

Fabrication of Tris Suspension Tricycle

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Abstract— Safety is the most important consideration for two-wheelers. The tilting mechanism increases the maximum speed in curves. The use of tilting mechanism in automobile would decrease the rate of accidents due to skidding. It will give better dynamic stability as well as directional stability to the vehicle, better road grip and better comfort to the passengers. The tilting trike uses a mechanism includes a parallelogram linkage which allows tilting of the vehicle similar to any other two wheelers. The tadpole configuration of the trike provides more stability compared to delta design. Tilting mechanism is operably connected to the frame of the vehicle using a set of vertically aligned bearings which holds it in place. The mechanism ensures proper alignment of the independent wheels in all possible types of movements. The use of tilting mechanism in automobile would decrease the rate of accidents due to slippage. It will give better dynamic stability as well as directional stability to the vehicle, better road grip, better comfort to the passengers, and the most important load carrying capacity of vehicle increases, by this leaning, the center of gravity balances the centrifugal force which is acting on the vehicle and makes it more stable during turning.

Key words – suspension, tilting mechanism, tricycle.

1. INTRODUCTION

Trikes are 3 wheeled vehicles great for performing an exercise, getting outdoors for rides and having fun, comfortably. Selecting a Trike over a Bike is a great choice and worth a lot. These days trikes became popular because of its numerous advantages. Trikes are the best option suitable for long rides and comfort. The third wheel of trike adds extra stability and reduces the driver's dependency to the minimum. Trikes are of two types based on the wheel configuration; tadpole and delta trikes. Tadpole trikes have two wheels in the front and one at the back. Whereas delta trikes have one wheel at front and two at back. There are different requirements and different facts to select trikes. Based on design, stability, speed, cornering and steering control we can choose an appropriate type of trike. Tadpole trikes are the tricycle with two wheels at the front that steers. The two wheels in the front make the cornering slightly better at speed, offering more stability to resisting cornering forces. The weight distribution at the front is more so it provides better stability and control over steering and braking. The tadpole trikes have a lower center of gravity and are near to the steering axis, which is better for speed and stability. These trikes are much more compact, lower, faster, lighter in weight and sportier. Although the steering geometry is complicated but best to ride hard and fast. Delta trikes are the tricycle with a single wheel at front that steers. A single wheel for steering out at the front causes instability. The delta trikes are the oversteering vehicles that try to swap ends while taking a turn too aggressively. The front-wheel design allows taking sharp turns almost 90 degrees, giving a very tight turn with a radius nearly equal to its length. In a delta configuration, the center of gravity is high and well behind the steering axis, which is not good for steering and stability. At the front wheel of delta trike, the weight is less which reduces the steering control and may lift the front end of the trike at steep hill climbing. Delta trikes are larger, slower, heavier in weight and less sporty. The ground clearance in delta trike is high which allows better visibility and allows you to ride on uneven terrain. If someone prioritizes versatility over speed and stability then delta trike is the best option. Some users prefer delta trikes, as the seats are high allowing better visibility and allows to easily sit on the seat and get off the seat. The disadvantage of a three-wheel configuration is lateral instability- the Tris bike will tip over in a turn before it will slide. This can be prevented in 3 ways, namely, by Placing the Centre of mass Closer to the ground, by Placing the Centre of mass Closer to the front wheels and by increasing the track width. The problem for delta vehicles is how to distribute their weight and control their weight transfer during a turn to avoid undesirable outcomes. If you design the weight distribution for a heavy front bias to achieve under steer, you increase the risk of tipping over. If you increase the weight distribution on the rear tires, the vehicle will over steer in hard turns. The front wheels on any vehicle provide the majority of your stopping power. The delta is at a disadvantage considering the weight distribution and the fact that it has one less front tire to brake on. The steering system for a tadpole is definitely easier to design for the delta. No special considerations need to be taken into account to avoid lateral wheel slipping on turns. Front suspension design is a common feature on the delta. The best choice is the telescopic fork. For any tadpole trike, the center of gravity of the rider is low, and located ahead of the forward tipping axis so it would tip forward under a 1g braking force. With modern caliper brakes, this would have a tendency to lift the rear wheel. On a downward slope the tipping manifest would be even less. Now many customers will have this question on their mind "Why not position the front wheels further forward" Well there are some issues with such as; the cross member will get in the way of the cyclist's calves, the seat will become more difficult to stand up out and the rider's feet will be located are too far forward. The combination of steering systems are capable of giving combined advantages of both the steering systems like anti-skidding Effect, reduced turning radius. By implementing both regular turning mechanism & tilting mechanism it is possible to have combined advantages of both turning & tilting.

2. DEFINITION OF THE PROBLEM

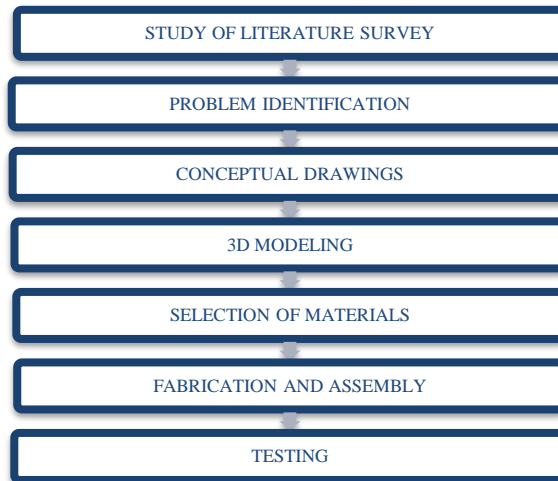
Nowadays most of the accidents occur on two wheelers are because of the instability of vehicles in slippery conditions and the skidding of vehicles. Travelling in bikes during rainy season or snowy seasons is risky. Safety of passenger must be considered as the

primary concern. Trikes are designed in order to provide maximum safety to passenger. Avoid skidding during ride is very much important factor for a bike. For such situation trikes play a major role to provide safety to passenger. The Tilting trike is much safer than motorbikes and scooters, and much smaller and lighter than any car. The third wheel offers better braking as well as increased stability while braking. It offers more traction when roads are slippery.

3. OBJECTIVES

The objective of this project work is to successfully develop a design of a tilting mechanism for automobile, and to provide banking to the vehicle on unbanked curves, so as to enable added threshold speed on curves.

4. METHODOLOGY



5. DESIGN AND DRAFTING OF COMPONENTS

5.1 - Fork

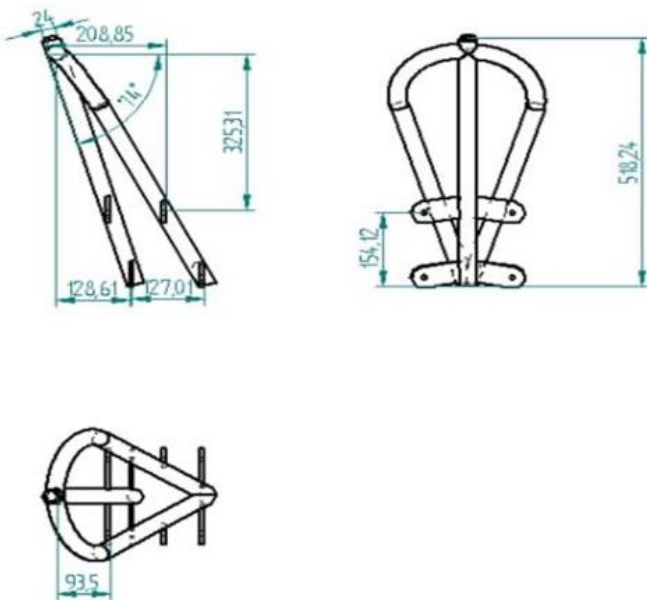


Fig (1) : Fork



Fig (2) : Fork in 3D

5.2 – Fringe Frame

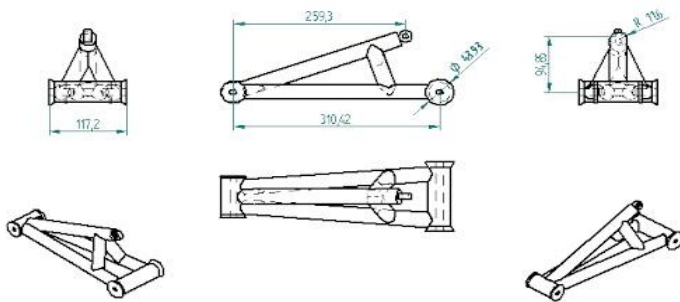


Fig (3) : Fringe Frame

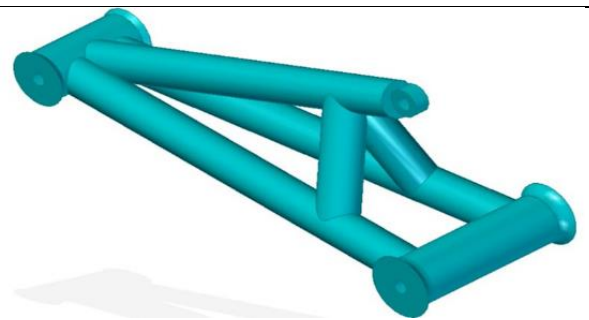
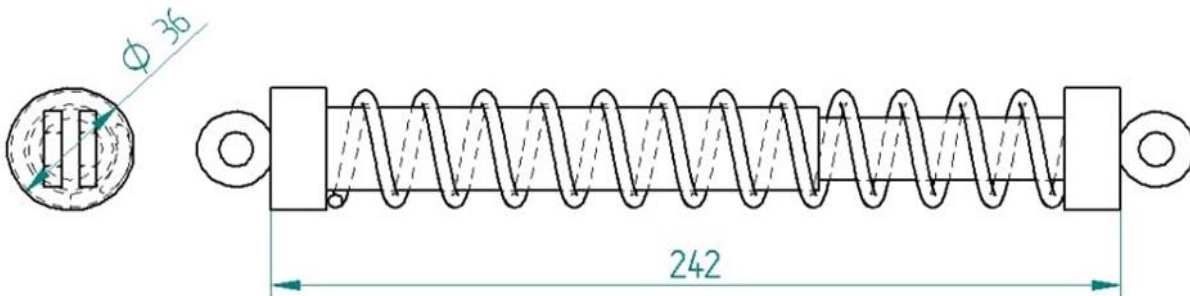


Fig (4): Fringe Frame in 3D



Fig(5) : Shock Absorber

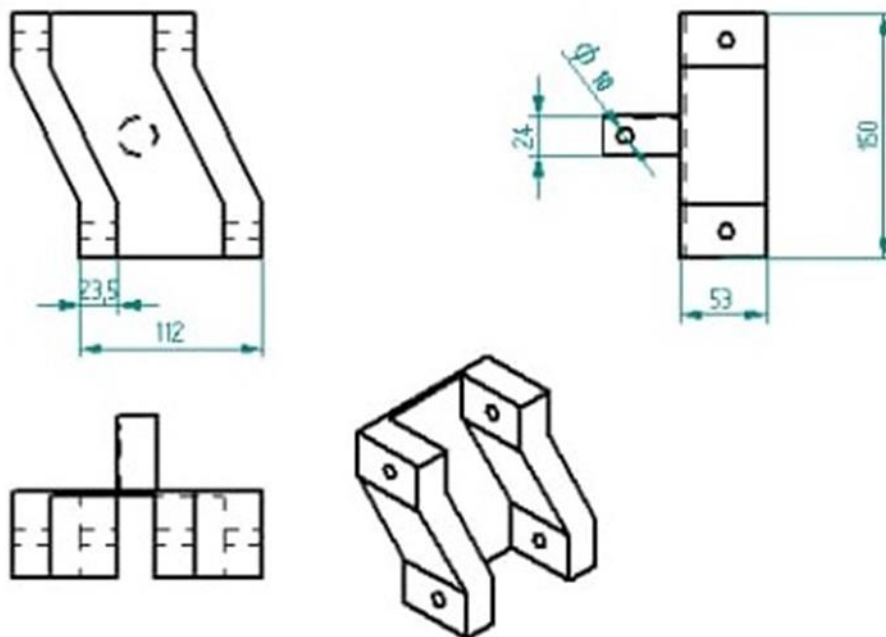


Fig (6): Wheel Connecting Plate

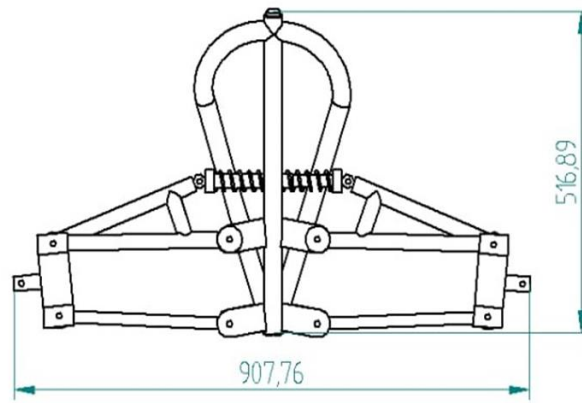


Fig (7): Tilting Suspension

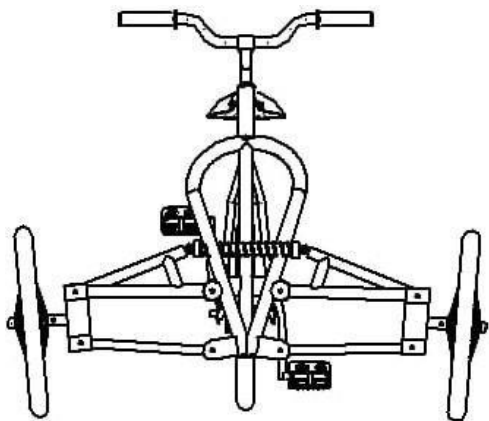


Fig (8): Front View of Trisuspension Bike

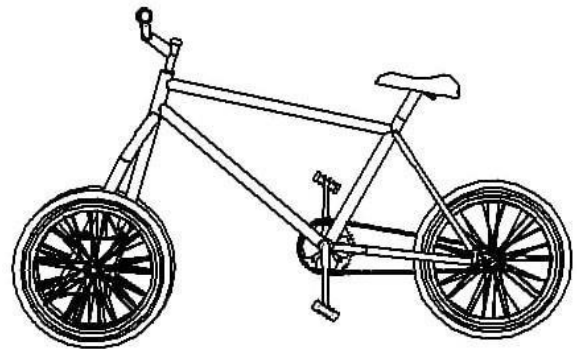


Fig (9): Side View of Trisuspension Bike

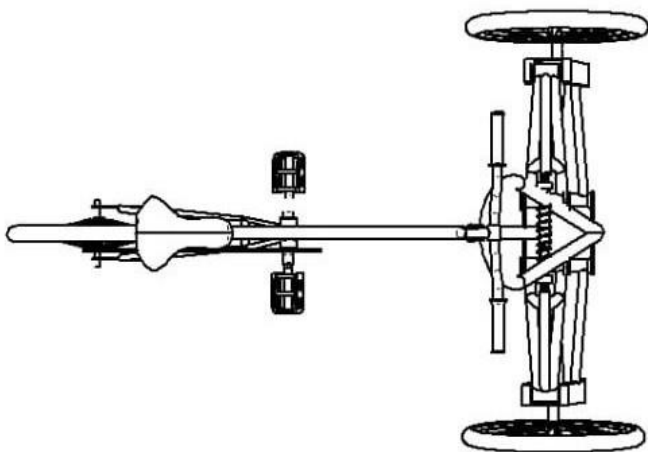


Fig (10): Top View of Trisuspension Bike

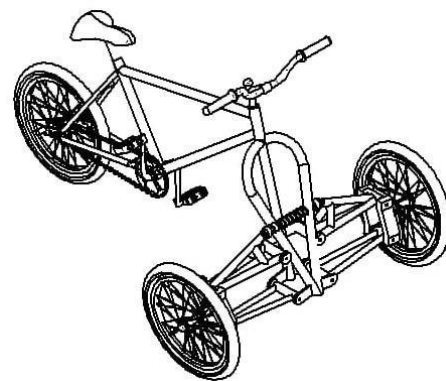


Fig (11): Isometric view of Trisuspension Bike

6. FABRICATION OF TRI CYCLE:

6.1 Milling: - Turning involves rotation of the work piece while the cutting tool moves in a linear motion. This results in a cylindrical shape. A lathe is the machine of choice for all turning operations. Like most machining operations, turning is either done manually or automatically. The downside to manual turning is it requires continuous supervision. Automatic turning does not. With Computer Numerical Control, or CNC, you program all the movements, speeds, and tooling changes into a computer.

These instructions then get sent to the lathe for completion. CNC allows for consistency and efficiency of high production runs. Single point cutting tools used in turning come in various shapes. They're placed at different angles for a variety of outcomes.

6.2 Turning and Phasing:- Drilling creates a round hole in a workpiece. A drill press or tapping machine is designed for drilling, but this process can also be performed using a milling machine. Chips are the bits of waste metal produced when machining a workpiece. The shape of the drill bit helps chips fall away from the workpiece, keeping the workpiece free of debris. Placing the drill bit perpendicular to the workpiece reduces drifting or leading-off. For even more precision, a center drill operation is often added before drilling. Some drilling operations need angular drilling. Angular drilling requires special work-holding tooling. Other options include: rotation of the head on a manual machine or use of multiple axis on a CNC machine. I work in Spotting Drills – short drills used to create shallow or pilot holes. If using a longer drill for these shallow holes it could have a tendency to drift.

6.3 Drilling, boring: - Milling operations involve using multi-point rotary cutters to remove material from a workpiece. There are two main types of milling operations: face milling and peripheral milling. Face milling cuts flat surfaces into the workpiece and flat-bottomed cavities. The feed can be either horizontal or vertical. Peripheral milling cuts deep slots, threads, and gear teeth. The workpiece can be fed into the cutting tool in either of two ways. Conventional milling involves feeding the workpiece against the cutter rotation. This is the recommended method for manual milling machines. Climb milling, on the other hand, feeds the workpiece in the same direction as the cutter rotation. This is the preferred method for CNC milling. Milling is best applied as a secondary process to an already machined workpiece. It helps to define features and serves as a “finishing coat”. Use milling as a secondary process to add features such as holes, slots, pockets, and contours.

6.4 Welding: - Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a joint as the parts cool. Welding is usually used on metals and thermoplastics but can also be used on wood. The completed welded joint may be referred to as a weldment. Some materials require the use of specific processes and techniques. A number are considered 'un weldable,' a term not usually found in dictionaries but useful and descriptive in engineering. The parts that are joined are known as a parent material. The material added to help form the joint is called filler or consumable. The form of these materials may see them referred to as parent plate or pipe, filler wire, consumable electrode (for arc welding), etc. Consumables are usually chosen to be similar in composition to the parent material, thus forming a homogenous weld, but there are occasions, such as when welding brittle cast irons, when a filler with a very different composition and, therefore, properties is used. These welds are called heterogeneous.

7. Working Procedure Tris Suspension Trycycle: -

7.1 When the Tilting Mechanism Hits Bumps and Pot holes: - The construction of tilting mechanism in tilting trikes is like a double wishbone suspension system. Thus, the wheel under bump and potholes only experience road shock and this shock is not transmitted to the other wheel as in fig(12).



Fig (12): Tilting Mechanism Hits Bumps



Fig (13): Tilting Mechanism during Turning

7.2 Tilting Mechanism During Turning: - During turning the tilting mechanism of the trike helps in tilting the vehicle like an inline two wheel bike as in fig (13).

7.3 During Straight Road Conditions:- During straight road conditions the tilting mechanism provides better traction, stability, braking performance with comfortable ride condition.

8. Cost incurred: -

COMPONENTS	REQUIRED	COST
• Bicycle	01	2500
• Square bar	01	500
• Clamps	AS REQUIRD	200

• Bolt and Nut	AS REQUIRD	200
• Suspension	03	1500
• Front cycle wheel	02	1000
• E N 8 M S block (100*100mm)	01	300
• Welding rod	01 (pack)	480
• Cutting wheel	06	300
• Grinding well	02	150
• Round pipe (M S)	01	200
• Paint	01	300
• Machining charges	-	1000
• Labor charges	-	3000
		Total 11,630

9. Conclusion: -

Tri suspension bike is perfect for those that would like to ride a large two wheeled vehicles, but are not confident about their physical strength to handle a heavy Bike or being short, unable to withstand the weight of vehicle when turning or stopping. This assures higher safety than the regular two wheeler bike or bicycles and provides smoother and more confident cornering and gives higher speed incurves. Good directional as well as dynamic stability.

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