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DESIGN AND DEVELOPMENT OF ELECTRIC KART MOTOR COOLING SYSTEM

Prof. P. N. Shende[1], Atharva Kalbande[2], Deepak Methwani[3]

[1]Mechanical Engineering, Yeshwantrao Chavan College of Engineering.
[2]Mechanical Engineering, Yeshwantrao Chavan College of Engineering.
[3]Mechanical Engineering, Yeshwantrao Chavan College of Engineering.

Abstract - The paper represents the electric karts are being uplifted in formula races and other such events where these vehicles require a high performing motor and high power battery and overheating of motor is one of the major drawbacks. So in this innovation instead of coolant jacketing system we are using surrounding air for motor cooling. The aim is to design and manufacture a light weight F.R.P. [fibre reinforced plastic] duct for carrying out convection which will be used for motor cooling purpose and to reduce the chance of motor overheating. Considering that this reduces the weight of the kart, instead of using cooling fans which is highly power consuming it uses surrounding air which is forced to enter the hollow F.R.P. duct consisting of a peltier plate arrangement which is used to cool the air performing convection. This replaces the old conventional heavy body works with the new multipurpose set of bodyworks. The main objective this innovation is to reduce the usage of secondary battery, ensure reliability, utilization of lighter material. The designing of the electric kart will be done on the ANSYS software, then after finalising the light weight design the F.R.P. modelling and fabrication will take place. To make the kart more attractive than before buffing, surface finishing & spray painting will be done. The impediment of using traditional customary motor cooling technique is more battery consumption, less methodical, risk of peril. Hence, it will become imperative to design & develop a new and more advanced technique to solve this problem.

***Key Words*:** F.R.P.(fibre reinforced plastic), Hollow Bodyworks, Peltier plate arrangement, Wire cooling assembly, Less battery consumption.

1. INTRODUCTION

In this new era of electric vehicles we find that electric karts are being uplifted in formula races and other such events where these vehicles require a high performing motor and high power battery.
These may provide the necessary power to the wheels but like every innovation it has some drawbacks and overheating of motor is one of the major drawbacks.
Like in fuel engines the heating is overcome by providing a jacketing of coolant around the engine, Similarly in this innovation instead of coolant jacketing system we are using surrounding air for motor cooling.
An air circulating duct will be manufactured so as to direct the flow of air entering through the front inlet port, and directed towards the motor casing resulting in reduction of heat generated during functioning of motor.

2. GAP ANALYSIS

The innovation of this idea is that this reduces the weight of the kart, instead of using cooling fans which is highly power consuming it uses surrounding air which is forced to enter the hollow F.R.P. duct consisting of a peltier plate arrangement which is used to cool the air performing convection.
This replaces the old conventional heavy body works with the new multipurpose set of bodyworks.
Clamping force required is analogously less.

3. DESIGN AND METHODOLOGY

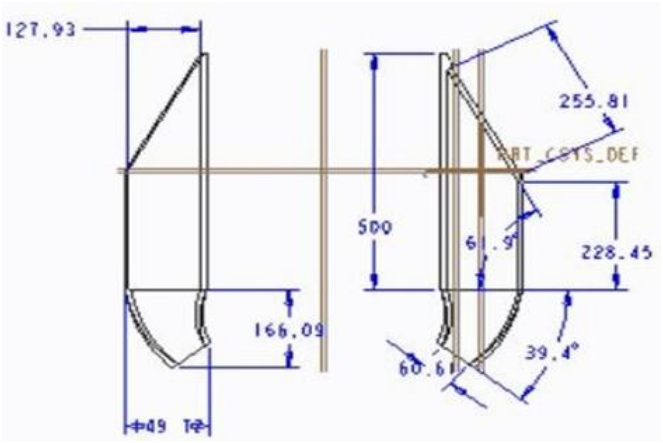
For the development of this system firstly we have done a conceptual CAD/CATIA designing of the bodyworks with a view of finalization of design.
The minimum required material strength was calculated using ANSYS software
Market survey was conducted to select appropriate material to meet the requirements.
After finalizing the design, the next phase is the manufacturing phase.
For the smooth functioning of kart motor we have to take care of the motor temperature and overheating of motor wires.
For this 2 different systems are need one for cooling the motor casing and another for cooling the motor wires.
Firstly for the motor cooling purpose a hollow F.R.P. duct is to be manufactured so as to direct the flow of air entering through the front inlet port, and directed towards the motor casing and there my providing a cooling effect via forced convection.
Steps for the manufacturing of F.R.P duct (bodyworks).
1. Create a acrylic mould of the desired shape and size by using acrylic sheets.
2. Cut the F.R.P. sheets accordingly.
3. Make the mixture of F.R.P resign and cobalt hardener in the ratio of 5:1 where we take 5 portion of resign and 1 portion of harden.
4. Now keep the F.R.P. sheets on the acrylic mould and apply a thick coat of the resign mixture on it.
5. Continue this process by adding more F.R.P sheets till its achieve the thickness of approx. 5mm.

6. Let it dry for 1-2 days so that it becomes hard and tough.
7. After the F.R.P. dries property remove it from the mould gently.
8. Then buff the surface of the bodywork for achieving a good surface finish.

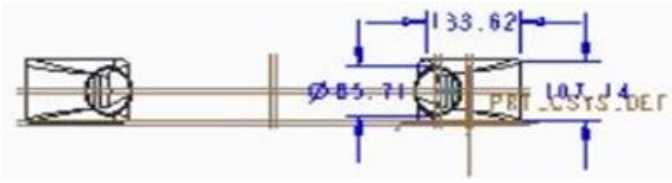
Now for the manufacturing of the wire cooling system.

1. A cylindrical cage with vertical slots is fabricated as shown in the figure(e), on which the motor wires will be mounted using zip ties so the maximum surface area of wires will come in contact with the moving air performing forced convection.
2. This slotted cylindrical assembly is now placed in another cylinder with greater I.D.
3. A high speed fan is placed at one end of the cylinder as shown in the figure.
4. Mica sheets will be is wounded on the wires.

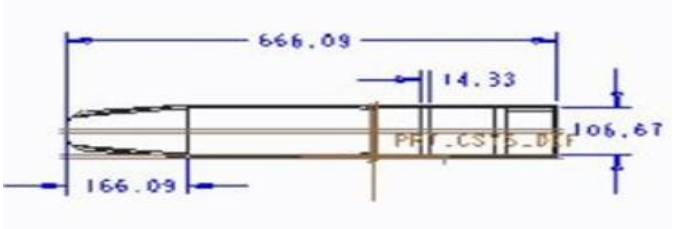
Finally both of these assemblies are mounted on the kart using various clams & fasteners.



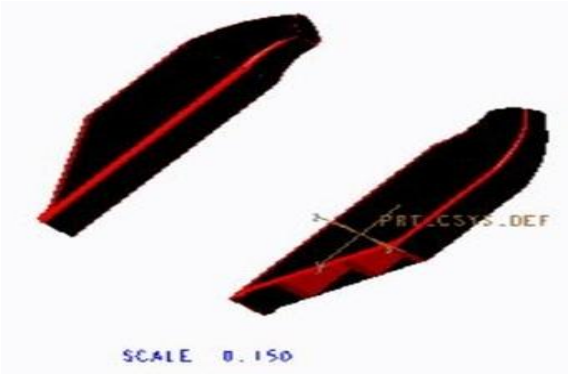
a) Top view of bodyworks



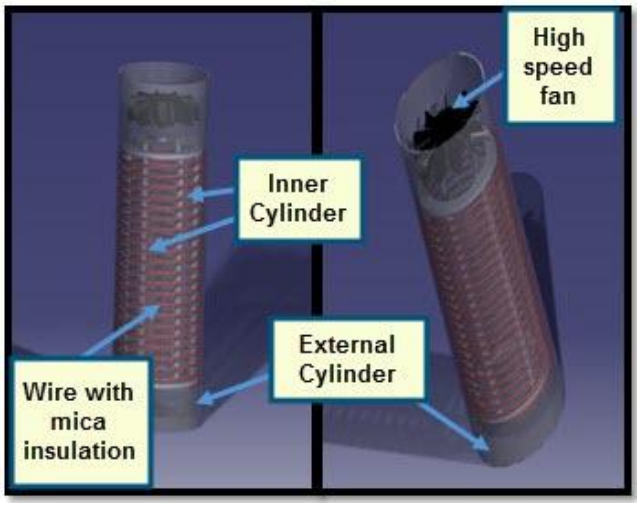
b) Back view of bodyworks



c) Side view of bodyworks



d) 3D view of bodyworks



e) Air cooled wiring system

4. COMPONENTS

- F.R.P. SHEETS

F.R.P. [fibre reinforced plastic] is basically a composite material which is made with polymer matrix reinforced with fibers. The aim is to design and manufacture a light weight F.R.P. duct for carrying out convection which will be used for motor cooling purpose. Resin and hardeners are used in making of FRP moulding.

- MICA INSULATION

Mica being a good conductor of heat, we are wounding mica sheets on motor wire with a view that it will absorb the heat produced by the wires.

- ZIP TIES

Zip ties are basically used here to hold the wounded wires which are equidistant from each other. And also the wires to hold their position.

- CYLINDRICAL METAL CASE

Cylindrical metal case is fabricated because to keep hold of all the wires at their respective places. And also this case is used to make the convection with ease.

- PLASTIC SHEET (thin 0.5 m.m.)

The plastic sheets we are using for the air which in a convective action should get a direction and should not escape in any case.

- FASTENERS

A fastener is a device which is basically used to affix two or more objects. They are used to clamp the plastic thin sheets are mounted.

- ACYLIC SHEETS

Acrylic sheet is a transparent plastic material with great outstanding strength, stiffness. These sheets are easy to fabricate. These are used to make the mould of the bodyworks.

5. CONCLUSION

The main goal was to simplify the overall design to make it more light-weight without sacrificing performance and durability. So, after applying the above methodology we will be able to manufacture the multipurpose bodyworks.

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