

Design and Fabrication of a Go Kart

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ABSTRACT: A Go Cart also spelled as Go Kart is a four wheeled vehicle designed and meant for racing only (though in some countries it is used for fun personal transportation). It is a small four wheeler run by I.C Engine. It is a miniature of a racing car. Go Cart is not a factory made product; it can be made by Automobile engineers. This report documents the process and methodology to produce a low cost go-kart. Simple but innovative, we have made a simple, self-fabricated 'Go Cart', chassis formed by hollow rectangular bar, powered by Honda 150 cc engine fitted with dual disc brake. The chassis are made of steel tube. There is no suspension therefore chassis have to be flexible enough to work as a suspension and stiff enough not to break or give way on a turn. We are replacing hollow tubular shaft with hollow rectangular shaft. The purposes of this replacement are; For the same length of tubular shaft, rectangular shaft weighs the same, for visual improvement, for better mounting ability and the main thing is, it is found that hollow rectangular shaft has more bending stress than the tubular shaft.

KEYWORDS: Go Cart, Racing Car, Bike Engine

I.INTRODUCTION

Almost similar to the original go kart, in this project, the main achievement is to make a moving vehicle. A simple go-kart will be recreated and will be provided with a more advance safety system and gear shifting technology to improve the kart's handling and performance. The chassis are made of steel tube. There is no suspension therefore chassis have to be flexible enough to work as a suspension and stiff enough not to break or give way on a turn.

Classifications:

Kart chassis are classified as 'Open', 'Caged', 'Straight' or 'Offset'. Open karts have no roll cage, caged karts have a roll cage surrounding the driver; they are mostly used on dirt tracks, in Straight chassis the driver sits in the centre. Straight chassis are used for sprint racing, in Offset chassis the driver sits on the left side. Offset chassis are used for left-turn-only speedway racing.[3]

Specialization:

We are replacing hollow tubular shaft with hollow rectangular shaft. The purposes of this replacement are: - For the same length of tubular shaft, rectangular shaft weighs the same, for visual improvement, for better mounting ability, and the main thing is, it is found that hollow rectangular shaft has more bending stress than the tubular shaft. [1]

Steering System:

The basic aim of steering is to ensure that the wheels are pointing in the desired directions. This is typically achieved by a series of linkages, rods, pivots and gears. One of the fundamental concepts is that of caster angle – each wheel is steered with a pivot point ahead of the wheel; this makes the steering tend to be self-centering towards the direction of travel.[2]

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Many modern cars use rack and pinion steering mechanisms, where the steering wheel turns the pinion gear; the pinion moves the rack, which is a linear gear that meshes with the pinion, converting circular motion into linear motion along the transverse axis of the car (side to side motion). This motion applies steering torque to the swivel pin ball joints that replaced previously used kingpins of the stub axle of the steered wheels via tie rods and a short lever arm called the steering arm. The rack and pinion design has the advantages of a large degree of feedback and direct steering "feel". A disadvantage is that it is not adjustable, so that when it does wear and develop lash, the only cure is replacement.

Older designs often use the recirculating ball mechanism, which is still found on trucks and utility vehicles. This is a variation on the older worm and sector design; the steering column turns a large screw (the "worm gear") which meshes with a sector of a gear, causing it to rotate about its axis as the worm gear is turned; an arm attached to the axis of the sector moves the Pitman arm, which is connected to the steering linkage and thus steers the wheels. The recirculating ball version of this apparatus reduces the considerable friction by placing large ball bearings between the teeth of the worm and those of the screw; at either end of the apparatus the balls exit from between the two pieces into a channel internal to the box which connects them with the other end of the apparatus, thus they are "recirculated".[4]

The recirculating ball mechanism has the advantage of a much greater mechanical advantage, so that it was found on larger, heavier vehicles while the rack and pinion was originally limited to smaller and lighter ones; due to the almost universal adoption of power steering, however, this is no longer an important advantage, leading to the increasing use of rack and pinion on newer cars.[7]

The recirculating ball design also has a perceptible lash, or "dead spot" on center, where a minute turn of the steering wheel in either direction does not move the steering apparatus; this is easily adjustable via a screw on the end of the steering box to account for wear, but it cannot be entirely eliminated because it will create excessive internal forces at other positions and the mechanism will wear very rapidly. This design is still in use in trucks and other large vehicles, where rapidity of steering and direct feel are less important than robustness, maintainability, and mechanical advantage.

Front Stub Axles and King Pins:

The Front Stub Axle and King Pin is one complete piece, however there is a Left and Right hand piece - so they are NOT identical. Only the Left hand Front Stub Axle and King Pin is outlined in the above drawing. With some common sense, a Right hand part can easily be fashioned. The "n" piece of the King Pin is made up by welding 3 pieces of flat steel to form a "n" shape. The steering arm is then welded to the King Pin (n shaped piece). Note this steering arm can be welded to the top of the King Pin to provide for greater room. In the plans above it was placed at the bottom, putting the track rods under the chassis and thus does not interfere with the Drivers feet etc. [8]

The angle of 110 degrees is a calculation from the Ackermann principle which is further discussed on this website here and here. The stub axle piece itself is welded onto the side of the King Pin. If you don't have access to a Metalwork Lathe to produce the piece as in the above Drawing, it can be made simpler by, obtaining a diameter 20mm metal bar, 125mm long. Obtain a 13mm Bolt, and cut the head off it.[5] Then weld the 13mm bolt to the end of the 125mm long metal bar. Finally to prevent the front wheel from moving in on the Stub axle, obtain a piece of tubing, inside diameter 20mm and outside diameter approx. 30mm. Weld this small piece of tubing at the correct distance on the inside of the front wheel. [6]

The 78degrees angle is to counter-act the 12degrees Camber angle as was covered in the Chassis Drawing. Attach the Front Stub Axles and King Pins to the Chassis using 13mm High Tension Bolts with Locknuts and washers in the appropriate places. Both Front Stub axles should now pivot and move from side to side. The "Track Rods" will tie together the Steering Arms which are welded to the King Pins.

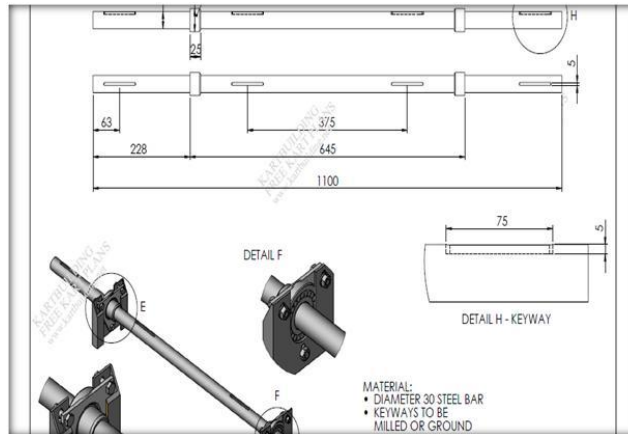


Fig:1-Chassis frame dimensions

Braking system:

Disc Brake:

A brake is a mechanical device which inhibits motion, slowing or stopping a moving object or preventing its motion.[9] Most commonly brakes use friction between two surfaces pressed together to convert the kinetic energy of the moving object into heat, though other methods of energy conversion may be employed. For example regenerative braking converts much of the energy to electrical energy, which may be stored for later use. Other methods convert kinetic energy into potential energy in such stored forms as pressurized air or pressurized oil. Eddy current brakes use magnetic fields to convert kinetic energy into electric current in the brake disc, fin, or rail, which is converted into heat. Still other braking methods even transform kinetic energy into different forms, for example by transferring the energy to a rotating flywheel.[10][11]

Brakes are generally applied to rotating axles or wheels, but may also take other forms such as the surface of a moving fluid (flaps deployed into water or air). Some vehicles use a combination of braking mechanisms, such as drag racing cars with both wheel brakes and a parachute, or airplanes with both wheel brakes and drag flaps raised into the air during landing.

Since kinetic energy increases quadratically with velocity an object moving at 10 m/s has 100 times as much energy as one of the same mass moving at 1 m/s, and consequently the theoretical braking distance, when braking at the traction limit, is 100 times as long. In practice, fast vehicles usually have significant air drag, and energy lost to air drag rises quickly with speed.

Almost all wheeled vehicles have a brake of some sort. Even baggage carts and shopping carts may have them for use on a moving ramp. Most fixed-wing aircraft are fitted with wheel brakes on the undercarriage. Some aircraft also feature air brakes designed to reduce their speed in flight. When the brake pedal of a modern vehicle with hydraulic brakes is pushed, ultimately a piston pushes the brake pad against the brake disc which slows the wheel down. On the brake drum it is similar as the cylinder pushes the brake shoes against the drum which also slows the wheel down.[13]

Transmission system:

Clutch:

Multiple-disc clutches can be used to hold members to the case instead of using bands but in most transmissions, they couple planetary gear members and shafts together. A servo-operated band can only hold a member stationary, but multiple-disc clutches can hold or drive individual members. They have a set of driving plates, and a set

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of driven plates, collectively called a clutch pack. Both sets may be spring steel, but one has friction material bonded onto both faces, and since they operate in the transmission fluid they are called wet clutches. The friction material may be plain or grooved. Grooving allows for fluid to escape from between the plates when the clutch engages.[14] The steel plates may be dished, or waved, with alternate high and low segments. This design promotes smooth engagement. The size and number of plates in a clutch pack depends on the maximum torque it is required to transmit.

Three to five plates of each type are commonly used. The plates are pressed together for engagement by a hydraulically-operated piston. It moves in a short cylinder in a clutch drum, or in a cylinder machined in the casing. Release can be affected by one large coil spring, or by a pack containing many small springs. When a diaphragm spring is used, it gives extra leverage to increase the apply force as well as providing the release force. The outer circumference of the diaphragm spring rests against a step in the clutch drum. The piston pushes against the inner circumference of the spring to apply the clutch. The force exerted on the clutch pack is multiplied by leverage from the diaphragm, as it pivots against the pressure plate.[12]

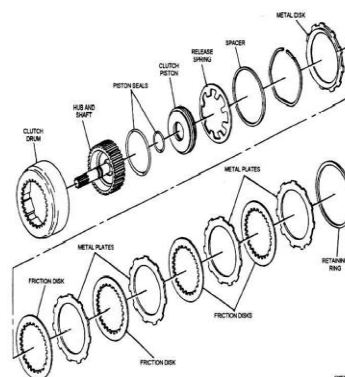


Fig: 2- Clutch components disassembled
Gear:

view

Most manual transmission two-wheelers use a sequential gearbox. Most modern motorcycles (except scooters) change gears (of which they increasingly have five or six) by foot lever. On a typical motorcycle either first or second gear can be directly selected from neutral, but higher gears may only be accessed in order – it is not possible to shift from second gear to fourth gear without shifting through third gear. A five-speed of this configuration would be known as "one down, four up" because of the placement of the gears with relation to neutral. Neutral is to be found "half a click" away from first and second gears, so shifting directly between the two gears can be made in a single movement. [15][16]



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Fig: 3-Arrangement of Gear controls

Engine Specifications:

Engine Type-4-Stroke, SI Engine, Air Cooled
Displacement 149.1 CC
Power 9.92 kW (13.3 bhp) @ 8000 RPM
Torque 1.3 Kg-m @ 5500 RPM
Bore x Stroke--
Compression Ratio--12:1
Transmission-5-Speed, Constant Mesh
Clutch-- Multiplate, Wet type
Fuel Type--Petrol
Carburettor--Carb
Final Drive--Chain
Gear Shift Pattern--1 Down - 4 Up
Starting System Self Starter / Kick Starter
Air Filter-Viscous Paper Filter

Formula:

Engine displacement is determined from the bore and stroke of an engine's cylinders. The bore is the diameter of the circular chambers cut into the cylinder block.

Or in decimal form:

$$\text{displacement} = \frac{\pi}{4} \times \text{bore}^2 \times \text{stroke} \times \text{number of cylinders}$$

Requirements:

Engine
Chain that fits the sprocket
Bolts, washers
Gas tank
For the drive train:
Wheels
Steering wheel
Gear and handbrake
Drive shaft
Bearings
Steering shaft
Brake pedal
Throttle/go pedal

II. TECHNICAL BACKGROUND

1. A 2-stroke engine: Any 2-stroke air-cooled engine which will gives 5-20hp
2. Welding and Cutting Tools

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3. A Battery: It is a device that stores the electricity and supply when required
4. Steel frame: For the construction of the chassis
5. Fuel: To run the engines
6. Cables: For accelerating, braking and gear shifting
7. Tyres

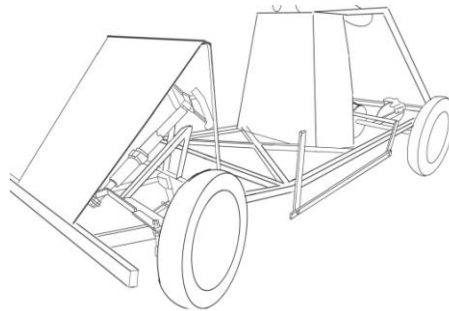


Fig: 4- Chassis of Go-kart

III. METHODOLOGY

EQUIPMENT:

1. A working engine
2. Tyres and tubes
3. A Battery
4. Chassis frame
5. Disc brakes
6. Chain and sprocket
7. Sheet metal
8. Wires
9. A Switch

IV. PROCEDURE

1. Steel hollow rectangular shafts of different size are cut with different length.
2. Steel shafts are welded together with appropriate order so as to make a strong and stable chassis. Since a go-kart is not equipped with a suspension system, the frame needs to be very strong and reliable for cornering and handling shocks.
3. The type of chassis is an open type chassis, and a single seater with low ground clearance.
4. Engine is mounted on a rear end of the kart. It will power the rear wheel through a torque converter. Engine will power the rear wheel through a chain mechanism.
5. Dual disc brakes are installed on the rear wheel.
6. Tyres and tubes of appropriate size are used for front and rear.
7. Rack and pinion type steering mechanism is installed

V. BLOCK DIAGRAM

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Fig: 5- Go Kart

VI. CONCLUSION

'Fabrication of a self-designed, self-assembled Go Kart' is been carried out by our team with diligent and continuous effort. Chassis are paper designed with engine fitted manually. Axle is self-measured and fitted according to the chassis. Engine oil is replaced for optimum performance and for brake effectiveness the master cylinder is bled and for protecting the kart from atmospheric corrosion paints are applied. Gear shifting is modified and placed on the left side of the kart for the ease of shifting.

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