July 23, 1946. J. M. HAIT 2,404,492

AMPHIBIAN

Filed Feb. 15, 1943 4 Sheets-Sheet 1

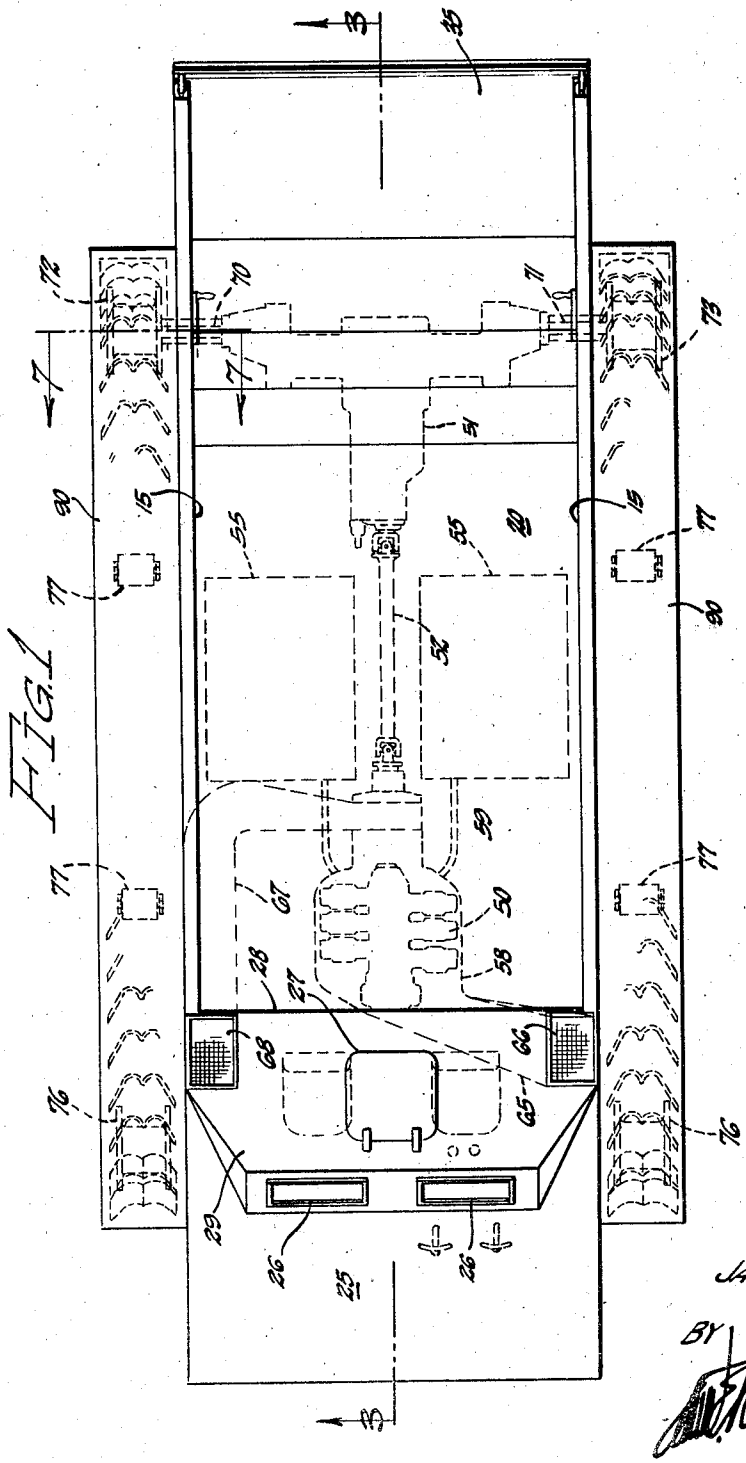


FIG. 1

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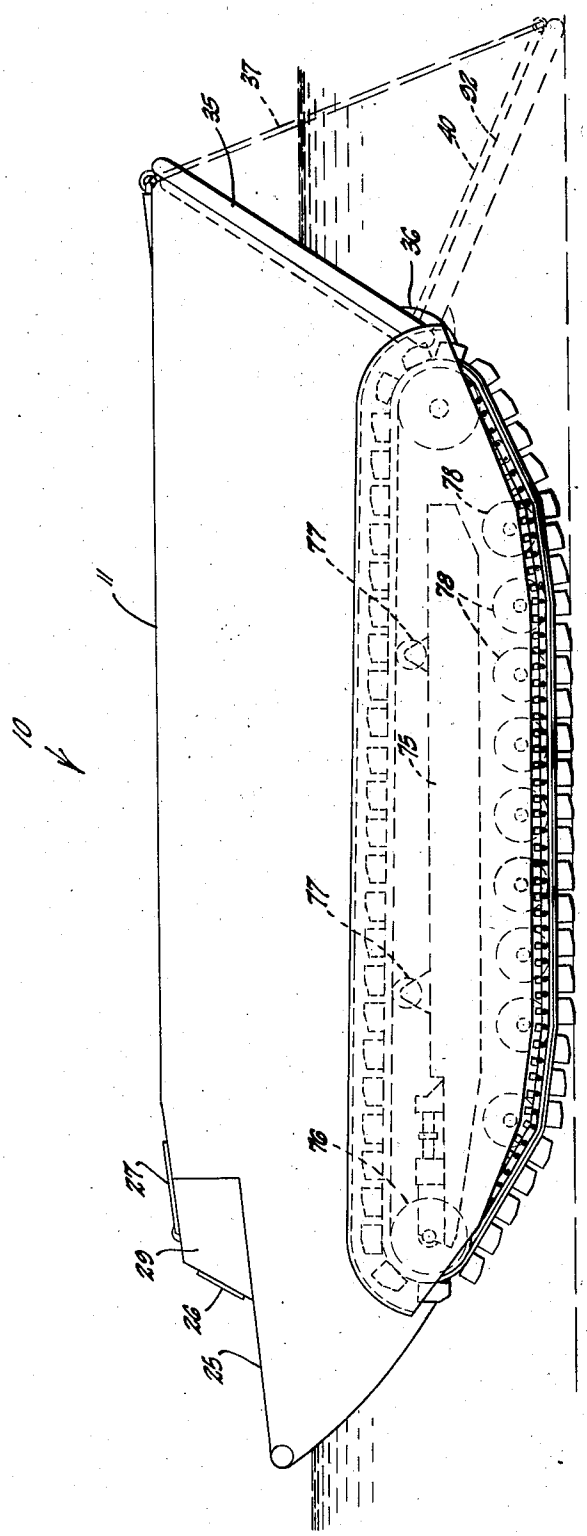



FIG. 2

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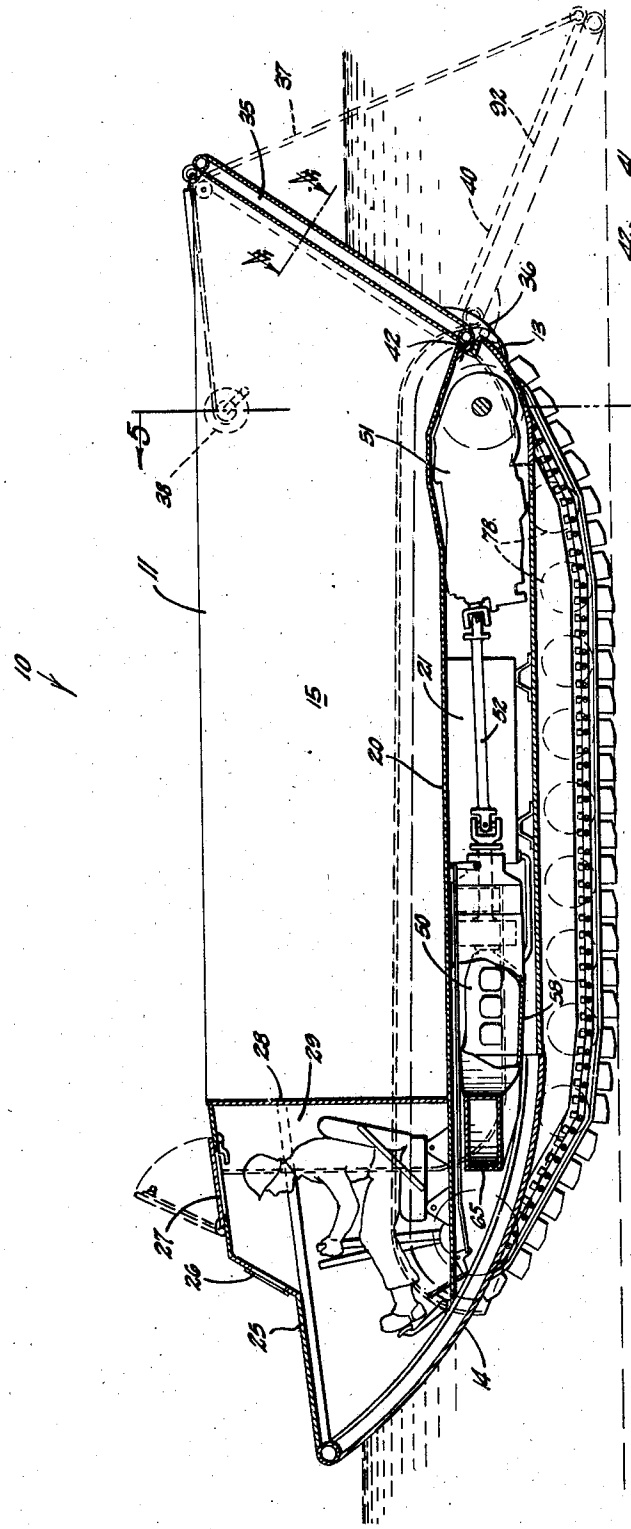


FIG. 3

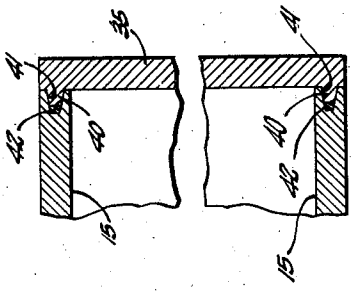


FIG. 4

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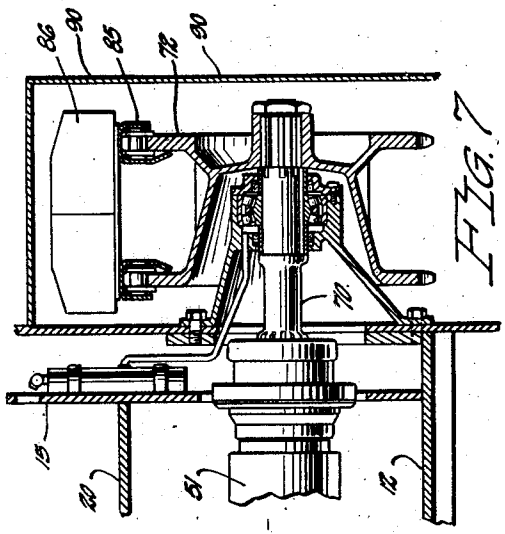


FIG. 7

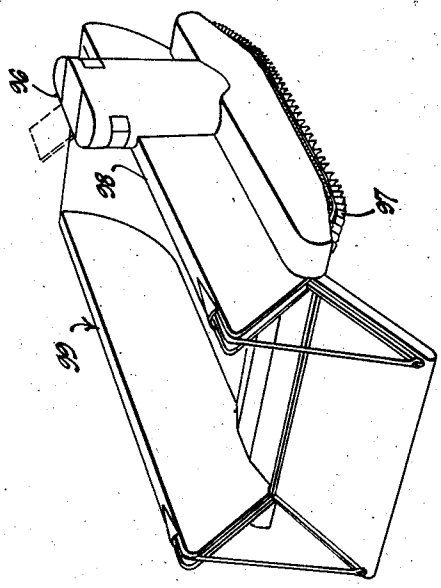


FIG. 6

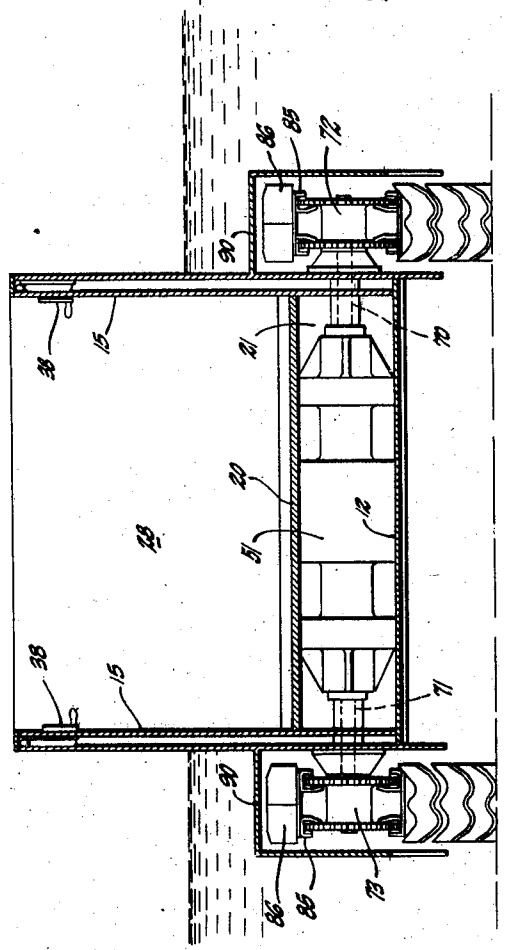


FIG. 5

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Patented July 23, 1946 2,404,492

# UNITED STATES PATENT OFFICE

2,404,492

## AMPHIBIAN

James M. Hait, San Gabriel, Calif., assignor to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application February 15, 1943, Serial No. 475,935

7 Claims. (Cl. 115—1)

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This invention relates to amphibians, and has particular utility in cargo-carrying amphibians employed in amphibious naval warfare.

Amphibians provided for this purpose have track-laying belts mounted on opposite sides thereof, and must be relatively short to permit them to turn readily by differential driving of these belts. The cargo-carrying compartment in the ship must therefore be fairly deep with its floor well below the water level, to accommodate the load they are designed to carry. Access to the cargo compartment in the loading or unloading of cargo, is had by lifting the cargo over the topside, and this constitutes a serious drawback where heavy pieces of cargo are carried, as it requires a large force of men or special equipment to accomplish the loading or unloading of the ship.

Another serious handicap inherent in this design is found in the hazards to which soldiers carried by the amphibian are subjected when they have to climb over the topside in the face of enemy fire, either to enter or leave the amphibian.

It is an object of my invention to provide an amphibian onto which cargo may be loaded and from which it may be unloaded without passing over the topside of the ship.

Contrary to amphibians, the common design of landing boats is to make these relatively long and shallow, with their deck disposed above the water level, and provide an end door which may be lowered onto the beach to serve as a ramp over which men and cargo, including wheeled vehicles, may be transferred from the deck onto the beach, or vice versa. However, amphibian designers have heretofore been bound by certain prejudices which prevented the conception of an amphibian equipped with any such door.

For an amphibian to be well balanced in the water, either when loaded or light, it is necessary that the heavier elements of the equipment, such as the engine, transmission, control cabin, and fuel tanks be distributed about the ship in balancing relation with the center of buoyancy. It has become accepted as an unavoidable necessity, therefore, to occupy and block each end of the ship with one or more of these heavier equipment items. As the track-laying mechanisms are mounted on the side walls of the ship, no way has been apparent of providing a door in a hull wall of the amphibian for introducing cargo into or unloading it from the cargo compartment of the ship.

It is a further object of my invention to provide an amphibian in which the heavier items of

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equipment are so disposed as to give the amphibian good balance in the water when traveling loaded or light, and at the same time leave one end of the amphibian free for the installation of a door therein.

The utility of cargo-carrying amphibians in amphibious warfare is limited by the extent to which they are seaworthy in heavy seas and able to pass through a high surf.

It is an object of my invention to provide an amphibian which has a high degree of seaworthiness.

Amphibians in actual use in the present war have the track-laying belts mounted thereon so that the blades on these belts, which are relied upon to propel the craft when afloat, are lifted out of the water and cause a considerable splash which is visible for long distances and which tends to betray the presence of the amphibian to the enemy.

It is an object of my invention to provide an amphibian which not only has excellent characteristics of seaworthiness, but which operates without the track-laying belts producing any splash.

Heretofore the ratio of the cargo capacity of an amphibian to the weight of the amphibian has been relatively low.

It is yet another object of the present invention to provide an amphibian which is relatively light in weight compared to its cargo-carrying capacity.

In order to carry out the objects of my invention it is necessary that the motor for driving the amphibian be mounted on or adjacent the bottom of the amphibian hull. The necessity for eliminating all excess weight in these amphibians makes aviation motors particularly suitable for the power plant. Some of the best aviation motors now available are air-cooled and because of the bilge water which inevitably collects in the space just above the bottom of any ship, such engines are likely to be quickly corroded and rendered unreliable by bilge water if mounted close to the hull bottom.

A still further object of my invention is to provide an amphibian in which an air-cooled motor may be mounted close to the hull bottom without the motor being subjected to the corrosive action of the bilge water.

The manner of accomplishing the foregoing objects, as well as further objects and advantages, will be made manifest in the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatic plan view of a preferred embodiment of the invention.

Fig. 2 is a side elevational view of Fig. 1.

Fig. 3 is a longitudinal vertical sectional view of Fig. 1, taken on the line 3—3 of Fig. 1.

Fig. 4 is a detail diagrammatic sectional view taken on the line 4—4 of Fig. 3.

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 3.

Fig. 6 is a diagrammatic perspective view of a modified form of the invention.

Fig. 7 is an enlarged transverse vertical sectional view illustrating the connection of a drive sprocket to the transmission of the amphibian of my invention.

Referring specifically to the drawings, the amphibian 10 shown therein includes a hull 11 having a central bottom plate 12, the stern portion 13 of which is curved, an arcuate bow plate 14, and side walls 15.

Spaced from the bottom 12 is a floor 20, which cooperates with the bottom to form a shallow power plant compartment 21. The bow of the amphibian 10 is provided with a deck 25 providing windows 26 and an escape hatch 27, this deck cooperating with a bulkhead 28 and the forward portion of the floor 20 to form a control cabin 29.

The rear end of the hull 11 is closed by a door 35 which is attached to the hull by hinges 36 and is adapted to be closed or opened by cables 37, which are operated by ratchet winches 38 mounted in the side walls 15. As shown in Fig. 4, the door 35 is provided with tongues 40 which extend into grooves 41 provided in the adjacent edges of the side walls 11 when the door 35 is closed. Strips 42 formed of yieldable packing material, such as rubber, are disposed in the grooves 41 and between the bottom of the door 35 and the adjacent edge of the hull, so as to provide a water-tight seal between the hull and the door when the latter is closed.

Mounted in the compartment 21 on the bottom 12 is a relatively flat opposed-cylinder engine 50, and a differential drive gear transmission 51, the latter being driven by said engine through a drive shaft 52. The engine 50 is preferably an air-cooled, aircraft type engine, the engine illustrated being a Continental 6-cylinder engine which develops 175-horsepower. Fuel for the engine is provided in tanks 55 which are disposed in the compartment 21 on opposite sides of the shaft 52.

The engine 50 is preferably covered by a housing 58, and has a fan unit 59 built integral therewith to suck air through the housing 58 to cool the engine. Air is delivered to the housing 58 by a conduit 65 which connects with the atmosphere through a screened opening 66. Air discharged from the fan unit 59 passes through a conduit 67 and out into the atmosphere through a screened opening 68. The conduits 67 and 65 preferably pass upwardly through opposite rear corners of the control cabin 59 to the openings 66 and 68, which are provided in the highest portion of the control cabin deck 25. Any suitable water trapping means (not shown) may be provided in the conduits 65 and 67 to divert to the bilge pump (not shown) any sea water which might enter the openings 66 and 68.

The housing 58 completely encloses the engine 50 so as to protect the motor from contact with any bilge water which may accumulate in the compartment 21. This housing is preferably made of monel metal or some other material which is resistant to the corrosive action of sea water.



The transmission 51 provides suitable gears whereby shafts 70 and 71 may be driven by the engine 50, at the same or different speeds and forwardly or in reverse, and at a suitable number of different gear ratios. Mounted on opposite ends of the shafts 70 and 71 are drive sprockets 72 and 73.

Extending laterally from the hull 11 near the bottom 12 thereof are running gear mounting bases 75 on the front end of each of which is mounted an idle sprocket 76, each base having on the top thereof a pair of idle rollers 77 and along the bottom thereof a series of bogie wheels 78.

Trained about the sprockets 72 and 76, the idle rollers 77 and the bogie wheels 78 on each of the mounting bases 75 is a track-laying belt 85. Each of these belts carries grousers 86 which rest upon the land and provide support and propulsion for the amphibian during land travel, and engage the water and provide propulsion when the amphibian is afloat.

It is to be noted that the upper flights of the track-laying belts 85 are disposed substantially on the level of the upper portions of the sprockets 72 and 76 and are entirely submerged in the water when the amphibian is afloat. These upper belt runs are covered by housings 90, which serve to prevent the development of a substantial counter thrust by these upper belt runs which would negative the propulsive thrust of the grousers 86 carried by the lower runs of these belts.

It is to be noted that by my invention I have provided an amphibian in which the heavier elements thereof are all disposed at a relatively low position on the craft, these elements including the engine 50, transmission 51 and the track-laying belts 85 with the devices for mounting these on the hull. This disposition produces an amphibian with a remarkably high degree of seaworthiness, inasmuch as the center of gravity is a maximum distance below the center of buoyancy. It is also to be noted that by disposing both the motor 50 and the transmission 51 below the floor 20, I have freed an end of the hull 11 so as to make possible the provision therein of a door 35, which, when in its lowermost position, indicated by broken lines 92 of Fig. 3, will form a ramp greatly assisting in the loading or unloading of cargo from the amphibian and rendering unnecessary the lifting of cargo over the topside of the craft when the latter is on land.

It is also to be noted that the amphibian of my invention combines splashless propulsion with the advantages aforesaid, by causing the grousers 86 to operate at all times beneath the surface of the water sustaining the amphibian. The engine 50 and transmission 51 are, of course, controlled from the cabin 29 by suitable control devices, some of which are diagrammatically shown, but which it is unnecessary to disclose in detail, as these are well known in the art.

Although the door 35 is shown as controlled by winches 38, it is to be understood that this door may be operated by power or any other suitable means.

The provision of a non-corrosive housing 58 for enclosing the air-cooled engine 50, contributes substantially to making practical the mounting of this motor in what is ordinarily considered dead bilge space in a ship. This housing not only protects the engine from the bilge water, maintaining it in good running condition, but conducts air about the cylinders of the engine which keeps these from overheating.

While the control cabin 29 is preferably provided in one end of the amphibian 10 a modified form of amphibian 95 is shown in Fig. 6 in which the entire interior of the amphibian is left free for the carrying of cargo and a control cabin 96 is mounted over one of the track-laying belts 97 in one of the side walls 98 of the hull 99.

What I claim is:

1. In an amphibian, the combination of: a hull having a bottom and side walls; two track-laying belts; means for mounting said belts on said side walls of said hull, said belts being equipped with means for propelling said amphibian when afloat, and for supporting and propelling the same when traveling on land, and at a height to give adequate clearance for said bottom to pass over obstacles encountered in land travel; means for closing opposite ends of said hull; a floor cooperating with said side walls and said hull end closing means to provide a cargo compartment in said amphibian, said floor being spaced from said hull bottom to form a shallow power plant compartment between said bottom and said floor; a relatively flat internal combustion engine mounted in said power plant compartment; a transmission disposed in said power plant compartment; means for connecting said engine to said transmission, and means for connecting said transmission to said track-laying belts.

2. An amphibian comprising: a hull having a bottom, side walls and means for closing opposite ends of the hull; a floor spaced from said bottom to provide a shallow power plant compartment; a relatively flat engine disposed in said compartment; a differential speed drive transmission disposed in said compartment on the opposite side of the center of buoyancy of said hull from said engine; means for transmitting power from said engine to said transmission; shafts connecting with said transmission and extending laterally through said hull; drive sprockets on said shafts; a pair of track-laying belts trained about said sprockets and means cooperating with said drive sprockets for mounting said track-laying belts on said hull so that said amphibian is supported on the lower runs of said belts at a height to give adequate clearance for said bottom to pass over obstacles encountered in land travel.

3. An amphibian comprising: a hull having a bottom, side walls and means for closing opposite ends of the hull; a floor spaced from said bottom to provide a shallow power plant compartment; a relatively flat engine disposed in said compartment; a differential speed drive transmission disposed in said compartment, said engine and transmission being disposed about the center of buoyancy to counterbalance each other; means for transmitting power from said engine to said transmission; shafts connecting with said transmission and extending laterally through said hull; drive sprockets on said shafts; a pair of track-laying belts trained about said sprockets; means cooperating with said drive sprockets for mounting said track-laying belts on said hull so that said amphibian is supported on the lower runs of said belts at a height to give adequate clearance for said bottom to pass over obstacles encountered in land travel, and to entirely submerge said belts beneath the surface of the water whenever said amphibian is afloat; and means for housing over the upper runs of said belts to substantially prevent the development of a counter propulsive thrust by said upper runs.

4. A combination as in claim 1, in which a door is provided in one end of said hull and hinged at its lower edge substantially on the level of said floor; means for opening and closing said door, said door when open forming a ramp for loading and unloading said amphibian; and means forming a water-tight seal between said door and said hull when said door is closed.

5. A combination as in claim 1, in which a control cabin is provided at one end of said hull and a door provided in the opposite end of said hull; means for opening said door so that the latter will form a ramp to assist in loading or unloading said amphibian, and for closing said door; means for integrating said door with the balance of said hull when said door is closed; and means for forming a water-tight seal between said door and said hull when said door is closed.

6. An amphibian comprising: a hull having a bottom and side walls, and means closing the ends of said hull; two track-laying belts; an engine mounted on said bottom; a differential speed drive transmission mounted on said bottom and connected to said engine, said engine and transmission being disposed about the center of buoyancy in balancing relation therewith; drive sprockets disposed outside said hull on substantially the same level as said engine and transmission and connected to opposite sides of said transmission; two track-laying belts trained about said drive sprockets; means cooperating with said drive sprockets for mounting said belts on said side walls of said hull, said belts being equipped with means for propelling said amphibian when afloat and for supporting and propelling the same when traveling on land, and at a height to give adequate clearance to permit said bottom to pass over obstacles encountered in land travel; a floor covering said engine and transmission; and a control cabin provided in one of said side walls and overlying one of said belts.

7. A combination as in claim 6, in which a door is provided in one end of said hull; and means for closing said door or opening the same so that the latter forms a ramp to assist in loading or unloading said amphibian.

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