DESIGNING AND MANUFACTURING ASPECTS OF GO-KART

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Abstract – *The purpose of this paper is to understand the elements to take into consideration while manufacturing a Go-Kart like steering mechanism, hydraulic brakes, power-train and many more. Its main feature is that it uses four stroke engine for higher performance and also gives high fuel efficiency coupled with reduced pollution. The drive train consists of 4-stroke engine connected with CVT. We have installed kill switch system which helps in shutting off the engine. Driver can switch off and switch on the engine anytime. Electrical start eliminates the rope pulling action to crank the engine. Furthermore it has an adjustable seat for a long and short drivers so they can adjust the seats as per there comfort. Generally, in go-kart mechanical braking system is used where sometime the parts wear out and the brakes lose its efficiency so for the betterment of braking system it has a hydraulic braking system which gives a great brake power. As well as, for steering system it has an Ackerman steering system for true rolling condition or correct steering angle. It also provides a sharp turning into the race tracks. In design of frame or chassis we use cross section between the front side and the rear side, the major concern of this design to attenuate the failure together issue of safety in design.*

Key Words: Go-Kart, Ackerman Steering, Hydraulic Brakes, Power Train.

1. INTRODUCTION

The Go kart is same as other cars but has really low CG and low driver siting position, which gives birth to race thrills where one can dive into corners at very high speeds without much worries. Main chassis of go-kart is made from bunch of bent pipes welded together and with an engine, four wheels and tires attached on it becomes the Go- kart. Due to its popularity countries around the globe have started giving license to the go karts. In European Countries Go Karts are licensed with set of rules such as head lights, tail lights, horn, indicators and maximum 20hp. Go- karting is very popular racing sport for the enthusiastic. Even some commercial platforms provide rental services on their indoor or outdoor track, with renting period being 10 minutes or 15 minutes.

2. Main Components of Go-Kart

Go-Kart consist of Chassis, Ackerman steering system, Hydraulic Brakes, DTSI Engine, CVT, Tires.

2.1 Chassis

Chassis is same as any buildings foundation, it provides rigid support to engine, steering, brakes, axel, driver, etc, It is crucial to have a good design of chassis which can give the go-kart better traction for the driver to maneuver, especially diving in corners at high speeds. Go-Kart does not have a suspension system. So, compared to the normal vehicle the go kart requires the chassis itself to be flexible to fulfill the role of suspensions. Even so the go-kart chassis should be rigid enough to withstand the strains experienced during race such as weight of the drivers. It is also notable that by doing proper design of chassis we can have less vibrations which expands the life span of the chassis. Chassis should withstand different track conditions too. Dry tracks demands stiffer chassis. On the opposite side a wet track will need a more flexible chassis. Innovations have took place in this field too. One can put removal stiffening bars on the rear, front, and side of the go-kart that can be removed or added depending on the track conditions. Caged, open, offset and straight chassis are the main four types of chassis. Caged chassis has a type of chassis pipes which surround the driver and protects him/her in the event of roll over. If the track is dirt track or has uneven racing terrain, this kind of caged go kart is preferable for driver safety issues. Open, offset and straight chassis does not have roll cage around the driver. Offset and straight chassis can be differentiated from the sitting position of the driver.

We used mild steel square pipes with cross-section dimensions of 32×32 mm. Over chassis overall dimension being 6.5 feet × 4 feet.

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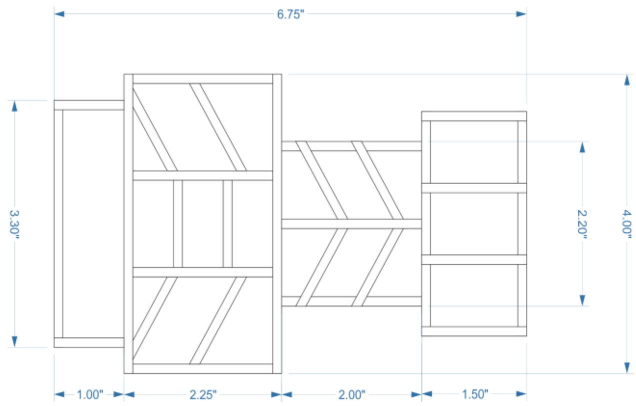

Fig -1.1 Design of the Chassis

2. Steering

Steering system is core part for any racing vehicle. Good Steering system ensures the high performance of vehicle on the track. Go-kart steering should turn full with the steering wheel input being only 90°or half turn. By keeping driver steering input to only 90° drivers can easily do aggressive maneuvers. The steering system has steering spindle and steering plate which are bolted together. Which gets connected to the plate and link mechanism. The mechanism follows Ackerman geometry to connect the 2 front wheels.

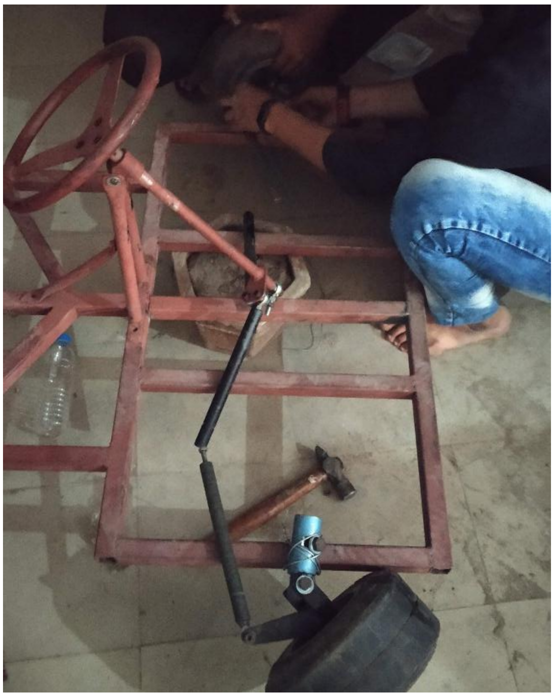

Fig 1.2 Steering System

3. Engine

Typical go-kart will have two-stroke and four-stroke engines to choose from. By referring to Vortex's engine specifications, a two-stroke engine usually produces power at range of 8hp single-cylinder unit to 90hp with a twin cylinder unit (Vortex, 2010). Whereas, four-strokes engine from manufacturer such as Aixro which can produces at maximum power up to 45hp (Aixro, 2010). Engine is a heart of Go-Kart, the sport gets its fame from thrill gained by the high powered engines.

Here, we have used Bajaj DTSI 109.7cc Engine. Whose specifications are as below,

Table 1 Engine Specifications

Displacement	109.7 cc
Maximum Power	8 HP @ 7000 rpm
Maximum Torque	8.82 Nm @ 5000 rpm
Number of Cylinder	1
Number of Gears	Automatic

4. Transmission system

This go-kart has no gears and clutches. The transmission we use is not manual, it is automatic. So to give it automatic drive which can also give very good performance we used CVT.

To explain the CVT working, at low rpm the driving pulley's pitch diameter is small in comparison to the driven pulley so as a result the drive shaft has low rpm similar to the low gear characteristics. For high gear configuration the diameter of driving pulley is higher than the driven pulley. During this gradual change in size it generates infinite no. of gear ratios.

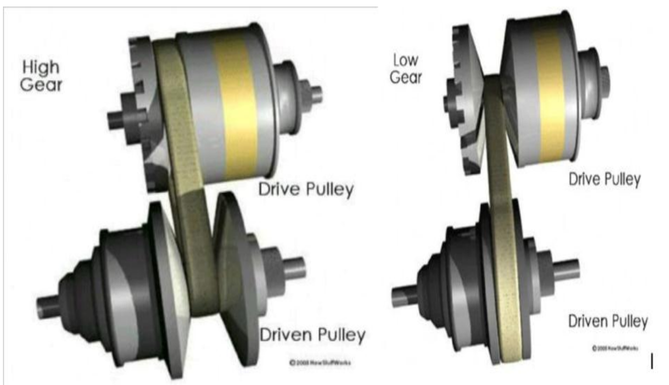

Fig 1.3 CVT

Then power from engine passed through CVT reaches on merged sprocket which then gets carried out by chain to bigger sprocket on the main axle.

5. Axel and Sprocket

We have used EN 24 material 1.5 cm diameter with wall thickness of 0.3 cm hollow shaft which has high torsion resistance. We used tripod joint to transfer the rotation of Axel to wheel rotor. On CVT shaft we have 16 tooth sprocket which connects to 76 tooth sprocket on drive shaft. By doing that we can multiply the torque available at wheel by more than 4 times.

Fig 1.4 Axel with Sprocket, brake disc and bearing

6. Transmission gear calculation

On engine shaft we have about 6000 rpm at peak performance.

In the CVT driving pulley is mounted on engine and it gets connected to driven pulley. Here, in the initial phrase the driving pulley has small diameter which gradually increases and at the same time the driven pulley has the exact opposite effects on its diameter. Initially the driving pulley: driven pulley is 3:1 which gets 2:1 with higher engine rpm.

Driving pulley: Driven pulley = 2:1 rpm

At engine rpm 6000 driven pulley has rpm of 3000.

Tire height 10 inches= 0.254 meter

Tire circumference $\pi D= 3.14\times 254= 0.79756$ m

Hence, 1 revolution of wheel = 0.79756 m distance travelled

Expected speed of our go kart was 30 km/h which is equal to 500 m/min.

Now, 0.79756 m = 1 revolution of wheel

500 m =? Revolution of wheel

So, for 30km/h speed wheel rpm is 626.91.

Engine rpm= 3000 and tire rpm is 626.91.

3000/626.91= 4.785

CVT output has 16 tooth which gave us the required tooth on the axel sprocket which is 76 tooth.

7. Brakes

Conventional Go Karts have mechanical brakes but we have optimized this conventional method by replacing it with hydraulic brake system. We have used inboard disc brake on rear drive axel. We used dual piston floating caliper to gain optimum braking performance. We used DOT 3 brake fluid and master cylinder of BOSCH with bore diameter of 19.05 mm. Cast iron is used for the disc material with the disc diameter of 196 mm.

Fig 1.4 Brake disc`

8. CONCLUSION

To conclude, it can be safely said that we have converted the experience into skill and created a vehicle, keeping in mind ergonomics and performance along with its primary concern of a safe design. A high level of manufacturability and fabrication skills were incorporated to create a vehicle with high maneuverability and esteemed performance.

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