Natatorial Car (Amphibious)
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Abstract:
Natatorial car is capable of going both on land and in water, so it is amphibious in nature. This car uses a single engine for propulsion on both land and in water and has no transformations while switching between the modes. The paddles built into the rear wheel propels the car in the water.

Keywords: amphibious, car, single engine, no transformation, paddles at rear wheel

INTRODUCTION
You would have seen cars that go on land and water in the movies. Such amphibious cars do really exist, but the major issue with those cars is that they are too expensive as they either use dual engines with wheel retraction system or single engine with complicated transmission systems to engage water propeller with sophisticated waterproofing techniques. This car uses a single propulsion system for both the land and in water. There will be no such transformations while switching between the land and water and so it is the same for the car to run both on land and in water. Also the design of this car avoids sophisticated waterproofing techniques which greatly reduces the manufacturing and maintenance cost. On the whole making it cheaper and affordable to the people. As a step of precautionary safety measure – life jackets, radar, GPS programmed with country boundaries and safety alert systems will be provided in this car.

BUOYANCY
For an object to float, the buoyancy condition must be positively satisfied. Here, the dimensions of a general hatchback car is considered for the Buoyancy calculation.

![Fig - 1: Buoyancy Calculation](image)

For the volume calculation, the shape of the car is considered into rectangular segments and the buoyancy calculation is proceeded

where, the width of the car = 1690mm

Volume of the first segment = l*b*h = 1550*534*1690 = 1398813000 sq.mm

Volume of the second segment = l*b*h = 1550*1982*1690 = 5191849000 sq.mm

Volume of the third segment = l*b*h = 762*1219*1690 = 1569803820 sq.mm

Total Volume = 8160465820 sq.mm = 8.160 sq.m

Though sea water density ranges between 1029 to 1050 kg/m³

- Let us consider density of water as 1000 kg/m³

Force produced by buoyancy be "F"

\[ F = Volume \times Density \times Gravity \]

\[ F = 8.160 \times 1000 \times 9.81 \]

\[ F = 80049.6 \text{ Newton (upward force exerted by water on car)} \]

Let \( G \) be the downward force exerted by the car over the water,

\[ G = Mass \times Gravity \]

\[ G = 1480 \times 9.81 \]

\[ G = 14518.8 \text{ Newton} \]

\[ F > G \]

The value of \( G \) is far less than \( F \)

If the force of buoyancy is greater than the downward force produced by the object, the object will float.

On the other hand,

if the downward force is greater, it will sink and if they are equal, the object is said to be neutrally buoyant.

Let us see, the extent of weight upto which the car can float if it is made to float by providing a hull,

\[ F = 80049.6/9.81 = 8160 \text{ kg} \]

\[ F = 8.160 \text{ tons} \]

(until the weight of the car exceeds 8.160 tons, it will float. To the maximum, including the weight of car, passengers, cargo, etc., the weight of the car is never going to exceed 2.5 tons)
**DESIGN**

A. **Shape**

Vehicle structure

Fig - 2 shows the image of duck, from which the shape of this car is inspired, the tadpole shape of this car (converging towards rear) is to support proper motion in water, balancing and as well as for the best possible aerodynamics.

![Fig - 2: Shape inspired - Duck](image1)

Rear wheels with paddles

If the rear wheels are as usual (both pairs of front and rear wheels are of equal size), they will be completely immersed in water while the car gets into the water giving more rotational force and less linear force. So the rear wheels are made larger integrated with paddles in its spokes, for achieving perfect linear propulsion force in the water.

**VIEWS OF NATATORIAL CAR**

Let us see different views of this natatorial car

B. **Front View**

The fig-3 shows the front view of natatorial car. Tadpole shape in the sense means the front part of the car is wider and it converges to the rear end. The front dead axle must be made waterproof which can be done easily at comparatively low cost.

![Fig - 3: Front view of Natatorial Car](image2)

C. **Rear View**

Fig - 4 shows the rear view of this car. The rear wheels are larger as it is designed to support propulsion in water by integrating the paddles into the wheel spokes

![Fig - 4: Rear view of Natatorial Car](image3)

D. **Side view**

The fig - 5 shows the side view of this car.

![Fig - 5: Side view of Natatorial Car](image4)

**WORKING**

The natatorial car is a rear engine car with rear wheel drive. The rear wheels are larger than the pair of front wheels in order to integrate paddles over the spokes of the rear wheel.

Let us see how it goes on land - water and steering methods,

E. **Land**

The working of this car is completely asusual while running on land terrain. The rear wheel is powered by the engine.

F. **Water**

The fig - 6 shows the rear wheel integrated with paddles in the spokes. The paddles built into the spokes of the rear wheel pushes the water and propels the car - as it is made in the first generation ships. The paddles must enter the water at nearly 220 degrees and must leave the water before nearing 330 degrees and so the built in paddles are designed as such. The propulsion system is kept at height greater than the water level, so there is no need of waterproofing at the rear driving shaft.
The steering method used in this car is an as usual one.

H. Steering in water

Fig - 7 shows the top view of the wheel and front axle apparatus, it portrays the working method of steering in water. Let us see how this normal steering method works in water.

Fig - 6: Rear wheel integrated with paddle

Fig - 7: Steering in water

P - Pressure
HP - High Pressure
LP - Low Pressure

High pressure and low pressure regions are created due to the flow of water. In the 1st case, as the pressure on both sides of the front wheels are equal and so there is no deviation in the direction. In the 2nd case, the net deviation in direction is towards the left side and in the 3rd case it is towards the right side because the force always tends from higher pressure to lower pressure.

APPLICATIONS

I. Floods

This car can be used during floods for transportation, supplying food, medicine and rescue purposes in flooded areas. Hundreds of cars will be completely wasted during floods, this car will be an exceptional one in such cases.

J. Tourism

Tourism is economically important and is growing rapidly. There are many places across the globe with water bodies and land connected together. After acquiring proper permission from Tourism Corporation and also by following some governmental norms and regulations, this car can be effectively utilized in tourist places and so being advantageous both for the tourists and for the government.

K. River Transportation

There are thousands of navigable waterways in each country. The risks of accidents and breakdowns are minimum in this form of transport as compared to any other form of transport, so safety factor is high. People who longs for a bit lengthy and peaceful travel, can adopt transportation by river thereby reducing traffic congestion in the roadways to an extent. Thus this car opens a new channel of transportation.

L. Beach Patrol and Coast Guard

This car can be used by the beach patrol and coast guards for their various uses such as patrolling, etc.,

M. Police, Military and Navy

This car provides an additional mode of transportation which can be optionally utilized under certain circumstances considering safety, privacy etc., by the police, military and the navy.

N. Entertainment

For this car, games which involves land and water in its stream can be designed. Everyone loves to play games with their own vehicle, which will become a tourist attraction to the theme parks, dams etc., Proper governmental norms and rules must be followed. This will be a target to youngster community which brings revenue to the tourism corporation of India.

ADVANTAGES

- Can be used in roads and as well as in water bodies like rivers, seas etc.,
- Can be used for the purpose of rescue in flooded areas for saving life. It will be apt if the vehicle can go both in land and in water during rescue operations in times of flood
- Can be produced at comparatively cheaper cost
- Single propulsion system for both the land and water
  - No switching time (0 second) between modes of land and water
  - No wheel retraction
  - No additional transmission system or water propeller
  - Fuel efficiency is higher while used in water
No complicated waterproofing methods are used

Highest possible aerodynamics can be achieved since it is tadpole shaped vehicle

High traction since it comprises of a rear engine and a rear drive

DISADVANTAGES

- Only moderate speed can be achieved in water
- Larger tyres at rear (pair of tyres are not of uniform size)
- The weight of the car is relatively high due to the hull at the base
- Comparatively requires high power engine in consideration to its weight
- Fuel efficiency will be low

CONCLUSION

Thus this car has single propulsion system with no complicated waterproofing techniques making it cheaper and affordable to people and the natatorial car have neither any transformations nor consumes time while switching between the land and water. That is, it is the same for the car to run both on land and in water. Thus this car opens up an effective additional mode of transportation at low investment. During natural crisis this car can serve its best in saving life. It provides an extra utility for people, government and other institution. This will bring joy, pleasure, etc., for the people and as well as revenue for the government & other institutions.

FUTURE SCOPE

The car will be made much more affordable by reducing its cost further. The difference in size of pairs of front and rear wheels will be reduced as much as possible. Additional safety features rather than life jackets will be added to this car. The top speed in water will be much more increased in future.

LITERATURE REVIEW

The first known self-propelled amphibious vehicle, a steam-powered wheeled dredging barge, named the Orukter Amphibolos, was built by US inventor Oliver Evans in 1805. Amphibious car came out in the 1920, Amphicar was the first commercially successful amphibious car. Amphicar was manufactured in Berlin Germany from 1962 to 1967. It was the only non-military Amphibious vehicle ever put into production on a commercial basis during that period.

REFERENCES

[1] www.amphibiousresponder.com
[5] auto.howstuffworks.com
[8] www.searoader.com