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Design and Fabrication of Hovercraft

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ABSTRACT: Air cushion supported vehicles could only be successfully developed using suitable light materials for the hull and air blower. The design and development of a hovercraft prototype with full hovercraft basic functions is reported. Experience from flying boats was particularly valuable because normal aircraft materials are not generally designed to resist corrosion when immersed in salt water an important design parameter for marine vehicles. Further research is recommended to improve on the efficiency of the craft.

KEYWORDS: Hovercraft, Air blower

I. INTRODUCTION

A hovercraft is a special type of vehicle that moves on a cushion of air. It is capable of travelling over land, water, mud or ice and other surfaces. The lifting motion is controlled by a fan or fans so that an air gap can be formed. Such separation between the bottom of the hovercraft and the ground provides a motion platform, on which the friction force between the hovercraft and the ground reduces to a very small amount.

Since a hovercraft does not have wheels, the forward motion is created through the propelling action, which is generated by the use of a propulsion fan and/or a set of fans. These propelling fans send air out of the back of the hovercraft to produce a thrust force, which moves the hovercraft forward.

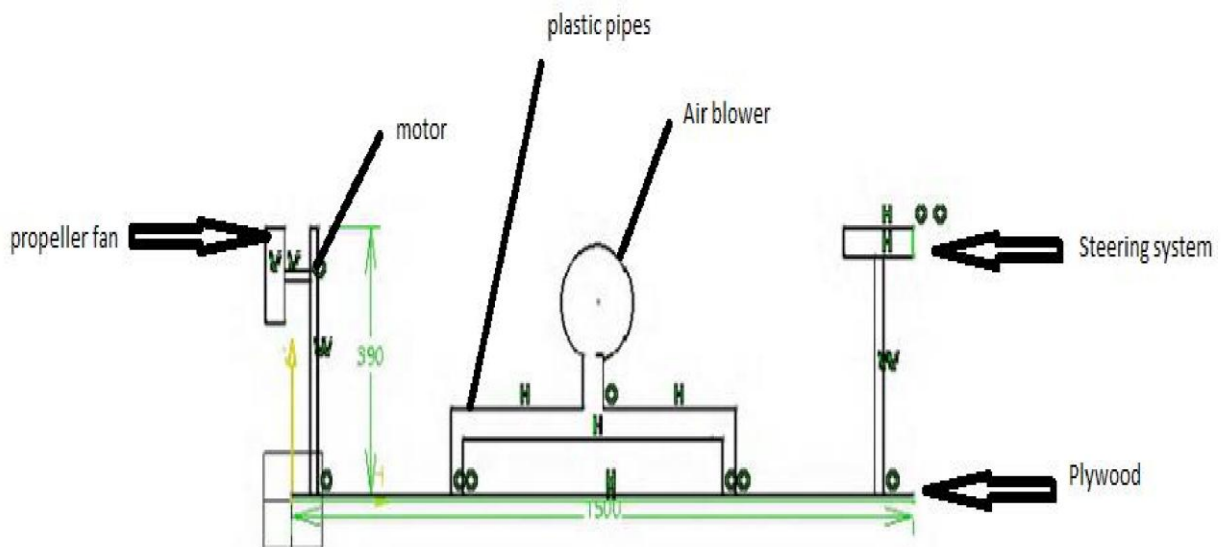
Hovercraft use blowers to produce a large volume of air below the hull that is slightly above atmospheric pressure. The pressure difference between the higher pressure air below the hull and lower pressure ambient air above it produces lift, which causes the hull to float above the running surface. For stability reasons, the air is typically blown through slots or holes around the outside of a disk or oval shaped platform, giving most hovercraft a characteristic rounded-rectangle shape. Typically this cushion is contained within a flexible "skirt", which allows the vehicle to travel over small obstructions without damage.

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II. DESIGN OF HOVERCRAFT



Hovercraft- A hovercraft is a self-propelled vehicle, dynamically supported by a self-generated cushion of slow moving, high pressure air which is ejected against the surface below and contained within a flexible skirt such that is totally amphibious and has some ability to travel over less than perfect surfaces.

Propulsion is not derived from contact with the water or the ground.

III. PRINCIPLE OF HOVERCRAFT

The hovercraft floats above the ground surface on a cushion of air supplied by the lift fan. The air cushion makes the hovercraft essentially frictionless. The hovercraft relies on a stable cushion of air to maintain sufficient lift. The air ejected from the propeller is separated by a horizontal divider into pressurized air utilized for the air cushion and momentum used for thrust. The weight distribution on top of the deck is arranged so that the air is distributed the air from the rear of the deck throughout the cushion volume in an approximately even fashion to provide the necessary support. The skirt extending below the deck provides containment, improves balance, and allows the craft to traverse more varied terrain. We maintain the rigidity of the skirt by filling the air-tight skirt with the same pressurized air diverted towards lift.

MOTOR

An electric motor is an electrical machine that converts electrical energy into mechanical energy. The reverse of this would be the conversion of mechanical energy into electrical energy and is done by an electric generator. In normal motoring mode, most electric motors operate through the interaction between an electric motor's magnetic field and to generate force within the motor. In certain applications, such as in the transportation industry with traction motors, electric motors can operate in both motoring and generating or braking modes to also produce electrical energy from mechanical energy.

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Found in applications as diverse as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and disk drives.



MOTOR

The specifications of the product are given below:

Voltage: 230V AC 50 Hz.

Power Consumption: 750 Watts.

Motor: Universal 750 Watts High Power Motor. No load speed 20,000 RPM (approx.)

With load speed 11,500 RPM (approx.) Material of Body: A.B.S. Speed Controls: 360° Rotary Switch with 3 Speeds and Incher Switch.

AIR BLOWER

A leaf blower is a gardening tool that propels air out of a nozzle to move yard debris such as leaves. Leaf blowers are powered by electric or gasoline motors. Gasoline models have traditionally been two-stroke engines, but four stroke engines were recently introduced to partially address air pollution concerns. The main purpose of blower is to suck air from atmosphere to the beneath of skirt and hull. It can able to lift hovercraft and maintain less amount of surface traction. Noise pollution is also a concern with leaf blower, as they emit noise levels well above those required to cause hearing loss to both the operator and those nearby.

Specification of air blower:

Blowing rate: 13000rpm. Rated voltage: 220V. Rated Frequency: 50Hz. Rated Input power: 600W. Blowing rate: 2.3 m³/min.

Wood Dimensions:

- Diameter of wood =105cm
- Thickness of wood=2cm
- Weight of wood=5kg
- Diameter of hole=2.54cm

Skirt

Skirt is which is used bottom of the plywood and the air is filled in the skirt. When air was blown into the space

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between the sheets it exited the bottom of the skirt in the same way it formerly exited the bottom of the fuselage, recreating the same momentum curtain, but this time at some distance from the bottom of the craft.

Skirt Dimensions

- Length of skirt =120cm
- Noof holes=6
- Hole of skirt=2.54cm
- Width of skirt=0.2cm

The air inflates the plastic which pushes upon the floor and provides a ground-hugging "skirt." This lifts the entire hovercraft. The coffee-can lid provides "strain relief" so that the inflated plastic doesn't tear loose from the centre. It also lifts up the vent holes so air can escape into the centre donut-hole. The air leaks along the floor and out from the edges of the hovercraft.

IV. CLASSIFICATION OF HOVERCRAFT

(i) Single propellant hovercraft: This hovercraft uses only one fan to provide both lift and thrust. The fan is usually mounted vertically using the top two thirds for thrust and the bottom one third for lift. The lift air is directed into the skirt through the duct by the diverting inlet. The air under the hovercraft is known as the air cushion. This air cushion leaks away under the skirt to provide a film of air which the hovercraft rides on.

Fig 3.1:Single propellant hovercraft



ii)Multi propellant hovercraft: It has two different motor propeller systems for Lift and Thrust mechanisms. The amount of lift independent of the amount of thrust. It has two planes. Horizontal plane is used to lift the hovercraft and vertical plane is used to create thrust (or) propulsion mechanism, integrated with controls.

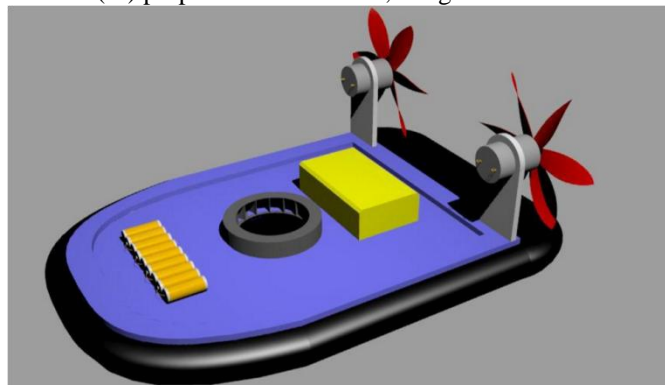


Fig3.2Multipropellant hovercraft

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Advantages:

- Wildlife conservation and research
- Transportation or "island-hopping"
- Fishing anywhere ... including ice fishing
- Travelling from land to water where there is no boat dock
- Military services: Assault vehicles and transporting troops
- Dive recovery teams
- Retrieving birds from tailing ponds at mining sites
- Water management
- Border Patrol and Homeland Security
- Port authorities/drug enforcement
- TV and film companies (James Bond movies often use hovercraft)
- Entertainment at Disney World water shows

V. CONCLUSION

The craft principle has been demonstrated using low cost material and has proved capable as a viable means of transport both on land and water after series of tests. The propulsion and lifting systems gave excellent performance. Hovercrafts are generally simple mechanisms in theory. Yet the process from theory to manifestation is not as easy as it may seem. A plethora of problems exist and must be faced in order to attain a well function hovercraft. The plans and designs must be flawless. One must take under consideration the weight and the shape of each component in order to avoid problems such as instability and dysfunction. One thing is certain; when building a hovercraft, be well aware of the demands of construction.

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