

Design and Development of Air Screwing Watercar

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ABSTRACT: The high-speed propeller system was invented over 170yrs ago and has dominated the propulsion system ever since. Contrapel technology is a propeller system working slightly above the water line. It uses a pair of contra-rotating fully enclosed hybrid propellers capable of operating above the water line and the system requires generation of high pressure, also it requires high energy to produce the required thrust. In this paper a new type of system is considered, the propulsion system is Electric propulsion system in which the propellers are completely above the water line powered by electric source. The laws governing the working of this system are Newton's third law of motion and Archimede's principle. The propellers use air instead of water to propel the system hence it consumes less power compared to existing propulsion system.

I. INTRODUCTION

Contrapel technology is a propulsion system working slightly above the water line. It uses a pair of contra-rotating fully enclosed hybrid propellers capable of operating above the waterline and the system requires generation of high pressure. hence requires high energy to produce the required thrust. In this paper researcher tries to develop a new type of propulsion system i.e. Air screwing propulsion using electric motors in which propellers are completely above the waterline screwing air for propulsion. when the vehicle is on water it travels like a boat and when it on land moves like a car, thus being amphibious. The laws governing this system are Newton's third law, Archimede's principle. The propellers screw air instead of water to propel the vehicle and hence consuming less energy compared to existing propulsion system.

Barry Davies and Paul Patterson, two scientists from Kiwi, New Zealand invented a propulsion system, Contrapel that combines the best features of a waterjet with those of propellers. This means that boats can be made more maneuverable, as well as being able to travel further and faster. Though it travels faster ,it requires generation of high pressure energy resulting in the consumption of more fuel. hence we need a new kind of propulsion system which can give required thrust consuming considerably less fuel. Here we have considered a new propulsion system in which the propellers are located completely above the water line and are powered by electric source. Operation is remote controlled.

II. TYPES OF PROPULSION

Some of the various **Types of propulsion systems** used in ships and boats can be enumerated as follows:

•**Diesel Propulsion:** Diesel propulsion system is the most commonly used marine propulsion system converting mechanical energy from thermal forces. Diesel propulsion systems are mainly used in almost all types of vessels along with small boats and recreational vessels.

•**Wind Propulsion:** Wind propulsion emerged as an alternative to those systems which emit huge quantities of CO2 gases in the marine atmosphere. However, the usage of wind turbine marine propulsion has not started extensively in large commercial ships because of a requirement of constant windiness. Two wind propulsion systems for ships that have become lately are- kite propulsion and sail propulsion for merchant ships.

•**Nuclear Propulsion:** Naval vessels incorporate the usage of nuclear maritime propulsion. Using the nuclear fission process, nuclear propulsion is a highly complex system consisting of water reactors and other equipments to fuel the vessel. The nuclear reactors in the ships are also used to generate electricity for the ship. Several merchant ships are also being planned to be constructed with this propulsion system.

•**Gas Turbine Propulsion:** Gas turbine propulsion is used for naval as well as non-naval ships. In case of naval ships, the gas turbine propulsion system aids in faster movement of the ships which is necessary in case of the ship coming under attack.

•**Fuel Cell Propulsion:** Fuel cell propulsion systems use hydrogen as the main fuel component. Electricity is created in the fuel cell without any combustion whatsoever. The process is clean and therefore has been regarded as a very important alternative marine propulsion system. There are various types of propulsion under the fuel cell propulsion head like PEM (Photon-Exchange-Membrane) and the molten-carbonate systems.

•**Biodiesel Fuel Propulsion:** Biodiesel propulsion has been deemed as a potential marine propulsion system for the future. Currently tests are being carried out to find out about the viability of this propulsion system which is expected to be in full operation by the year 2017.

•**Solar Propulsion:** Solar propulsion for ships was utilised for the first time in the year 2008. Solar propulsion benefits include a high reduction in the poisonous carbon dioxide emissions. Solar propulsions are capable of generating a capacitance as high as 40 kilowatts (kW).

•**Steam Turbine Propulsion:** Steam turbine propulsion involves the usage of coal or other steam-generating fuels to propel the vessel. Steam turbine maritime propulsion system was highly utilised between the late 19th and the early 20th century.

•**Diesel-Electric Propulsion:** In simple terms, diesel-electric ship propulsion systems use a combination of a generator operated by electricity attached to a diesel motor. The technology has been in use since the early 1900s. In today's times, submarines and merchant ships incorporate the diesel-electric propulsion system to propel themselves.

•**Water-Jet Propulsion:** Water-jet propulsion has been used since the year 1954. The most important advantage of water-jet propulsion is that it does not cause noise pollution and offers a high speed to the vessels. In contrast the water-jet propulsion as a ship propulsion system is costlier to maintain which can cause problems to the user.

•**Gas fuel or Tri Fuel Propulsion:** LNG fuel is now utilised to be burnt in the Main Engine after adopting some modification in the propulsion engine to reduce emission from the ship. It is known as tri fuel because it can burn gas fuel, diesel and heavy fuel.

The various types of propulsion systems offer their own unique advantages to a vessel. Depending on the necessity and the requirement, the best type of ship propulsion system needs to be fitted. Only then the vessel will be able to offer its optimum service capacitance.

In this paper we are highlighting only on the Electrical propulsion system.

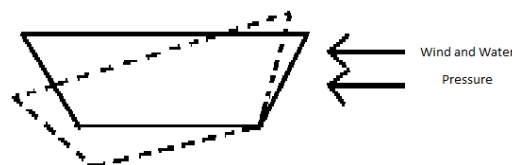
In earlier times, DC motors were used with electrical drives and the ships used to have completely separate electrical system for propulsion and other purposes.

But after the invention of Marine type Thyristor convertors, the ships are able to connect all their machinaries to one single electrical system, just as in Power stations.

III. CONCEPT OF DESIGN

The current marine vehicles have closed hull structure design which gives better floatation, but may meet the disasters when they are acted by excess Air and Wind pressures as shown in figure

Figure :



Hull structure of a conventional boat and ships

In which there are chances of filling water in the ship and the ship may drown. The propulsion here is water screwing i.e., the propellers are below the waterline. All the ships work mainly on Archimede's principle and Newton's third law of motion. It states that "For every action, there is an Equal and Opposite reaction". That's what implies on Propellers.

i.e., when the propeller screws the water, the water is sent backward and hence the vehicle moves in forward direction. Since the propellers screw the water and are located completely below the waterline and water offers some resistance for screwing. (Density of water = 1000kg/m³). Thus power and energy required to propel the boat is high.

To overcome these problems, we need a new type of propulsion system which can give the required thrust consuming comparatively less fuel.

This new type of propulsion is known as Air Screwing propulsion system in which the propellers are completely above the waterline. Here the working principle is same as that of current only. Thing is that the propellers are located completely above the waterline hence screwing air instead of water. Here Newton's third law comes into picture. i.e., the propeller screws the air and send it backward as the result the vehicle propels forward. Water has a greater pressure. Lift is always produced in the low pressure side. Usually the pressure below the surface of water is higher and lift is produced upwards. Along with this Density plays a major role in floatation. The objects with lower density floats whereas the ones with greater density will sink.

IV. WORKING

"Externally this propulsion system resembles an aircraft turbo fan propulsion system, however internally the method for developing thrust has much more in common with conventional propeller systems." The propulsion system uses a pair of contra-rotating, fully exposed hybrid propellers, capable of operating above the water line. These propellers are powered by electric source and are remote controlled. The mode of operation of the hybrid propellers is to accelerate by screwing the air.

The laws governing the Propulsion and Floatation are:

1) Newton's 3rd law of motion which states "For every action there is equal and opposite reaction".

As the propellers rotates they screw the air and the air is pushed back giving forward thrust to the vehicle.

2) Archimede's principle

Which states "Any object, wholly or partially immersed in a fluid, is buoyant up by a force equal to weight of the fluid displaced by the object".

It further depends on Density and Shape of an object. When the density of the object is low it floats on water.

Also the thrust obtained depends on size of the propellers and speed of propellers.

V. PROPELLER SPECIFICATIONS



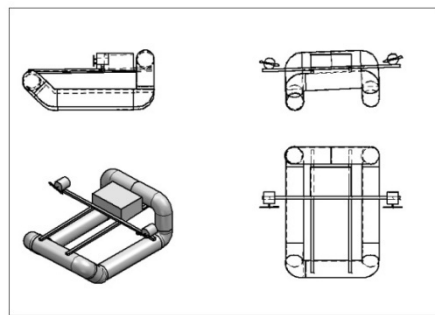
- ❖ Propulsion device – X 2 120mm diameter Propellers
- ❖ Hybrid propellers – X 2 per unit, plastic fibre
- ❖ Shafts – Counter-rotating
- ❖ Completely exposed hybrid propellers, above water level
- ❖ No water lubricated bearings – Dry run capable
- ❖ Control – Wireless R/C control

- ❖ Speed – 9200 to 9500 rpm
- ❖ Max torque – 11.05 N-mm

(a) Design Specification

- ❖ Polyvinylchloride (PVC) body
- ❖ Density – 1.3g/cm
- ❖ Length – 447mm
- ❖ Width – 323mm
- ❖ Front Height – 138mm
- ❖ Rear height –198mm
- ❖ Pipe diameter – 63mm

VI. CAMD MODEL VIEW OF WATERCAR



Various views created using solid edge V19.

VII. ADVANTAGES

This propulsion system is truly a revolution. Fundamentally it's a propeller system, with all the advantages. This results in high propulsive thrust at all speeds.

- ❖ Maximising the thrust and minimising the Fuel consumption.
- ❖ Additional benefits over high-speed water-jets. no wear caused by small particles in the water as propellers are above the water line.
- ❖ Compared with all high-speed water-jets and propellers, expensive maintenance is considerably less.
- ❖ The propellers are located above the waterline. This means that aquatic animal life, people and fragile seascapes are protected from damage. Propeller strike resulting in disfiguring scars and even death will become a distant memory consigned to our dangerous past.
- ❖ In addition there is very little torsion effect or vibration transmitted to the boat, as the counter-rotating effect helps balance out the forces.
- ❖ In case of current vehicles minimum depth of water is required as vehicle approaches the yard as propellers are located below the water surface but here the propellers are located above the waterline.
- ❖ Use of Plastic fibres and location of propellers away from the water surface results in corrosion resistance.
- ❖ Since the vehicle is made of PVC, it is light weight and power required to propel the vehicle is less.
- ❖ Electricity is easily available compared to other forms of energy.
- ❖ Reduction in noise.
- ❖ No Air pollution since the propellers are electric powered.
- ❖ Operation is easy as it is remote controlled.

VIII. APPLICATIONS

Various applications of Air screwing Watercar are as follows

- ❖ Surveillance – A certain places like Drainages and Tunnels where you cannot swim but you face a scenario wherein you have to know where is the obstacle we can make use of Watercar.
- ❖ Rescue mission – In case of Disasters and you do not to know to swim, Watercar can be used as a rescue vehicle.
- ❖ Fishing – In case of Fishing , when a fisherman goes to fishing he may face disaster and can be risked to death. By the use of this Watercar fishing can be done just sitting in one place in a easier way.
- ❖ Recreation – Watercar can be used for recreation in small ponds and lakes. Marine survey – Watercar can be used for marine survey to know the parameters like depth at the specified region.

IX. LIMITATIONS

- ❖ High wind velocity can disturb the movement of the vehicle.
- ❖ Payload capacity is less compared to current water moving vehicles.
- ❖ Not applicable to ships (Limited to boats)

X. SCOPE OF FUTURE WORK

- ❖ To Aviate.
- ❖ To Fix cameras and sensors to estimate the number of fishes in the fishing zone.
- ❖ To Provide Omni or Magnum type of wheels to make it run on all kind of surfaces.

XI. CONCLUSION

“This Hybrid propulsion system will dominate the field of water propulsion in the future.” Those who have been around a while may remember another propulsive technology that made some similar claims and statements, the Pursuit Drive from Pursuit Dynamics, that has since faded from view. It came out of Australia, as did the RingProp whose intellectual property is currently being sold in bankruptcy. A remnant of Pursuit Dynamics appears active in developing food processing technologies.

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