficient strength and thickness, for example, steel, aluminium, carbon fibre plate or rubber, such that entry of water and other substances into the engine compartment is minimalized. Furthermore, adequate sealing means is provided at the junction where the primary drive shaft protrudes through the impermeable barrier to minimalize the amount of water, etc, that enters. Appropriate sealing means would be known to those skilled in the art. Aft of the barrier, the primary drive shaft and other components are exposed to the elements and water.

In a preferred embodiment of the present invention, the impermeable barrier is made of a flexible material, for example a strong form of rubber, providing a means for reducing vibration within the vehicle during operation. The rotation of the primary drive shaft which penetrates the impermeable barrier can create a vibration within the impermeable barrier, due to its rotation with respect to the fixed impermeable barrier. A barrier constructed of a flexible material can dissipate or absorb a portion or all of this generated vibration, thus reducing or eliminating the amplitude of vibration transmitted though the vehicle, which otherwise would adversely affect the comfort of the passengers. As the stiffness of the material used to construct the impermeable barrier increases, however, said barrier absorbs less vibration, which results in the unwanted transmission of vibration throughout the vehicle.

An advantage of the present invention is provided by the fact that one engine supplies the torque to operate both the land motive means and the marine motive means, providing ease of operation of each of said means. The operator can activate one gas pedal, for example, to provide an increase in power to the marine drive unit or the front drive steel axle.

In one embodiment of the present invention switching means can be installed providing a means for the operator to optionally select the preferred motive means. For example separate switching means can be provided for the land drive unit and the marine drive unit. These separate switching means provide a means for engaging and disengaging both the land drive unit and the marine drive unit independently. The independent switching means provided for both the land motive means and the marine motive means enables the smooth transition of the vehicle from marine to land operation. For example, activation of the land motive means, prior to contact of

said land motive means with a marine exit ramp, will provide a seamless transition between marine operation and land operation. Furthermore, by incorporating an operator activated switch for each of the motive means, there is a reduction in the inherent complexity of the system, reducing the possibility of error. For example, an automated system for the activation of each motive means, can be prone to increased errors, not only due to the complexity of the system but also due to an unanticipated series of events causing a malfunction.

In one embodiment of the present invention there is an operator activated switching means providing a means for the activation of a differential locking mechanism operatively connected to the land motive means. As would be known to a worker skilled in the art, a differential locking mechanism provides a means for improving traction of the land motive means by ensuring the compatibility of the rotation of the drive wheels.

Furthermore by using a single primary drive shaft to operate both the marine motive means and the land motive means, there is a streamlining of the components exterior to the hull of the vehicle, thus enabling the improvement of the efficiency of the marine drive unit in addition to ease of construction and maintenance.

In a further embodiment of the present invention, the vehicle may include bow or stern thrusters, commonly known in the art, as a supplemental means of propulsion and to aid in the manoeuvrability of the vehicle in the water. A bow thruster can be positioned ahead of the midpoint of the vehicle so as not to hinder the above described propulsion system and a stern thruster can be positioned aft of the midpoint of the vehicle. Such thrusters can provide a means for augmenting the propulsion of the vehicle in the water, however they are typically used for the lateral adjustment of the vehicle's water movement. For example, these thrusters can be useful for squaring the longitudinal axis of the vehicle with the exit ramp counteracting the effect of a cross-wind or current which may be present.

Steering Mechanism

The steering mechanism for land and water use in one embodiment of the present invention is illustrated in Figure 6. Both land and water steering can be mated to provide a relatively simple steering system which requires minimal operator handling or experience.

Primary land steering of the present invention employs a configuration which is known in the art. Land steering is effected with the primary steering system, which in one embodiment comprises steering means **220,** such as a steering wheel, operatively connected to a pitman arm and rack and pinion device **230** via a steering arm **225**. The engine **10** provides sufficient power to a steering pump **200** which in turn is operatively connected to a steering box **210**. The steering box is also operatively connected to said pitman arm and rack and pinion device **230**, which is operatively connected to the front drive steer axle **110** through the impermeable barrier **40** via the front drive steer steering arm **245**. As the steering means **220** turns, the rotary motion is translated through the steering mechanism to ultimately direct the front wheels, which causes the vehicle to change direction. In one embodiment, the rotary motion is translated with assistance provided by said engine **10**.

Primary marine steering can use marine steering means **260** which in one embodiment, may be operatively connected to a flexible assembly steering cable, such as a Teleflex™ steering cable enclosed in a protective conduit, to permit mechanical remote control of the vehicle in the water. The marine steering means **260**, can be activated with one or more mechanical cables similar to the steering cable assembly used in many small water craft which employ a steering wheel or other steering lever system. In one embodiment of the present invention, the cable **240** is attached to the end of the pitman arm and rack and pinion device **230**, which is also used for land steering, as described above. When the pitman arm and rack and pinion device **230** moves as a result of the rotary motion of the steering means **220**, the cable **240** is pushed or pulled accordingly. The cable **240** may be installed along the chassis of the vehicle and attach to the marine steering means **260** in order to transmit a push, pull or rotary motion, thus providing a means for manipulating the steering means, causing the vehicle to change direction.

On land and in water therefore, when the steering means **220** in the primary steering mechanism is turned, both the front drive steer axle **110** which is operatively connected to the front wheels (for land use) and the marine steering means **260** (for marine use) adjust accordingly. During the vehicle's operation, the movement of the marine steering means **260** does not adversely affect land use and front wheel movement has negligible or no adverse affect during marine use.

An emergency or secondary marine steering mechanism **250**, known in the related marine art, can also form one embodiment of the present invention as a backup to a failed primary steering system in the water. Such a secondary marine steering mechanism **250** may be located aft of the vehicle, proximate to the marine steering means **260** and is preferably operated manually. For example, a cotter pin can be removed to disable primary marine steering by disconnecting the cable **240** from the marine steering means **260**. Once primary marine steering is bypassed, a secondary marine steering mechanism **250** can then control the vehicle's direction in the water by employing a device such as a second steering wheel or bar operatively connected to said marine steering means **260**.

Cooling

The engine is cooled by an air ventilation system. Unlike in some prior art vehicles, the radiator in the vehicle of the present invention does not come in contact with the water. Some significant advantages of this system are that the radiator fan continues to operate when the amphibious vehicle travels from land to water. In one embodiment, one or more fans at the back of the vehicle draw hot air out of the engine through pipes, which may run under or at floor level. This exhausting system provides an unobstructed view from the vehicle in all directions, as opposed to a venting funnel from the engine room as would be present on typical marine vessels.

Safety Features

Because the vehicle travels in water, there is a significant requirement for additional safety features. Safety is a major concern of organisations such as the Coast Guard, Transport Canada and similar regulatory and safety bodies, when an amphibious vehicle is designed to operate as a passenger carrier.

One precaution, known in marine art, is to position a watertight door between the driver's cab and the passenger compartment, as depicted in Figure 1 and 2A. A watertight door provides a significant safety feature such that if the driver's cab should fill with water, such water will be prevented or at least delayed from entering the passenger compartment and completely flooding the vehicle, thus providing passengers time to exit safely. The watertight door may be located above the impermeable barrier that separates the engine compartment from other mechanical apparatus exposed to the environment. The sealed engine compartment may however extend aft of the watertight door, depending on the size and placement of mechanical equipment. If the driver's platform is surrounded by watertight sides and a roof, such a watertight door may extend from floor to roof. However, if the driver has to communicate with the passenger compartment, the watertight door should be of sufficiently height as not to impede such effective communication, while providing the safety feature of allowing the safe exit of the driver from the driver's platform to the passenger compartment in case of flooding.

Space Optimization

One type of passenger application could be used in the tourism industry, wherein the operator of the vehicle provides scenic tours along town streets and approved waterways. In such an application, the profit generated from each tour is related to the number of passengers that can safely enjoy the tour. By maximising passenger space, the vehicle in this embodiment gains a competitive advantage over prior art vehicles. Means of increasing passenger space, subject to the approval of safety and transport authorities, include extending the chassis to the maximum length allowable or adding two or more levels of passenger seating similar to ferry configurations. These changes would affect the shape, configuration and stability of the vehicle.

In one embodiment of the present invention, a simpler way is to strategically position of the engine compartment and driver platform in order to maximise the passenger and/or cargo space. For example, the driver platform can be positioned over the engine compartment as opposed to behind the engine. For a single deck vehicle, this implies that the engine compartment is below the deck level and thus may be at or below the water line of the amphibious vehicle during marine operation. It is therefore advantageous to provide an impermeable barrier to seal the

engine compartment from water infiltration, thus providing a means for the engine and further equipment contained in said compartment to operate efficiently.

EXAMPLES

EXAMPLE 1:
AMPHIBIOUS BUS VEHICLE

One embodiment of the present invention is based on a school bus chassis and front engine, which is converted for amphibious use. Among the mechanical components underneath the floor of this vehicle are a front drive steer axle, transfer case, propeller and shaft and shafts between the transfer case and the engine and between the transfer case and the front drive steer axle. The transfer case in this vehicle may optionally be air-operated and electronically controlled to engage or disengage the propeller. The propeller can be disengaged by an operator while the vehicle is travelling on land and engaged prior to and during the vehicle's water operation. The transfer case known in the land vehicle art to operate a vehicle's rear wheels is thus adapted in the bus embodiment, by mating the rear wheel drive to the propeller shaft.

The front engine, which may be a diesel engine, clutch/torque converter and transmission are housed in a waterproof sealed engine compartment, also known as the cage. The portion of the drive shaft which exits the cage is shielded from major water penetration by an impermeable barrier which may be located adjacent to the waterproofed seal bearing or the transmission. Such an impermeable barrier may be constructed from a suitable material such as a strong high impact rubber plate.

Similar to the related marine art, when water does enter the cage, it can be removed by a standard pumping means, such as a bilge pump system.

The flotation means may use buoyancy tanks known in the art and depicted in Figure 4, which are enclosed within the "claw" shape hull, illustrated in Figure 3.

The bus embodiment may be adapted to passenger and cargo applications since there is sufficient space in the vehicle to transport at least 40 persons with seats and other safety equipment or the equivalent space for cargo transport, in addition to a driver. In tourist applications, the driver may also be the operator of the switching means or initiate the secondary steering means as described above in addition to being the tour guide to further minimise the requirement for multiple operators and maximise passenger space. The engine compartment position relative to the driver, as described above, also increases passenger space.

EXAMPLE 2:

OTHER AMPHIBIOUS VEHICLES

Others embodiments of the present invention are based on modified truck vehicles, jeeps, luxury vehicles such as stretch limousines, or other appropriate vehicles such as recreational vehicles.

Adapted from certain land use trucks known in the art, this embodiment could operate on land using the rear drive component and in the water using the propulsion means as described, supplemented with an inboard/outboard engine known in the art, positioned near the stern. Such an inboard/outboard engine may be used to facilitate the vehicle's exit from the water by providing additional momentum to the vehicle so that its rear wheels may grip onto an adequate surface such as an exit ramp.

The positioning of the truck embodiment's flotation means may be outside and adjacent to the sides, rather than within the hull due to limited space requirements.

The truck embodiment may be adapted to smaller applications (as compared to the bus embodiment) for the transportation of passengers or cargo as there is sufficient space in the vehicle to transport at least 12 persons with seats and other safety equipment or the equivalent space for cargo transport in addition to a driver. As in the bus embodiment above, in tourist applications, a single driver/operator may also suffice to operate the vehicle to maximise passenger space.

As in the previous embodiments described above, a worker skilled in the art educated by the present invention, may convert other known land or water use vehicles to the amphibious vehicle of the present invention.

Luxury land vehicles, for example, may be adapted on an even smaller scale than as previously described with minor variants to accommodate the smaller amphibious vehicle's requirements, such as a different size power train. In tourism applications, the demand to tour or be seen as a passenger in such a vehicle is typically high, which would lead to increased profits, thus offsetting the profit consequences of a smaller passenger space.

Similarly, larger vehicles, such as trailers or camper vans may be converted to the amphibious vehicle of the present invention with minor variants to accommodate the larger amphibious vehicle's requirements. Such a vehicle may have additional features in tourism applications, such as the ability to undergo relatively longer voyages, as a result of the vehicle's other pre-modification advantages. For these and other reasons similar to the amphibious luxury vehicle, demand for an amphibious trailer vehicle would increase, which would also lead to increased profits.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

THE EMBODIMENTS OF THE PRESENT INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An amphibious vehicle comprising:
   a) a vehicle body, wherein said vehicle body functions as a displacement hull during marine use;
   b) land motive means for providing land motive force, wherein said land motive means incorporates a front wheel drive system;
   c) marine motive means for providing marine motive force;
   d) an engine positioned within the vehicle and operatively connected to provide power to both said land motive means and said marine motive means; and
   e) a single power train, wherein said power train transmits torque generated by said engine, and wherein manual switching means is provided for selectively directing said torque to said land motive means and said marine motive means.

2. The amphibious vehicle as in claim 1, wherein said power train comprises:
   a) a transmission which is operatively attached to the engine and an output shaft operatively attached to a primary drive shaft;
   b) a transfer case operatively attached to said primary drive shaft, having two output shafts, wherein one output shaft is operatively attached to said marine motive means; and
   c) a front drive steer axle operatively attached to one of said output shafts.

3. The amphibious vehicle as in claim 1, wherein said vehicle body is selected from the group comprising: a bus, a sports utility vehicle, a limousine, a recreational vehicle, a car and a truck wherein said vehicle body has been adapted for marine use.

4. The amphibious as in claim 3, wherein said vehicle body has been elongated.

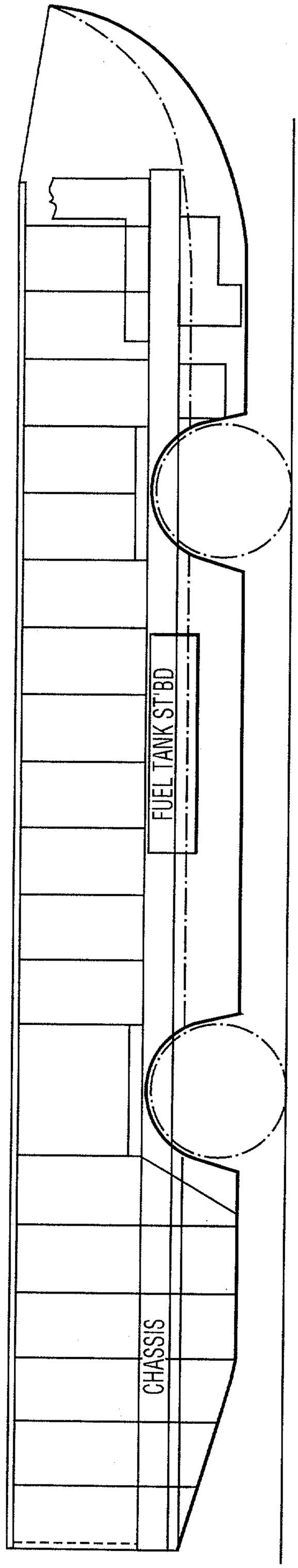


FIG.1

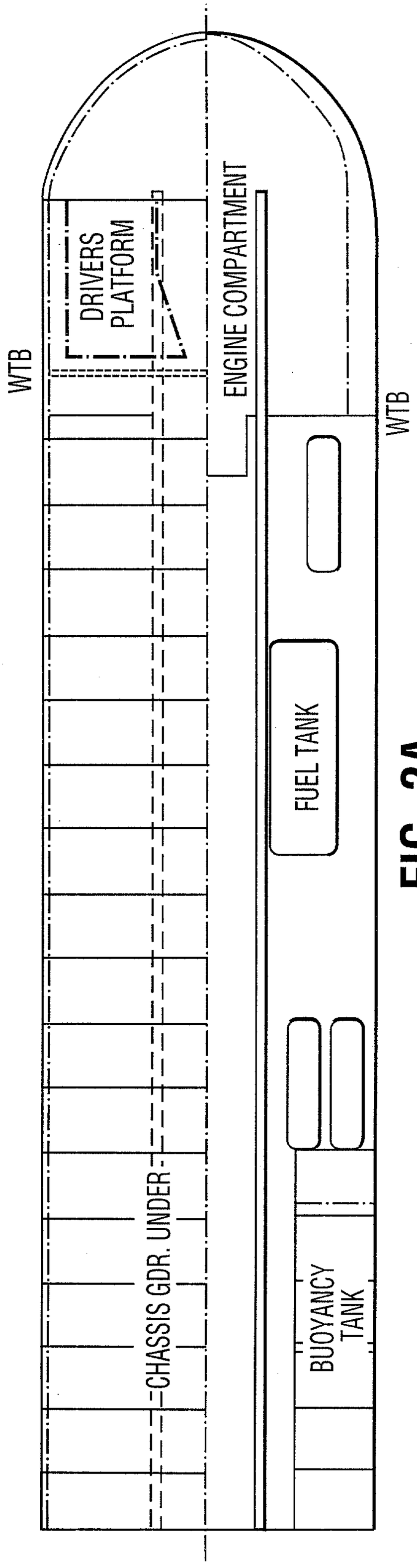


FIG. 2A

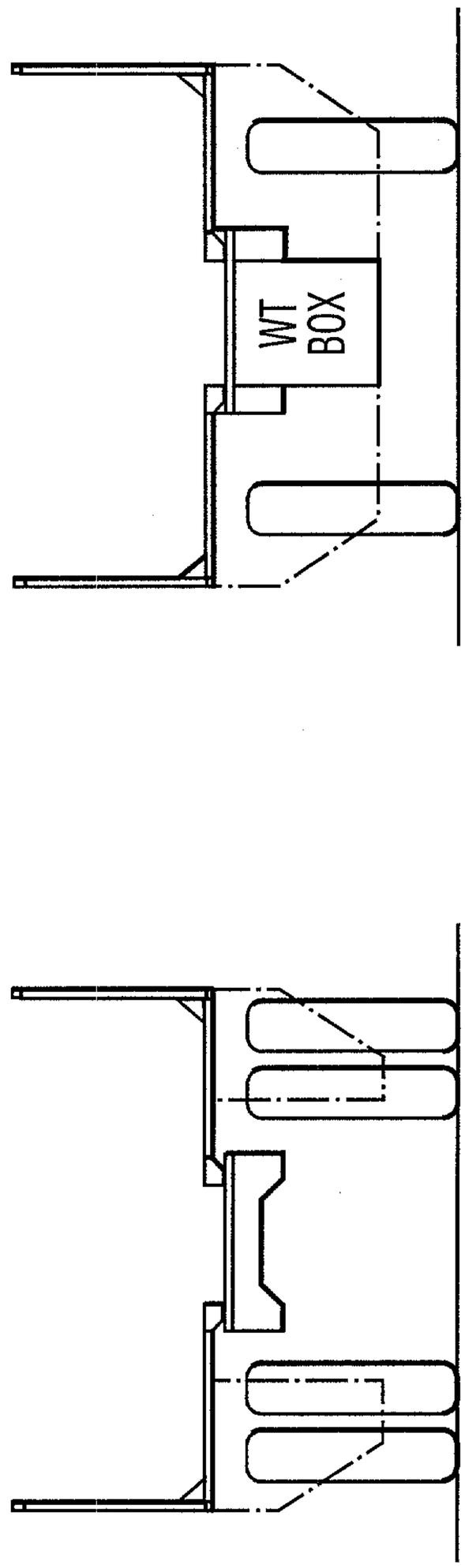


FIG. 2C

FIG. 2B

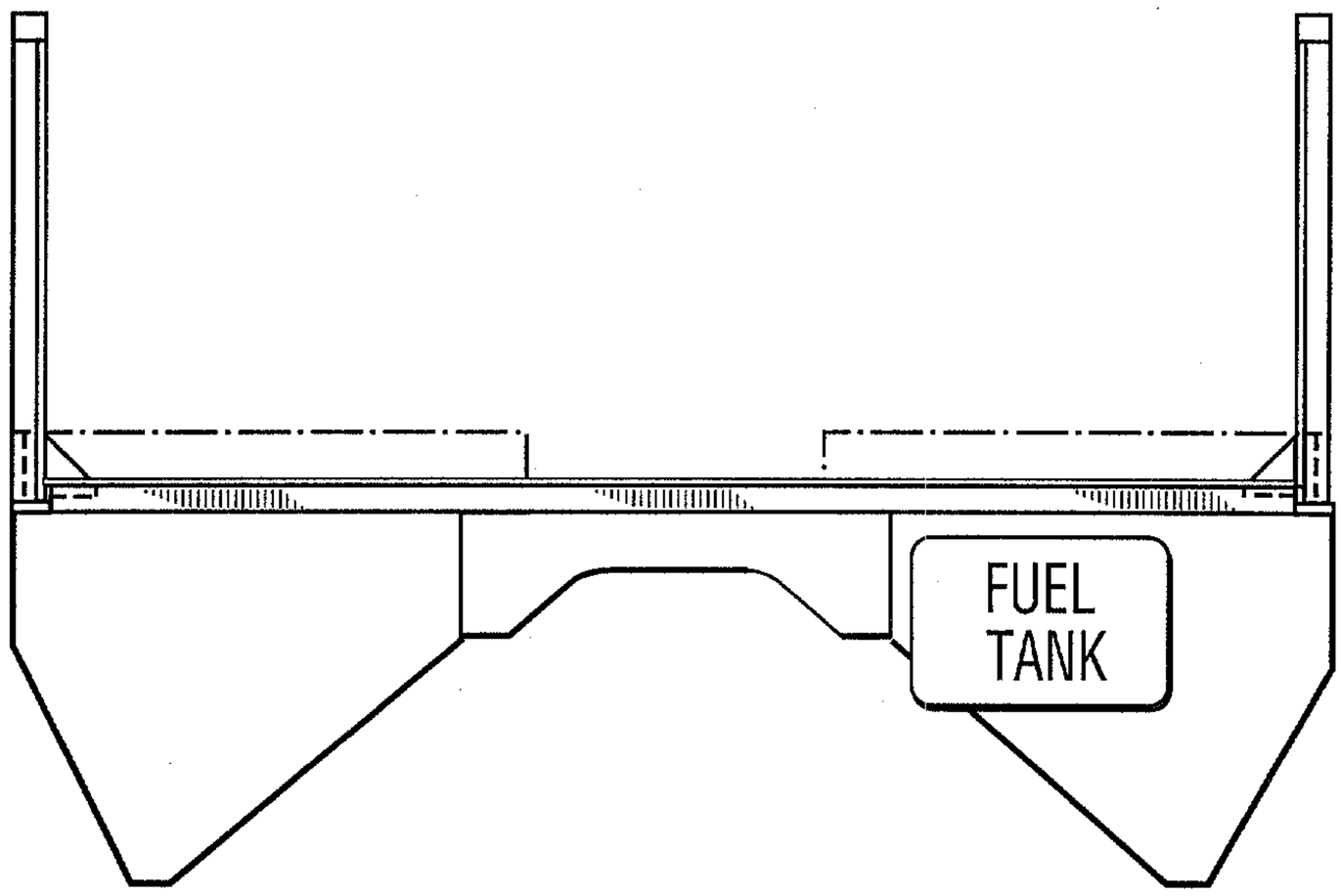


FIG. 3

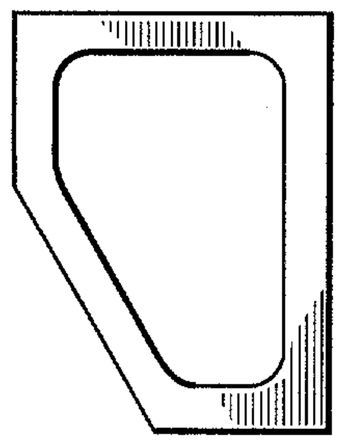
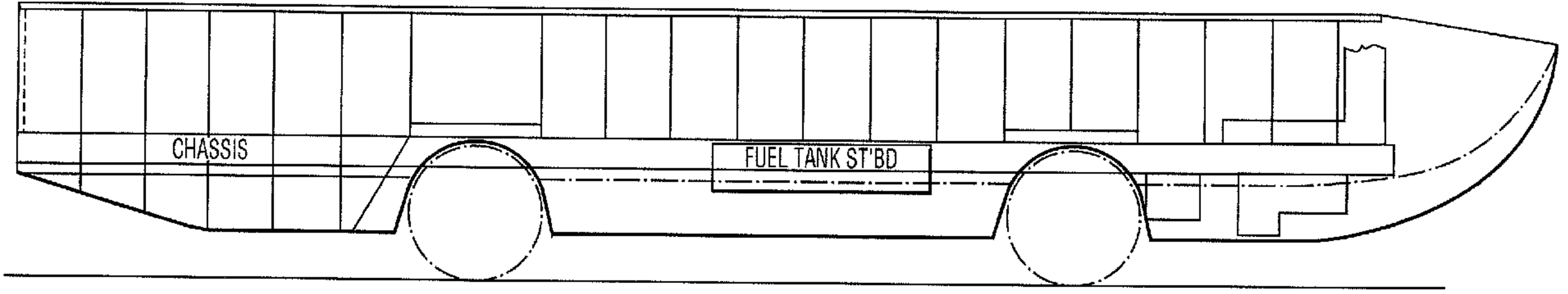


FIG. 4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