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 [33] **Germany**
 [31] **P 15 56 451.9**

Primary Examiner—Andrew H. Farrell
Attorney—Robert H. Jacob

[54] **AMPHIBIOUS VEHICLE**
5 Claims, 24 Drawing Figs.

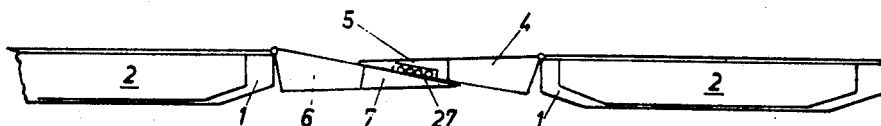
[52] U.S. Cl. **115/1**
 [51] Int. Cl. **B63f 3/00**
 [50] Field of Search **115/1**

[56] **References Cited**

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ABSTRACT: Amphibious vehicle adapted for use as a ferry or a bridge unit with a vehicle body in the form of a floating unit having auxiliary floating members at its longitudinal sides which can be blown up and swung outwardly, and ramps linked to both ends of the body that have a pivot joint centrally with respect to the length thereof, where the ramps are also in the form of buoyant hollow bodies and which, when unfolded, are of a length corresponding to the length of the vehicle and when folded are shortened to one-half the length, and are equipped with coupling means at the end surfaces thus established, where furthermore loose planks are arranged on the vehicle the length of which corresponds to the width of the lateral auxiliary floating members in blown up or unfolded condition, and where associated retaining and connecting means are provided on the vehicle, the ramps and the auxiliary floating members on the one hand and on the planks on the other hand.



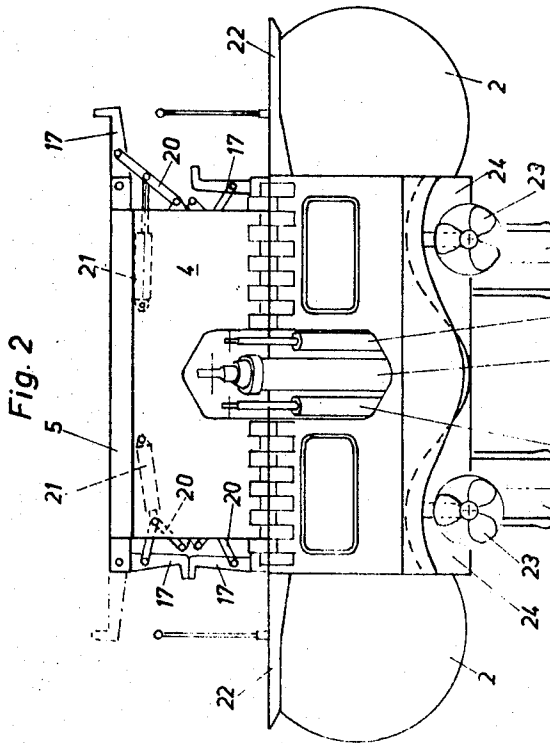


Fig. 1

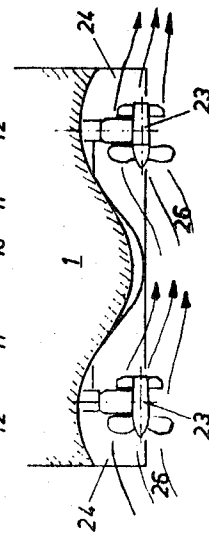


Fig. 2

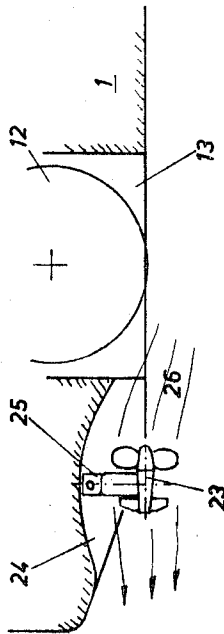


Fig. 3

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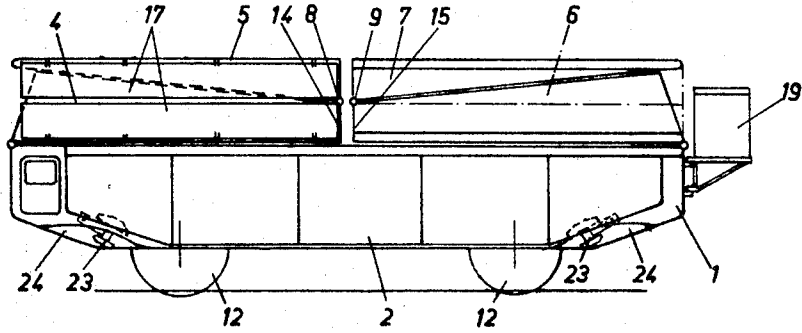


Fig. 5

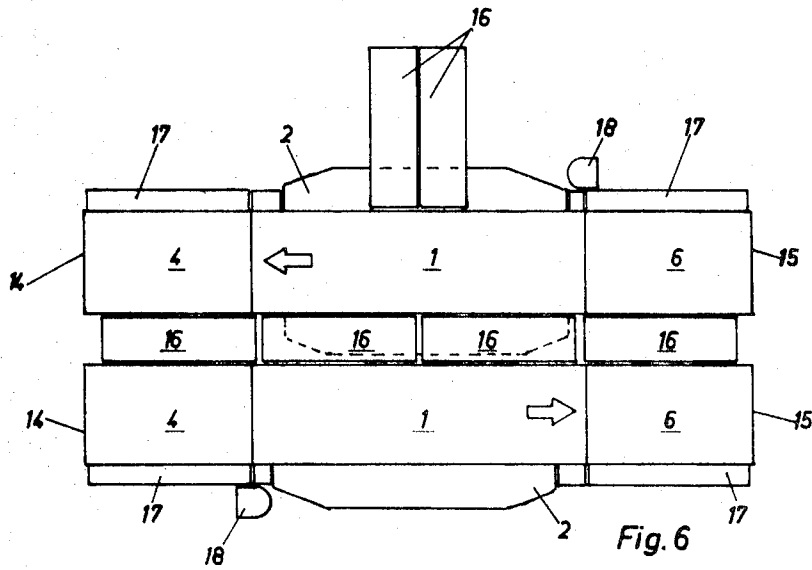


Fig. 6

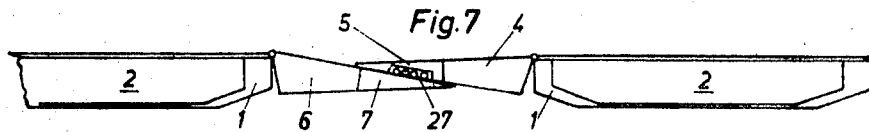


Fig. 7

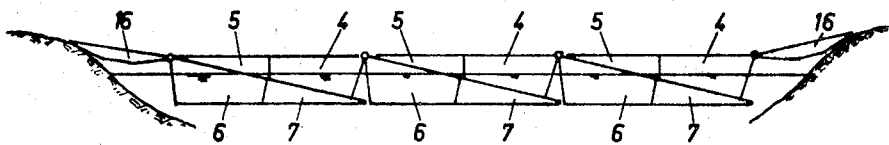
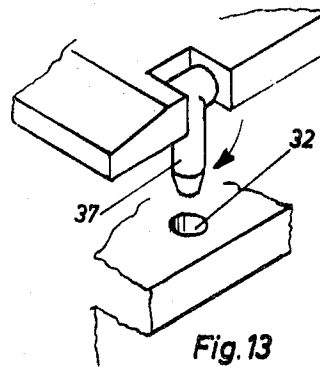
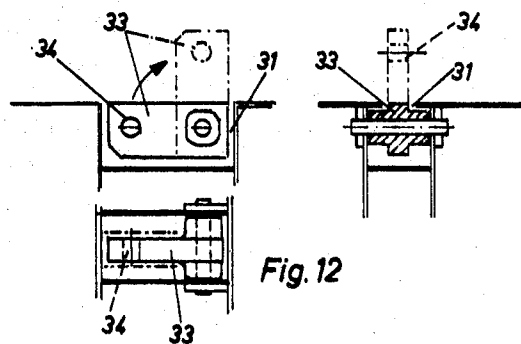
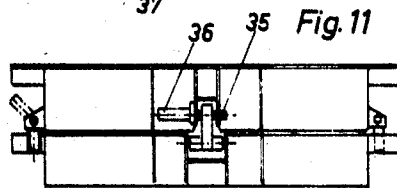
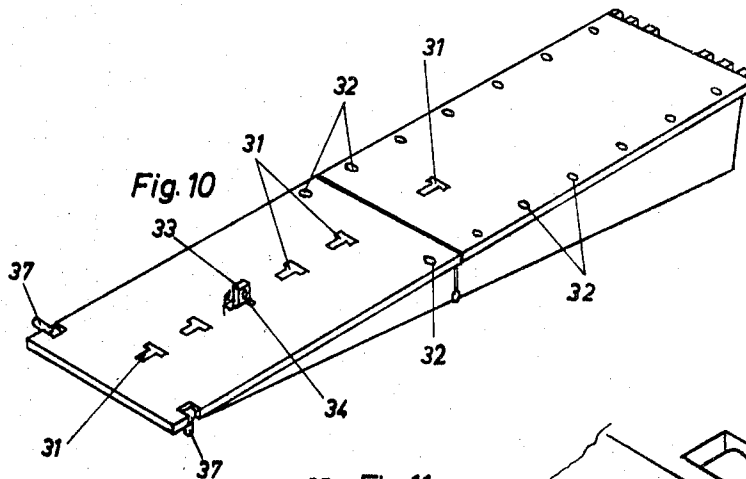
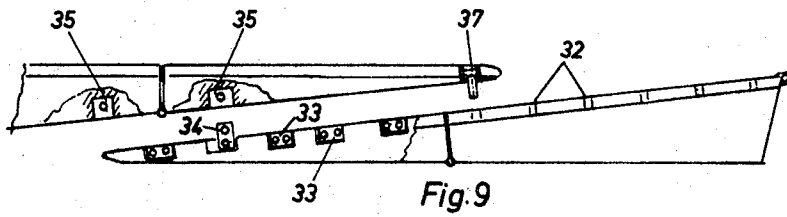
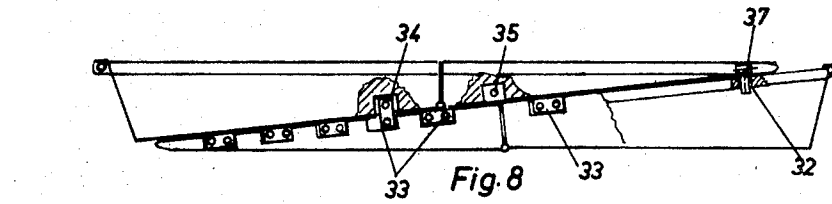


Fig. 14

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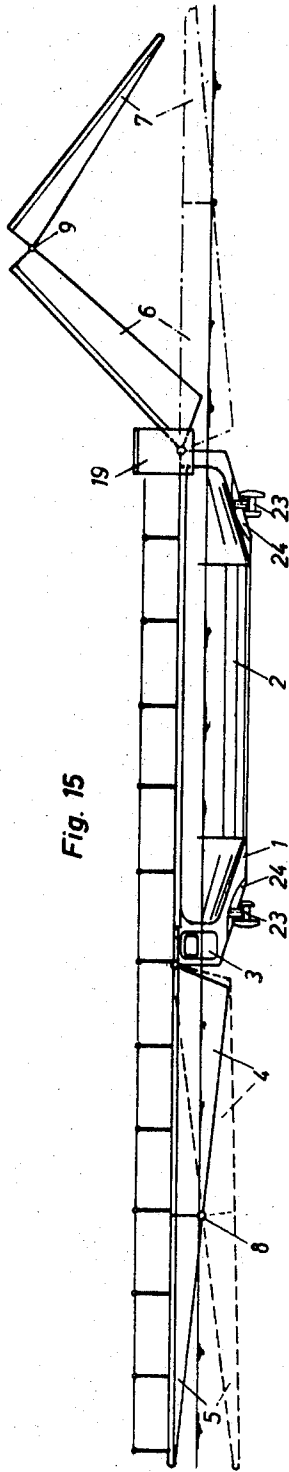


Fig. 15

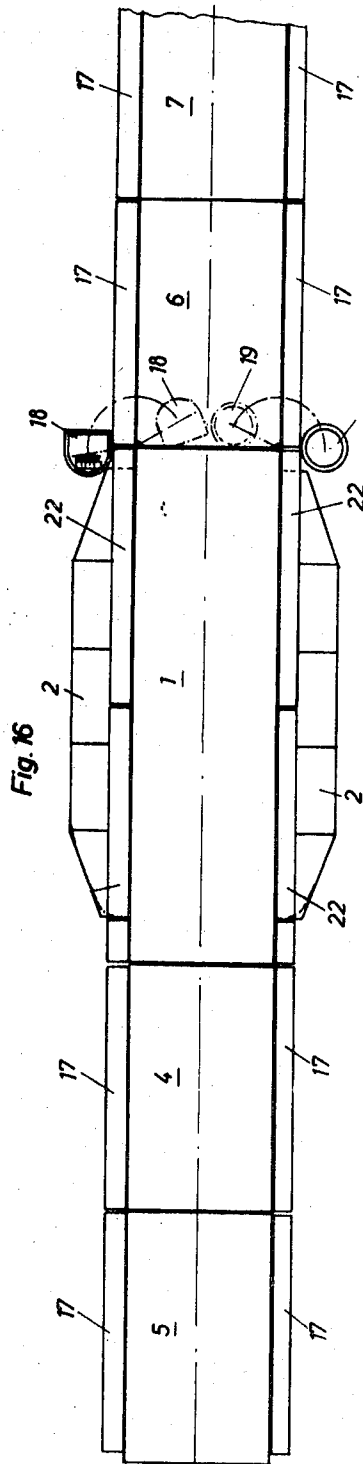


Fig. 16

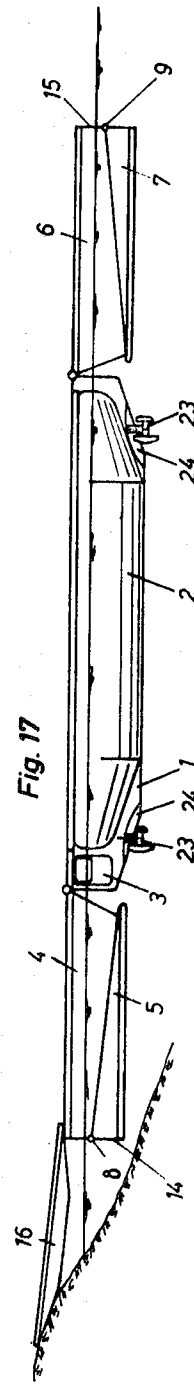


Fig. 17

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Fig. 18

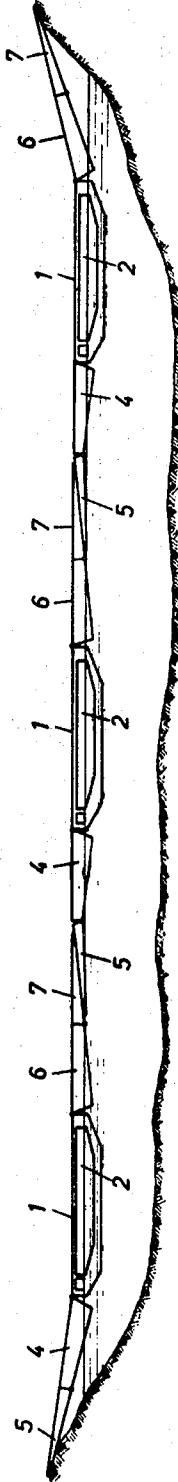


Fig. 19

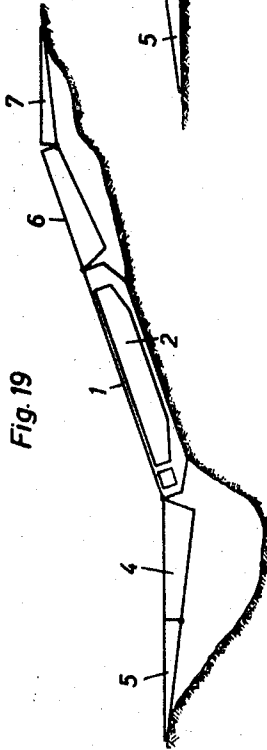


Fig. 20

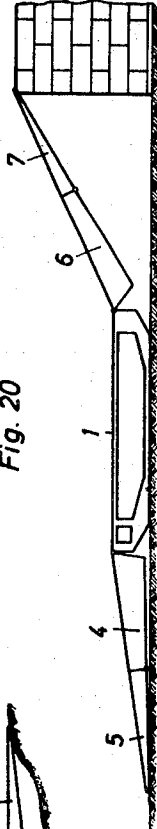
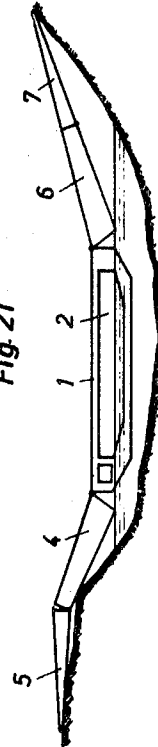


Fig. 22



Fig. 21



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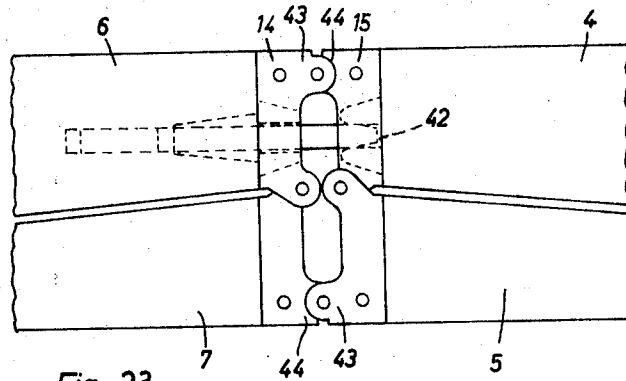


Fig. 23

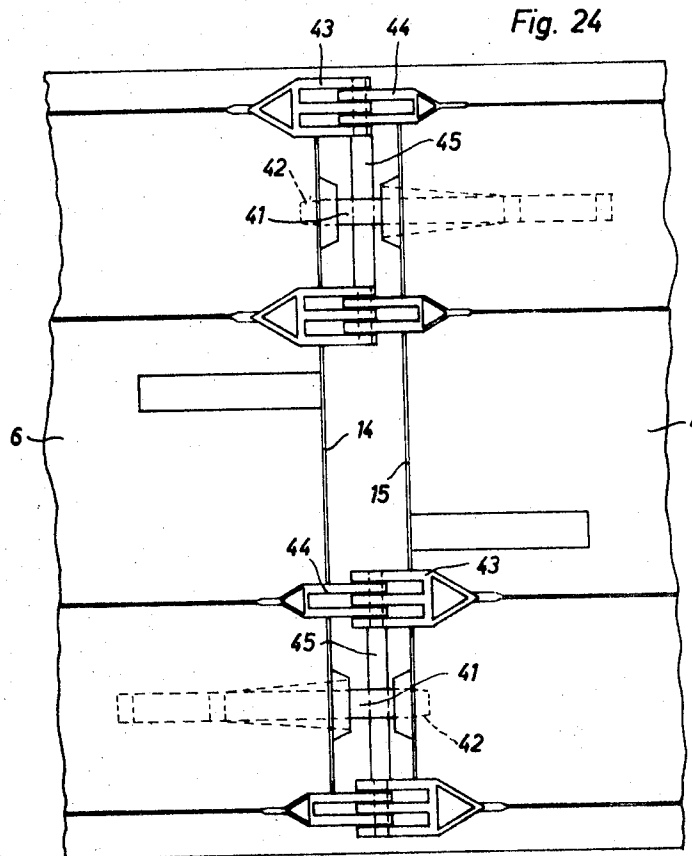


Fig. 24

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AMPHIBIOUS VEHICLE

BACKGROUND OF THE INVENTION

The invention relates to amphibious vehicles of the type which can be utilized as bridging units on land as well as in the water. More in particular, the invention is concerned with an amphibious vehicle derived from known embodiments which are adapted to be deployed individually as a ferry or in combination with other vehicles as a larger ferry, on land for bridging obstacles in the terrain such as valleys or the like, or as bridge vehicles in combination with a floating bridge, and which have two ramps linked to the ends as well as auxiliary floating bodies provided laterally of the vehicle.

The demands that are made of such vehicles regarding the scope of the deployment possibilities are extremely great. These requirements are further increased by the fact that the vehicles normally have to be deployed in rapidly flowing waterways, frequently transversely of the direction of the stream, and which are furthermore expected to be able to take over extremely heavy loads on the high seas from correspondingly seaworthy vessels. In addition to these characteristics that are essential for seaworthiness the vehicle must also be adapted for deployment on land to overcome the most variegated obstacles, such as steps in the terrain, ditches, valleys and the like. Where ditches and valleys are concerned, the additional difficulty may exist that they are entirely or partly filled with water or are swampy.

This means that amphibious vehicles of this type must, on the one hand, be extremely versatile in their appointments, particularly their ramps and similar equipment, permitting the most difficult kind of cargoes and which permit optional coupling together of the vehicles in various different ways, which also permit safe docking of the vehicles against piers or land, while on the other hand, the vehicles require sturdy readily operable and controllable drive means which are nevertheless sensitive and extremely responsive, especially during operation on water.

SUMMARY OF THE INVENTION

In accordance with the invention a vehicle of this type is provided which is based on an amphibious vehicle having a vehicle body in the form of a floating body, along the longitudinal sides of which auxiliary floating bodies are arranged that may be blown up or unfolded and at both ends of which vehicle body ramps are pivotally connected which have a folding or pivot joint at the center as related to their length, where these ramps are likewise in the form of hollow floating bodies which in accordance with the invention may be unfolded to a length corresponding to the length of the vehicle body and folded to be shortened to half the length, where the end surfaces thus formed are equipped with coupling means, and furthermore loose planks are associated with the vehicle, the length of which is about half the length of the vehicle, i.e., corresponding at the same time to the length of the folded ramps, and the width of which corresponds to the width of the lateral auxiliary floating bodies in blown up or unfolded condition that normally disappear in the sidewalls of the main floating body and which furthermore have associated cooperating supporting and connecting means on the vehicle body, the ramps and the auxiliary floating bodies on the one hand and the planks on the other hand.

By equipping an amphibious vehicle of this type with ramps and planks a plurality of assembly possibilities is provided which are described more in detail hereinafter, and thus the possibilities of deployment of such a vehicle in water and on land are made possible, especially with a plurality of such vehicles.

The ramps that are pivotally connected at the ends are preferably interchangeable, and thus they are implicitly removable. Thus, under certain conditions a plurality may be coupled together to form independent floating bodies, in which event, however, they are without driving means.

For example, the parts of the ramps are furthermore equipped with corresponding connecting means at their top and bottom sides which permit more or less extensive sliding over one another of the ramp parts of adjacent vehicles and of coupling them together in different positions.

In order to fully and completely utilize the given possibilities of deployment the vehicle is preferably equipped at the stern with a second operating or piloting station, which is adapted to be swung out about a vertical axis at the vertical side corner of the stern and which is furthermore removable. In addition, it is possible to provide at the stern of the vehicle, at the free vertical side corner thereof, an observation platform that may also be adapted to be swung out and removable.

For the operating or driving station and the observation station at the stern of the vehicle the means provided for the pivotal movement thereof may be operated from the stations as well as also from the driver's cabin.

The ramps pivotally connected to the stern may be equipped with laterally unfoldable enlargement or widening bridges in a manner already known per se. The covers for the expandable or unfoldable auxiliary floating bodies are formed on the vehicle body proper as such widening bridges. When the aforementioned additional planks are used, the widening bridges of the ramps are folded in.

Finally, in order to satisfy the critical maneuvering qualities required particularly for deployment in water, the vehicle is equipped with four rudder propellers, two each of which are provided at the bow and two at the stern of the vehicle. These rudder propellers are pivotally mounted in recessed bights of the vehicle body which are adapted to the current conditions for forward, rearward and lateral driving.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and features of the invention and details thereof will become apparent from the following description of the invention with reference to the accompanying schematic drawings thereof, in which

FIG. 1 shows the bow portion of the vehicle in a lateral view for propulsion on land,

FIG. 2 shows this bow portion in an end view,

FIG. 3 shows the bow portion for water propulsion in a side view,

FIG. 4 is an end view of the portion illustrated in FIG. 3,

FIG. 5 is a side view of the complete vehicle in condition for travel on land,

FIG. 6 illustrates an example of deployment as a double ferry,

FIG. 7 illustrates a special coupling possibility for two vehicles which

FIGS. 8 to 13 illustrate more in detail,

FIG. 14 shows the deployment of removed ramps solely as a floating bridge.

FIG. 15 is a side view of the vehicle arranged for travel on water with the end ramps unfolded,

FIG. 16 is a top view corresponding to FIG. 15,

FIG. 17 shows the vehicle connected to a bank,

FIG. 18 illustrates an example of deployment of a plurality of vehicles as a floating bridge,

FIGS. 19 and 20 show deployment examples for bridging obstacles on solid terrain,

FIG. 21 shows the bridging of a ditch filled with water,

FIG. 22 illustrates the deployment of two vehicles coupled together as a ferry, and

FIGS. 23 and 24 illustrate the coupling means employed between ramps when folded on top of the vehicles as shown in FIG. 5.

The vehicle in accordance with the invention has a vehicle body 1 in the form of a floating body having a deck surface 1a, along the sides of which expandable auxiliary floating members 2 are provided. At the bow the vehicle has a pilot cabin 3. Furthermore, the vehicle is equipped with ramps linked to the two ends composed of parts 4,5 and 6,7 which can be col-

lapsed or folded together about pivot points 8,9 provided centrally thereof. These ramp parts 4,5 and 6,7 are likewise in the form of buoyant or floatable hollow bodies.

The pivotal movement for folding and unfolding the ramps is effected by means of hydraulic cylinders 10 and 11.

The wheels 12 are completely retractable in a known and conventional manner into wheel bays 13 as indicated in dot and dash lines.

The ramps 4,5 and 6,7 when unfolded are of a length corresponding to the vehicle body 1, and when collapsed or folded, they each have one surface proximate said deck surface 1a, are shortened to half the length, and at the end surfaces 14,15 thus formed they are equipped with coupling devices to be connected with one another end to end.

These coupling devices may be of any desirable form of construction. One embodiment of coupling means is illustrated in FIGS. 23 and 24, where prongs 41 on one ramp end engage recesses 42 in the oppositely disposed end of the other ramp so that the ramps are first aligned. Thereupon the ramps are clamped together by means of bolts 45 inserted through eyelets in cramps 43,44 mounted on the ends of the ramps.

Furthermore, planks 16 are provided with the vehicle, the length of which corresponds approximately to half the length of the vehicle, i.e., also to the length of the folded ramps 4,5 or 6,7, and the width of which is adapted to the width of the lateral auxiliary floating bodies 2 in blown up or expanded condition. These planks 16 as well as also the vehicle body 1, the ramps 4,5 and 6,7, as well as the auxiliary floating bodies 2 are equipped with individual supporting and connecting means that are coordinate to one another. Preferably these supporting and connecting means are constructed in a manner that they permit of loosely hanging or hooking in the planks 16. However, arrangements may also be made that suitably disposed hydraulic cylinders that may be connected with the planks 16 are adapted to place the planks 16 into different angular positions.

The ramps 4,5 and 6,7 are removable and interchangeable.

The amphibious vehicle in combination with the lateral floating bodies, endwise linked folding ramps and additional planks is now in a condition to satisfy all imaginable requirements. Thus, for example, a ferry may be formed by two vehicles (FIG. 6) when they are coupled together while using one auxiliary floating body between the two vehicles. The intermediate space can be bridged by planks 16, while the planks 16 may also serve as laterally disposed ramps. Ramps 4,5 and 6,7 are opened in folded condition so that in their turn they contribute to the increase of buoyancy. In this particular manner the vehicles in accordance with the invention can moreover be coupled together at the ends to form a floating bridge having two runways, in which even the lateral arrangement of the planks 16 as ramp members is eliminated. The ramps 4,5 and 6,7 may be equipped with enlargement or widening bridges 17.

However, since especially when maneuvering in water the pilot cabin 3 does not provide the necessary visibility, a second control or operating station 18 is provided at the stern of the vehicle which is pivotally movable about a vertical pivot axis at the lateral corner of the stern of the vehicle and which, moreover, can be dismounted. At the opposite lateral corner of the vehicle which is still free, an additional observation stand or platform 19 may be provided, which is likewise pivotally movable about a vertical pivot axis and which is also dismountable (FIG. 16). These stations are unfolded towards the outside for travel on water, while for travel on land they are folded inwardly in order to avoid unnecessary widening of the profile of the vehicle.

The operator's station 18 is, of course, equipped with suitable connecting means which also permit steering of the vehicle from this operator's station. Furthermore, pivoting means for both stations may be provided, which are operable from the pilot cabin as well as also from the stations proper.

The aforementioned widening bridges 17 of the ramps 4,5 and 6,7 can be operated by suitable bars or brackets 20 by

means of hydraulic cylinders 21. In the area of the sides of the vehicle bodies 1 the covers 22 of the lateral auxiliary floating bodies 2 serve as such enlargement bridges.

In accordance with the invention the vehicle is furthermore equipped with four rudder propellers 23 or corresponding other water driving means, two each of which are provided at the bow and two at the stern of the vehicle. These rudder propellers 23 are arranged in recessed bights 24 of the vehicle body that are adapted for the current conditions for forward, rearward and lateral travel. As customary the rudder propellers are pivotable about a horizontal axis 25 into the bights 24 and beyond that in their unfolded condition they are pivotable by means of their vertical axis. The construction of the bights 24 and the current flow conditions indicated by means of arrows 26 are indicated especially in FIGS. 3 and 4, for forward travel in FIG. 3, and in FIG. 4 for side travel.

The ramp parts 5,7 may be equipped with special adjustable connecting means 27 (FIG. 7) which permit end to end connection of vehicles coupled together with completely unfolded ramps with the ramps overlapping at different widths. In this manner the loading surface and carrying capacity or buoyancy can be varied, and furthermore the distance can be regulated in connection with floating bridge arrangements.

In the following FIGS. 8 to 12 the connecting means 27 are illustrated in detail. The top sides of the unfolded ramp parts 4,5 and 6,7 are provided along their central axis with spaced T-shaped recess 31 as well as with bores 32 along their borders. In the T-shaped recess lugs 33 are inserted which are pivotally movable upwardly out of the plane of the top surfaces of the ramp portions 4, 5, 6, 7 and provided with a bore 34 in the area of their free ends.

The components cooperating with these means at the bottom sides of the ramp parts 4, 5, 6, 7 are horizontally extending bolts 35 which, guided by a hydraulic cylinder 36, engage or release bores 34 of the lugs 33. Furthermore, studs 37 that are pivotally movable downwardly are provided in the end area of the outer ramp parts 5,6 which are adapted to engage the bores 32.

These means make it possible to slide the ramp parts 4, 5, 6, 7 more or less over one another and then latch them to one another. For this purpose the procedure is preferably such that the ramp parts that are slid under are brought from below against the ramp parts extending over them so that the different connecting and latching means can engage each other.

The ramps 4,5 and 6,7 can also be deployed independently of the vehicle bodies as floating bodies, for example, as parts of a floating bridge (FIG. 14), in which event the planks 16 may be utilized as auxiliary ramps for connection with the bank or shore.

FIGS. 18 to 22 show further examples of deployment. In FIG. 18 three vehicles are coupled together to form a floating bridge for spanning a river. In this connection the ramp parts 5,7 of successive vehicles are slid entirely over one another. Depending on the necessary length of the bridge or also depending on the desired or required buoyancy, the ramps can be slid more or less over one another. By means of the end ramps that are provided it is possible to obtain with relatively few vehicles a considerable bridge length, in any event a multiple of the bridge length if vehicles are used that are equipped with bridge portions which essentially are merely of a length that corresponds to the length of the vehicle body proper.

FIGS. 19 and 20 illustrate the vehicle in accordance with the invention deployed for spanning obstacles on solid ground, for example, ditches (FIG. 19) or steps in the terrain (FIG. 20).

FIG. 21 shows an individual vehicle deployed for bridging a small waterway.

FIG. 22 illustrates a ferry assembled from two vehicles, where contrary to FIG. 6, the two vehicles are coupled to one another end to end with the ramp parts 4,5 of one vehicle extending completely under the ramp parts 6,7 of the other vehicle.

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Necessarily the foregoing description is limited to a few examples of deployment of the vehicle. There are practically no limits for deploying this vehicle. It can be utilized as an individual vehicle with the ramps unfolded and with the ramps folded; it can be utilized as an individual vehicle while using the lateral auxiliary floating body or without the same; it can as a single vehicle require the use of additional planks 16, but deployment without these planks is possible. Finally, the vehicle can be coupled in any desired manner to form ferries and floating bridges again with variable utilization of the ramps and planks.

Having now described my invention with reference to the embodiments illustrated, what I desire to protect by letters patent of the United States is set forth in the appended claims.

I claim:

1. Amphibious vehicle for deployment as ferry or bridge vehicle comprising a buoyant vehicle body having a deck surface, inflatable and unfoldable auxiliary floating bodies disposed along the longitudinal sides of said vehicle body and buoyant end ramps linked to both ends of said vehicle body which as related to their length are provided with a central folding joint, said ramps being in the form of buoyant hollow bodies each having a length when unfolded corresponding to the length of the vehicle body and when folded being shortened to half the length and having a surface proximate said deck surface, and presenting adjacent end surfaces, coupling

means on said end surfaces, loose planks associated with said vehicle, the length of said planks corresponding to the length of the folded ramps and the width of said planks corresponding to the width in expanded condition of the buoyant hollow bodies that otherwise disappear in the sidewalls of the buoyant vehicle body, and coordinated supporting and connecting means provided on the vehicle body, the ramps and the auxiliary floating bodies on the one hand and on the other hand on the planks, said vehicle furthermore comprising connecting means, permitting coupling together said buoyant end ramps in overlapping positions.

2. Amphibious vehicle in accordance with claim 1 where said buoyant end ramps are interchangeable.

3. Amphibious vehicle in accordance with claim 1 including an additional control station mounted at the stern of said vehicle and a vertical pivot axis at the stern supporting said station for pivotal movement.

4. Amphibious vehicle in accordance with claim 1 including four rudder propellers, two each mounted at the bow and two each at the stern of the vehicle.

5. Amphibious vehicle in accordance with claim 4 including bights recessed in said vehicle wherein said rudder propellers are mounted and pivot means operable to turn and adapt said rudder propellers to the current flow conditions for forward, rearward and lateral travel.

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