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Design and fabrication of amphibious cycle

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Abstract: An Amphibious cycle is a human-powered vehicle capable of operation on both land and water. The design which has probably received the most coverage is Saidullah's Bicycle. The bike uses four rectangular air filled floats for buoyancy, and is propelled using two fan blades which have been attached to the spokes. Moraga's Cycle Amphibioususes a simple tricycle frame to support three floaters which provide both the floatation and thrust. The wings on the powered wheels propel the vehicle in a similar way to a paddle wheel Amphibious cycle. The bicycle is a self contained convertible structure so that it may be readily adapted to operation in either environment comprising conventional wheels and pedal, sprocket, chain drive system but also including front and rear pontoons which are adapted to pivot about the frame of the bicycle from a retracted above-wheel position when in the land operating mode to a deployed, adjacent-wheel position when in the water operating mode. An attachable propeller, drive shaft, and gearing means cooperatively engages the pedal-sprocket structure for powered mobility when in water. This type of cycle is used in flood prone zones for transferring foods and other human utilities.

Index words –Versatile Bicycle, Buoyancy,L-Clamps, Rotating paddles .

I. INTRODUCTION

An amphibious cycle is a human-powered vehicle capable of operation on both land and water. The design which has probably received the most coverage is Saidullah's Bicycle. The bike uses four rectangular air filled floats for buoyancy, and is propelled using two fan blades which have been attached to the spoke. Moraga's Cycle Amphibious uses a simple tricycle frame to support three floaters which provide both the floatation and thrust. The wings on the powered wheels propel the vehicle in a similar way to a paddle wheel. It consists of 2 inflatable floats with straps that allow the carrying of a bicycle with passenger. The ensemble, when deflated, fits in a backpack for carrying by the cyclist.

The Amphibious Cycle combines a recumbent frame with separate floats, and is propelled using a paddle wheel. A speed test on water achieved an average speed of 1.12 m/s. The cyclist was able to transition the cycle both into and out of the water unassisted. This prototype has a real application in urban areas of flooding, as well as applications in the leisure industry. An amphibious vehicle was created by five engineering students at Calvin College as a senior design project (May 2010). This vehicle improves upon previous designs by allowing smooth transition from water to land.

Another recent design was made especially for Ebrahim Hemmatnia for his voyage around the world. This velomobile design was called the Ad Infinitum.

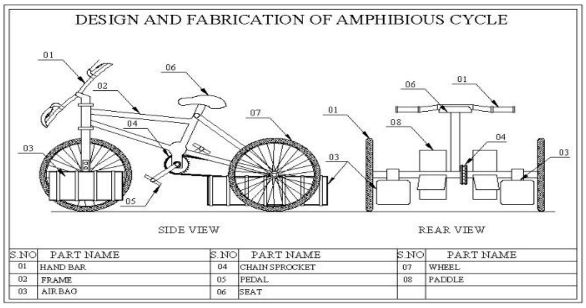

Fig. 1Amphibious cycle view chart

Fig. 2 3D view of amphibious cycle

Cycles have become important over a wide range of applications because nowadays petrol demand is very high. This project we have designed the amphibiouscycle. The main aim of the project is to design a cycle that moves in both water and land.

II.LITERATURE SURVEY

This pedal powered vessel, with its sleek design, is suitable for use in harbours, bays, ocean inlets and lakes. It is also used for transportation to an offshore yacht or island home. The boat's efficient Nauticraft designed single pedal drive system turns a 15" propeller, making movement through water feel effortless, reaching speeds up to 5 mph. A spade type rudder provideseasy and effective turning capability, controlled by a side mounted steering handle. The sailboat type hull positions the operator down inside the cockpit. Features a dry shelf up front for items you don't want to get wet and stretch cord retaining system around the front perimeter ofthe cockpit keeps life jackets, towels and even a beverage safely tucked away. A rear bench seat fits 1 to 2 people with a melded in storage compartment beneath the seat cushion. Guinness World Recordholder for the English Channel crossing in May of 2002.

A pedal (British English) or paddle boat (US, Canadian, and Australian English) is a small human-powered watercraft that a person drives by pedalling, which turns a paddle wheel. The paddle wheel of a pedal is a smaller version of that of the paddle steamer. A two-seat pedal has two sets of pedals, side by side, designed to be used together. Some models have three pedals on each side to allow a person to pedal from the centre when boating alone.. Pedals are suited to calm waters, such as in ponds and small lakes. They are sometimes rented for use on ponds in urban parks. Perhaps the earliest record of a pedal is Leonardo da Vinci's diagram of a paddle-powered craft driven by two pedals.

III.METALS AND FLOATING MATERIAL USED IN FABRICATION

(1)Mild steel or Plain-Carbon Steel:

Plain- Carbon steel is steel in which the main interstitial alloying constituent is carbon in the range of 0.12–2.0%. The American Iron and Steel Institute (AISI) define that:

Steel is considered to be carbon steel when no minimum content is specified or required for chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect;

When the specified minimum for copper does not exceed 0.40 percent; or when the maximum content specified for any of the following element does not exceed the percentages noted: manganese:-1.65, silicon:-0.60, copper:-0.60 The term "carbon steel" may also be used in reference to steel which is not stainless steel; in this use carbon steel may include alloy steels. As the carbon percentage content rises, steel has the ability to become harder and stronger through heat treating; however it becomes less ductile. Regardless of the heat treatment, higher carbon content reduces weldability. In carbon steels, the higher carbon content lowers the melting point. Carbon steel is broken down into four classes based on carbon content:

(2)Mild and low-carbon steel

Mild steel, also known as plain-carbon steel, is the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Low-carbon steel contains approximately 0.05–0.15% carbon making it malleable and ductile. Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing. It is often used when large quantities of steel are needed, for example as structural steel. The density of mild steel is approximately 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and the Young's modulus is 210 GPa (30,000,000 psi).

Low-carbon steels suffer from yield-point run outwhere the material has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If a low carbon steel is only stressed to some point between the upper and lower yield point then the surface may develop Lüder bands. Low-carbon steels contain less carbon than other steels and are easier to cold-form, making them easier to handle.

(3)Higher carbon steels :

Carbon steels which can successfully undergo heat-treatment have carbon content in the range of 0.30–1.70% by weight. Trace impurities of various other elements can have a significant effect on the quality of the resulting steel. Trace amounts of sulphur in particular make the steel red-short, that is, brittle and crumbly at working temperatures.

Low-alloy carbon steel, such as A36 grade, contains about 0.05% sulphur and melts around 1,426–1,538 °C (2,599– 2,800 °F). Manganese is often added to improve the harden ability of low-carbon steels. These additions turn the material into low-alloy steel by some definitions, but AISI's definition of carbon steel allows up to 1.65% manganese by weight.

(4)Low carbon steel:0.05-0.3% carbon content.

(5)Medium carbon steel: Approximately 0.250–0.6% carbon content. Balances ductility and strength and has good wear resistance; used for large parts, forging and automotive components.

(6)High-carbon steel: (ASTM 304) approximately 0.9–2.5% carbon content. Very strong, used for springs and high-strength wires.

(7)Ultra-high-carbon steel: Approximately 2.5–3.0% carbon content. Steels that can be tempered to great hardness. Used for special purposes like (non-industrial-purpose) knives, axles or punches. Most steels with more than 2.5% carbon content are made using powder metallurgy. Note that steel with a carbon content above 2.14% is considered cast iron.

(8) Float material:

The materials that can be used as floating materials should have a density less than that of the density of water. The commonly used floating materials are foam, thermocol, pipes which have the density less than water density such as HDP.

VI. CHAIN DRIVE

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles. The power is conveyed by a roller chain, known as the drive chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain puttingmechanical force.

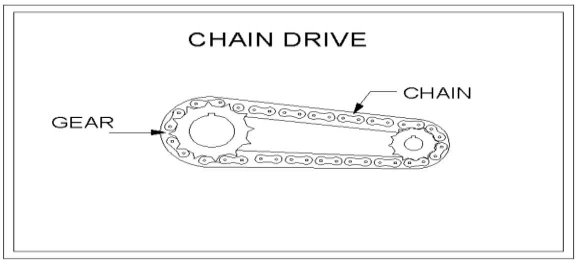

Fig.3 Chain drive view

V. FLOAT MATERIAL

Float materials used in the cycle is used for the supporting the cycle frame on the water such that it floats on water. The float material used here are the polyethylene pipes or the heavy duty pipes which has the density less than that of water. The density of the pipe is 0.9 which is less than that of water i.e., 1.0. The properties of the HDPE are

1. Large strength to density ratio
2. Harder, opaque and high tensile strength.
3. Can withstand temperatures upto 120^0C

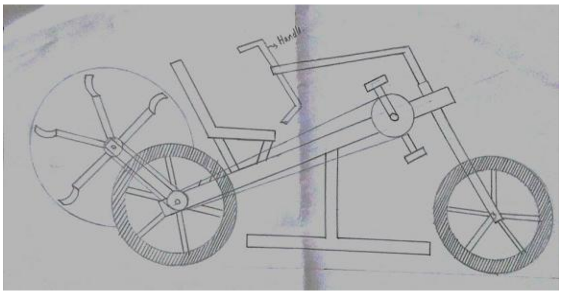

Fig . 4 Floating material of cycle in 2D view

VI. BUOYANCY FORCE

Buoyancy is an upward force exerted by a fluid that opposes the weight of an immersed object. In a column of fluid, pressure increases with depth as a result of the weight of the overlying fluid. Thus a column of fluid, or an object submerged in the fluid, experiences greater pressure at the bottom of the column than at the top. This difference in pressure results in a net force that tends to accelerate an object upwards. The magnitude of that force is proportional to the difference in the pressure between the top and the bottom of the column, and is also equivalent to the weight of the fluid that would otherwise occupy the column, i.e. the displaced fluid. For this reason, an object whose density is greater than that of the fluid in which it is submerged tends to sink. If the object is either less dense than the liquid or is shaped appropriately (as in a boat), the force can keep the object afloat. This can occur only in a reference frame which either has a gravitational field or is accelerating due to a force other than gravity defining a "downward" direction. In a situation of fluid statics, the net upward buoyancy force is equal to the magnitude of the weight of fluid displaced by the body.

VII. PADDLES

The rotating type paddles is used to give displacement in water. It’s made of sheet metal of 1 mm thickness. The paddles are nothing but blades that rotate by peddling action. The paddle blades are welded to a hollow pipe which is welded to a hub. The hub is welded with the sprocket and chain drive connects the paddle sprocket with the rear double threaded hub sprocket. Thus the paddles rotate by the chain drive power transmission. There are 6 blades in total which acts as two paddles in the versatile bicycle.

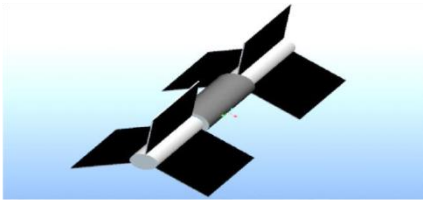

Fig. 5 *3-D model of paddles*

VIII. DESIGN PROCESS

The design stage process of UTeM's AHV body is shown in Figure 5. The early stage of the design process is to create a conceptualization idea. Creativity is required to generate the ideas during the conceptualization stage. Brainstorming approach is used to produce as many ideas that are relevant for the AHV specification as described .

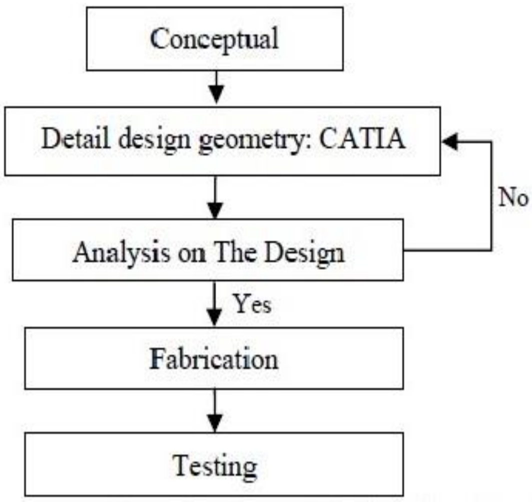

Fig. 6Show the flowchart of design phase for amphibious vehicle body

There are eight criteria to be concerned to evaluate the best selection for the concept design.

IX. WORKING OF VERSATILE BICYCLE

In versatile bicycle, thermocol blocks are used to create buoyancy force. There are 4 blocks of even volume to give balance in the water .The thermo cols are attachable and detachable in the L-clamps and the L-clamps itself is foldable. The movement in the water is given through rotating paddles that are fixed at the back of the versatile bicycle. These paddles are connected to the rear wheel of the bicycle through chain drive. Double threaded hub has been used to put on two sprockets. In one sprocket, the normal chain is connected to the pedals and in another sprocket, the chain drive that rotate the paddles are connected. Thus, the movement is given. These paddles can be adjusted according to the weight of the rider when inside the water. There is an adjustable rod that increases or decreases the altitude of the position of the paddles. The paddles should be half inside and half outside the water to maximum displacement.

X. COST ESTIMATION

(1) LABOUR COST:
Lathe, drilling, welding, grinding, power hacksaw, gas cutting cost

(2) OVERGHEAD CHARGES:
The overhead charges are arrived by "manufacturing cost"

Manufacturing Cost =Material Cost +Labour Cost

Overhead Charges =20%of the manufacturing cost

(3) TOTAL COST:
Total cost = Material Cost + Labour Cost+Overhead Charges

XI. CONCLUSIONS

There are many gadgets designed for moving on water surfaces. Some of them are very efficient but very few have the capacity to move both on water and land. Many of the existing systems require Advanced machinery and fuel to maintain them on water. Our proposed model is a very low cost and efficient system which achieves the same using human energy. The system currently lacks safety systems and hence is suitable only for shallow water lakes and ponds.

The prototype design does not include any safety instruments and hence is suitable for shallow water lakes and ponds only. The effect of strong water waves also could not be estimated in this project. We hope to include these improvements in a later model.

An amphibious vehicle 'versatile bicycle' is designed and fabricated successfully. It is tested in land as well as on water and the velocity is calculated as 4-5 km/hr in water and 15-20 km/hr on land. 100-200C

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