

Research Article

Research and Design on Amphibious Sightseeing Ship for Fitness and Entertainment

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Abstract: The aim of this research is to design a small mechanical amphibious sightseeing ship, of which the shape is beautiful, the structure is simple and reasonable, the technical content is high, manufacturability is good, the cost is low, the operation is convenient and the safety performance is good and which is in line with the ergonomics, meets the sightseeing, fitness and entertainment demand and achieves the double function of traveling in water and on ground. This study specifically researches its appearance shape, internal structure, working principle and other design, including the design of the pedal device, the handle of manipulating direction and the seat. And then its market prospect is analyzed. On this basis, the corresponding conclusions are reached.

Keywords: Amphibious sightseeing ship, aquatic motion mechanism, ground motion mechanism

INTRODUCTION

With the development of the modernization of life and the unceasing enhancement of people's living standard, all kinds of amusement places become the places by patronized frequently. Some novel sightseeing amusement equipments are not only popular with children, but also adults (Xin and Wang, 2007). Among the numerous sightseeing amusement equipments, the cars and boats are much concerned by people, but the existing cars and boats for sightseeing amusement either are shaped rigidly or lack humanity (Wei and Jiang, 2012). Of course, the main shortcoming is that their function is single, such as the cars could only walk on ground and the boats could only cruise in water, without a kind of car or boat could not only cruise in water, but also walk on ground. In this way it brings much inconvenience, such as to the lake it needs to take a boat and to the land it needs to take a car. The rearrangement of back and forth is very trouble, which often makes people tired (Jiang, 2013a).

Therefore, the research is to design a new tourism appliance that is beautifully shaped, easy to operate, in line with the ergonomics and could happily combine fitness and entertainment. It is an amphibious ship applicable to park or amusement park, which not only travels in water, but also on ground (Wu *et al.*, 2004). This study specifically researches its working principle, internal structure and appearance shape, including the design of aquatic motion mechanism and ground motion mechanism. This research will be beneficial to solve the above problems about sightseeing amusement. It could provide one-stop service and could well meet the common need for sightseeing on ground and leisure

in water, which makes the sightseeing amusement more smooth and more comfortable (Zhang, 2000). Meanwhile, it has simple structure, novel design, convenient operation and low cost, extremely possessing fun and entertaining. In addition, it drives the boat trip through manpower with pedal way, which could have very good fitness effect, such as the exercise of strength in waist and lower limbs and endurance, as well as the whole body coordination.

LITERATURE REVIEW

Amphibious vehicles have excellent unimpeded performance, which could cross mountains and river, not restricted, so it could play an enormous role in the military, transportation, disaster rescue, exploration survey and other professional fields (Xiao, 2008).

Amphibious vehicles came out in the 1920s, which were first used for military purposes (Wang *et al.*, 2004). The buoyancy of the amphibious vehicles in the water is produced by the duckweed around the body, which is specially made with rubber material. They need to rely on outside force to keep sailing in the water, so in the true sense they are not amphibious vehicles (Wu *et al.*, 2004).

During the Second World War, the American Motor Transport Committee recommended to develop amphibious vehicle. The institute of the American navy Stevens designed three kinds of ship form shells and the sample vehicle was manufactured successfully in February 1942, named GPA amphibious jeep, which is the first generation amphibious automobile of American equipment and also becomes the world's first truly amphibious automobile. After that, the United States

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still constantly developed various types of amphibious vehicle, in 50~60s of the 20th century, developing three kinds of amphibious carrier vehicles for supplies (LARC-5, LARC-15 and LARC-30). After the Middle East War in 1973, the amphibious carrier vehicles were given further attention, as they played the important role in crossing the ground and river or sea. For many years, the military powers, such as the United States, Russia and Britain, have developed various amphibious off-road vehicles, of which the main models are the GPA, IARC-5, LARC-15 and LARC-30 of the United States, the IVECO 6640G of Italy, the VAP 3550 of Spain and the Alvi Stalwart and Amphitruck of Britain (Wu *et al.*, 2004).

RESEARCH METHODOLOGY

Appearance design: According to the vehicles and ships technique and industrial design theory, the author puts forward the research on amphibious sightseeing ship for fitness and entertainment. Giving priority to ship and combining vehicle and ship is the overall guiding thought of appearance design of amphibious sightseeing ship for fitness and entertainment. To minimize the wave-making resistance, bow line adopts streamline, as shown in Fig. 1 to 3.

Structure design:

Confirm the overall design scheme: Through demonstration and simulation calculation, the author makes scheme screening to select the excellent one and finally determines the overall design scheme that the rudder is arranged front and the pedal drive is arranged in the middle. Such design that the center of gravity is low and the axial load distribution is reasonable is advantageous to the boat balance in water and climbing on ground. In particular, the rudder is arranged front, which changes the consistent practice that ships have always controlled the direction by stern rudder. It boldly adopts a front wheel to control the orientation. So, even if it sails in water, just as on land. Easily manipulating the handle of the direction just could drive freely, which not only avoids a lot of troubles on the operation, but also provides great convenience for drivers.

Research the aquatic motion mechanism and ground motion mechanism and the drive system:

Through argumentation and selecting the optimal scheme, ultimately it is determined that the aquatic motion mechanism consists of two propellers and a rudder; the ground motion mechanism consists of two rear wheels and a front wheel. To get the optimal design, the front wheel acts as a rudder in water, then connecting the front wheel and the handle of manipulating direction, so as to realize the steering. It could realize the movement by pedaling the pedal device with feet, transferring the power to the propellers and the rear wheels. In this way, the two

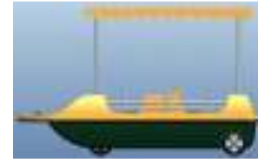


Fig. 1: Three-dimensional modeling of the amphibious sightseeing ship for fitness and entertainment (front view)



Fig. 2: Three-dimensional modeling of the amphibious sightseeing ship for fitness and entertainment (side view)



Fig. 3: Three-dimensional modeling of the amphibious sightseeing ship for fitness and entertainment (axonometric drawing)

manners of driving in water and on land respectively share a set of transmission system, which is not only simple and reasonable, but also achieves the research goal of low cost.

Research the concrete structure and the design of all parts of the amphibious sightseeing ship for fitness and entertainment:

According to the theory of mechanical design, after repeated research, finally it is determined the hull front end is equipped with a front wheel which is connected with the handle of manipulating the direction. The part of front-wheel hub does not set hole, so the front wheel could act as a rudder when sailing in water. The hull backend is equipped with the rear axle of which both ends are equipped with the rear wheels of which the insides are equipped with the propellers. Hull inside backend is equipped with two seats of which the front is the handle of manipulating direction, which makes the two persons who sit at the back all control direction, avoiding the fatigue of one person driving for a long time. Hull inside is also equipped with the pedal drive device which connects the rear axle through the chain. The front end of hull inside is equipped with two swivel chairs in order to make the two persons who sit in the front row change the sitting direction optionally and make the tourism freer and more comfortable.

Working principle: When the ship travels in water, it passes power to the propeller through the pedal and

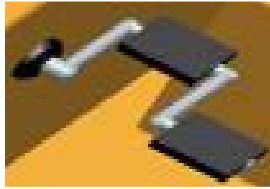


Fig. 4: Pedal device

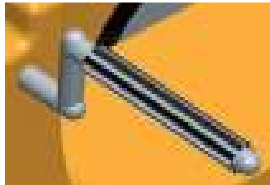


Fig. 5: Handle of manipulating direction

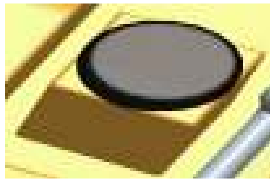


Fig. 6: Seat

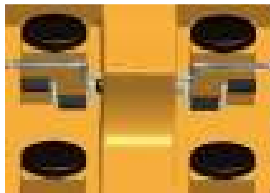


Fig. 7: The overall layout of seats, handles and pedals

then the propeller acts on the water which has a forward force on the ship again, so as to realize the advance of the ship and it changes the direction of the rudder through the handle of manipulating direction, so as to realize changing direction; when the ship travels on land, it is the same as in water, also through the pedal device to pass power to the rear wheels and through friction to realize the ship walking and it changes the direction of the front wheels through the handle of manipulating direction, so as to realize changing direction.

Other design:

Pedal device: The design inspiration of pedal device comes from the pedal device of bicycle, only adding a pedal device to the both ends of crankshaft, so as to realize double operation (Fig. 4).

Handle of manipulating direction: The design inspiration of handle of manipulating direction comes from the part of bicycle handle. This design could make two persons all control the direction, to avoid the fatigue of one person operating for a long time (Fig. 5).

Seat: There is a total of four seats, of which the two seats of front row is designed to be independent, turnable, inspired by the revolving chair and under the seat it is equipped with the body of revolution, in order to make the two persons sitting in the front row free to change the sitting direction, making the tourism more free and more comfortable; the two seats of back row together with the hull itself are an organic whole and it is unable to turn, so as to be convenient to manipulate.

The seat design should fully consider the man-machine engineering, because the correct sitting posture could reduce the energy consumption of the human body and eliminate fatigue (Jiang, 2013a). As a result, the height and angle of the seat and backrest and the distance between the seat and pedal device of this amphibious sightseeing ship are all calculated scientifically. And in view of the thickness of life jacket, it eventually makes the seat and the height of backrest completely accord with the sitting position of average human body. The Angle of backrest is suitable for the tilting posture when person pedaling and the backrest could give the body a forward reactive force, so that it could make person complete the action of pedaling in a comfortable position, reducing fatigue (Fig. 6 and 7).

Significance and prospects: Research and design on the amphibious sightseeing ship for fitness and entertainment will fill a void of tourism in our country (Jiang, 2013b). Because of its amphibious special function, it could widely apply to agriculture, health, public security and all fronts. Used as a means of transportation of tourism, it has more unique superiority.

In addition, the opening of market economy inevitably leads products to constantly update. Tourism appliances as the goods are no exception. The shift from unitary type to versatility is the modern economy of rapid development demand for industrial products. Therefore, the amphibious sightseeing ship for fitness and entertainment will be popular with the whole society and the development prospect is good (West and Deng, 2010). According to preliminary investigation, people are very eager to the amphibious tourism appliance. It is believed that it is once available and it will be in short supply.

The amphibious sightseeing ship for fitness and entertainment not only has the very high social benefits, but also its economic benefits will be considerable (Zhang, 2000). According to preliminary estimation, a single cost could be controlled in about RMB 9,000 Yuan and the lowest selling price could be set at RMB 12,000 Yuan. If establishing a amphibious car company whose annual output is 5000 amphibious cars, it not only could solve the employment problem of about 600 people, but also provide tax turnover of about RMB 4 million Yuan for the country every year.

CONCLUSION

This research is to design a mechanical amphibious car of small type, filling the gap on the market. It is suitable for small lake waters and has high popularity degree. The two manners of driving in water and on land respectively share a set of transmission system, which is simple and unique. In addition, it drives the boat trip through manpower with pedal way, which is energy-saving and has environmental protection and very good fitness effect. In particular, the rudder is arranged front, which changes the consistent practice that ships have always controlled the direction by stern rudder. It boldly adopts a front wheel to control the orientation.

At the same time, the design of the amphibious environment-friendly car for sightseeing, of which the shape is beautiful, the structure is simple and reasonable, the technical content is high, manufacturability is good, the cost is low, the operation is convenient and the safety performance is good, is in line with the ergonomics, meets the demand of tourism, fitness and entertainment and achieves the double function of traveling in water and on ground.

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