

Design and Fabrication of Tricycle for Handicapped People

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Abstract: We known and have seen the wheel chair which is to be normally the handicapped people or the patient use, it needs to push by someone or the force is applied by the person directly on the wheels due to which they fill tired and if the patient want to go to the table then there should have a need of other chair to shift him. Thus to remove these problems of a handicapped person tricycle is design. For the transportation number of hand driven tricycles, wheelchairs, solar operated tricycles, etc. can be seen in the market for handicapped people. The basic Tricycle is design by three-wheel, pedaled by handicapped persons in the side and for sitting arrangement the seat is used in the middle. This type of tricycle is operated by using one hand to steer the handle and other hand is used to rotate the pedal. Our aim is to design and fabricate a low cost effective three wheel base tricycle for the handicap people to be propelled by the link mechanism attachment to the steering column and which is also used for the accelerating function converting into cranking, using the advantage of leverage, with proper balance and distribution of mass and centre of gravity to crank the wheel shaft for propelling. As the person can use both the hands on the steering, the controlling and performance is better than pedal operated tricycle.

Keywords: Tiller, Link, Crank, Connecting Rod, Direction Rod.

I. Introduction

Tricycle means a vehicle that has three wheels. It is also called as Trike. Generally it is human powered. Now motorised cycles are also available. Tricycles are used by children, younger and elder peoples. It is a transport vehicle for a handicapped people. Because of three wheels the stability of vehicle is more than the two wheels vehicle.

Transportation is one in all the vital factors in our day to day life, except for traditional person it's terribly straightforward to travel from one place to a different place and this can be very tough for the someone.

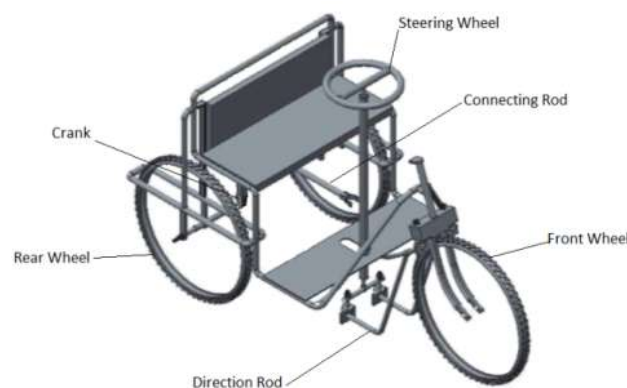


Fig.1: A CAD model of tricycle

Within the world nearly 100-130 million people would like chair. Someone ordinarily use trike that work on the chain and sprocket mechanism it operated by hand, however it's some disadvantages. Motorized trike is additionally developed, however currently days the worth of fuel is increase quickly and pollution is additionally increase rapidly. So that, this kind of trike is extremely helpful for disabled person. This trike relates to a conveyable self- propelled device while not exploitation either electrical or fluid power. In some embodiments it conjointly helps to require a flip too simply than the traditional wheel chair. During this trike we have a tendency to be exploitation crank and connecting rod mechanism that works on the principle of slider

crank mechanism. Once we move the steering of trike in to and fro motion then with the assistance of crank and connecting rod, tricycle wheels rotate.

II. Objectives

1. To provide a more stable and efficient arm propelled and arm steerable tricycle that can be safely be used by any person.
2. To make tricycle in which the steering as well as the accelerating function is done with the help of only one handlebar.
3. To design and fabricate a cost effective three wheeled tricycle attachment for easier accessibility.
4. To design and manufacture the tricycle for the handicap people to be propelled by the crank and connecting rod mechanism.

III. Vehicle Mechanism

When we apply the force on steering in forward and backward direction, liver and crank give the motion to wheel by changing the rotary motion into motility.

The direction of tricycle is controlled by steering rod. The device is operated by to and fro motion of steering that facilitates to rotate the wheel. The turning action happens by tilting the steering forward and backward direction.



Fig. 2: STEERING ROD

IV. Working Principle

Tricycle is three wheeled vehicle in which the front wheels being steered by the steering rod. The steering column has two tube, in which the outer tube is hinged at the base and the other side extension of the steering column is pulling and pushing the cranking mechanism of the rear wheel. The upper end of the inner rod is connected to steering wheel and lower end connected to link mechanism to the front wheel to steer the wheel as the steering handle is being rotated which is held at the top side of the steering column. The cranking mechanism is on one of the rear wheel axle. The rear wheels are held on two different axles. The pedestal bearing housing of the rear axles are joining to the frame.

The steering column once force or pushed, the steering column pivoted at the bottom from a distance. This can be termed as a lever. Lever connected to the fastened frame. The lever operates by applying force at the steering handle.

V. Lever Mechanism

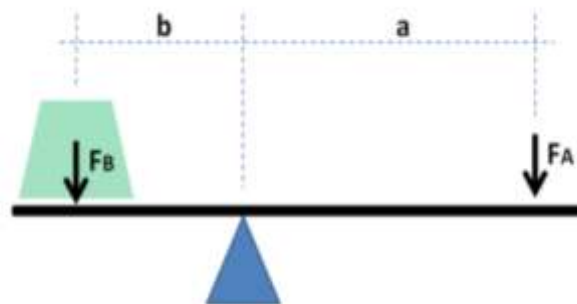


Fig. 3:- FORCE BALANCING

If a and b are distances from the fulcrum to points A and B and let the force F_a applied to at A is the input and the force F_b applied at B is the output, the ratio of the velocities of points A and B is given by a/b, so we have the ratio of the output force to the input force, or mechanical advantage is given by

$$MA = \frac{F_b}{F_a} = \frac{a}{b}$$

Where – a & b distances from pivot point

M1 & M2 masses

F_a & F_b are forces

This is the law of the lever which was proven by Archimedes using geometric reasoning. It shows that if the distance a from the fulcrum to where the input force is applied (point A) is greater than the distance b from fulcrum to where the output force is applied (point B), then the lever amplifies the input force.

Using the above principle, we are using the steering column as lever to get the mechanical advantage by using the pivot and use the smaller distance from the fulcrum to connect the crank link of the wheel to propel the wheel to effect the drive.

VI. Design

Given data for tricycle:-

Weight of tricycle = 35 kg

Weight of Handicapped people = 65 Kg (assume)

Total Weight = Total mass of tricycle

= Wt. of tricycle + Wt. of Handicapped people

= 35+65=100 kg

i.e. force acting on tricycle = $100 \times g = 100 \times 9.81 = 981$ N

Hence force acting on each wheel,

$$F_1 = F_2 = \frac{981}{2} = 490.5 \text{ N}$$

Where F_1 = Force acting on front wheel.

F_2 = Force acting on rear wheel.

Diameter of wheel (Rear wheel), $d = 700$ mm

Hence, radius of wheel, $r = 350$ mm

Linear velocity of wheel, $V = \frac{\text{distance}}{\text{time}}$

Distance travel by tricycle in 10 second = 43 meter

□ Linear velocity, $V = \frac{43}{10}$

□ $V = 4.30$ m/s

Linear Velocity (V) = Angular velocity (ω) × Radius of wheel(r)

$$V = \frac{2\pi N}{60} \times r$$

□ $N = \frac{60 \times V}{2\pi r}$

□ RPM, $N = 117$ RPM

[A] Force requires on steering to drive tricycle:

Let the time require to take the speed = 10 sec

□ Acceleration, $a = \frac{\text{total change in velocity}}{\text{total change in time}}$

$$a = \frac{4.3}{10} = 0.43 \text{ m/sec}$$

Now, Force on steering, $F = \text{mass (m)} \times \text{acceleration (a)}$

$$F = 100 \times 0.43 = 43 \text{ N} \approx 50 \text{ N}$$

[B] Calculation for Torque and Power on the Shaft:

Torque (T) = $F_1 \times r = 490.5 \times 0.350 = 172$ N-m

Power (P) = $\frac{2\pi NT}{60} = \frac{2\pi \times 117 \times 172}{60}$

$$P = 2.1 \text{ KW}$$

[C] Design of Shaft

Material for shaft:

SAE 1045 (Carbon steel) oil quenched and drawn 700 °C [1]

$S_{ut} = 579$ MPa and $S_{yt} = 306$ MPa [1]

For solid shaft, $\tau \leq 0.3 S_{yt}$ or $\tau \leq 0.18 S_{ut}$

$\tau = 0.3 \times 306 = 91.8$ MPa or

$\tau = 0.18 \times 579 = 104.22$ MPa

Consider minimum value of ' τ ',

∴ $\tau = 91.8$ (With out Keyway)

According to torsional strength of shaft,

$$T = \frac{\pi}{16} \times d^3 \times \tau$$

$$\square 172 \times 10^3 = \frac{\pi}{16} \times d^3 \times 91.8$$

∴ $d = 24.4$ mm

Standard diameter of shaft, $d = 25$ mm

(From page no. 111 on data book)[1]

Sr.No.	Parameters	Arm propelled tricycle
1	Weight	100
2	Force	490.5
3	Torque	172
4	Power	2.1
5	Speed	117

VII. Conclusion

From this project, we conclude that this vehicle is quite suitable for almost all the humans. For the propulsion of the wheeled vehicle with which may be provided the straightforward movement of tricycle over an existing vehicle with the assistance of various mechanism and combination of technology which can have larger advantage to the physically disabled persons to propel the vehicle. From above conclusion it is decided that use of lever power tricycle is suitable for handicap person and also for normal person and mechanical work is most comfortable for use.

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