

MODIFICATION OF DELTA TRICYCLE

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Abstract—Tricycle for physically challenged is a single seat tricycle. The front wheel of the tricycle has steering mechanism. The tricycle is driven by person by using one hand which is very difficult and is stressful for the driver. So a new design is put into consideration that is not similar to the presently available tricycle in terms of drive and steering mechanism. These modifications can be done by modifying two main parts of the conventional tricycle - Steering column and lever mechanism. The design of the parts is done by SOLID-WORKS. The steering column fulfills two purposes - to give motion to the rear wheel and to steer the cycle in desired direction. The steering column hinged to the base of the tricycle is pivoted with the link of the crank mechanism. The oscillating motion of the lever (steering column) is converted to rotary motion by crank and lever mechanism which will rotate the rear wheels. Full sized model of the tricycle will be made for demonstration.

Keywords --- Tricycle, Handicapped, Single slider mechanism.

I. INTRODUCTION

Today the available tricycle either uses chain drive or gear drive to propel the vehicle by arm. Especially for handicapped it is necessary the vehicle moves easily with lesser effort. Several attempts have been made at improving manual wheel chain mechanism.

The delta tricycle contains one wheel in front and two wheels at rear side. We modified the delta tricycle. The modified delta tricycle is arm powered tricycle. This tricycle consists of steering column which fulfills two purposes one is to give motion to the output wheel and other is to steer the cycle in desired direction. The steering column is pivoted to the base of the cycle. This steering column is pushed and pulled by human arm which imparts oscillating motion to the lever. The oscillating motion is then converted into rotary motion by cranking mechanism.

The cranking mechanism consists of one crank and connecting rod as shown in fig.1. The crank is connected to wheel hub and connecting rod is fixed rod steering column. When the steering column oscillates the connecting rod reciprocates and rotates the crank connected to it which further rotates the wheel. It is same as the fuel powered engine in which reciprocating motion of piston is converted to rotating by crank but the only difference is in this cycle oscillating is converted to reciprocating by crank and motion is given by human As this tricycle does not contain any chain drive mechanism or gear pairs which has direct surface contact amongst them so the friction is less and less effort is required.

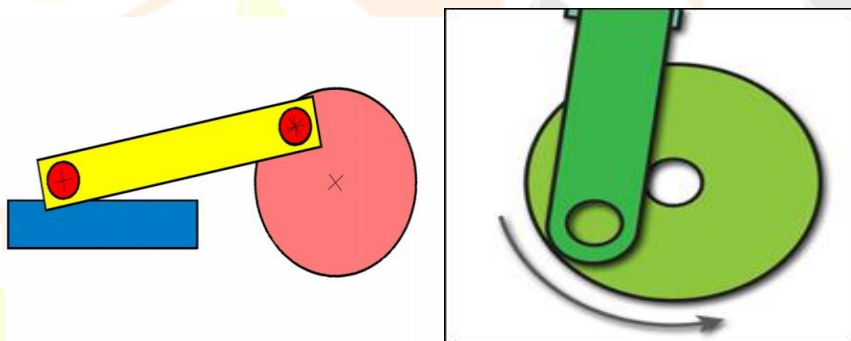


Fig.1.Cranking mechanism [1]

II. PRINCIPLE

The single slider linkage installed on rear wheel of tricycle, which therefore can capable to accelerate with suitable comfortable oscillatory motion. The intent of this vehicle is to improve the mobility with less effort. The human power is transferred to the rear wheel by the pivoted lever. The oscillatory motion is imparted to cycle by human hands through lever and in order to reduce the effort on human hands the advantage of leverage is taken i.e. by fixing of fulcrum point where mechanical advantage is more. This principle also dignifies the distance from where the force is to be applied by lever i.e. to get more torque distance of force applied should be more and to achieve speed torque is reduced by lowering the distance of force applied. While riding on steep road more torque is required so to get more torque motion is imparted by grabbing lever from the top. If we want more velocity while moving on straight road motion is imparted by grabbing lever a little lower from the top.

III. WORKING

This is a single seated vehicle with front wheels being steered by the steering column as shown in fig.2. The steering column has the outer tube which 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 internal rod of the steering column is hinged to the link mechanism of 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 steering column is holding the steering rod within the bearings.

The cranking mechanism is on one of the rear wheel axle. The rear wheels are held on two different axles. The bearing housing of the rear axles are welded to the frame.

The steering column when pulled or pushed, the steering column pivoted at the base from a distance. This is termed as a lever that pivots on a fulcrum attached to the fixed frame. The lever operates by applying force on the steering handle.

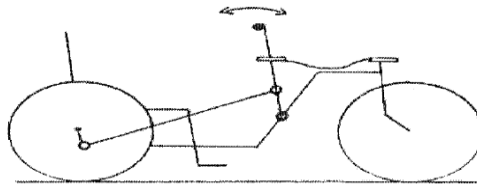


Fig.2. Basic Layout

IV. WORKING OF SINGLE SLIDER MECHANISM

When we have to go in forward in direction then just move steering from backward to forward with little effort which move the tricycle in forward direction and when we have to go in reverse direction then we have to first stable the tricycle and then move steering from forward to backward in direction which move tricycle in reverse direction. The steering is provided for giving direction and for too & flow motion which move tricycle in forward & reverse direction.

Working of single slider mechanism for forward direction is given as follows:-

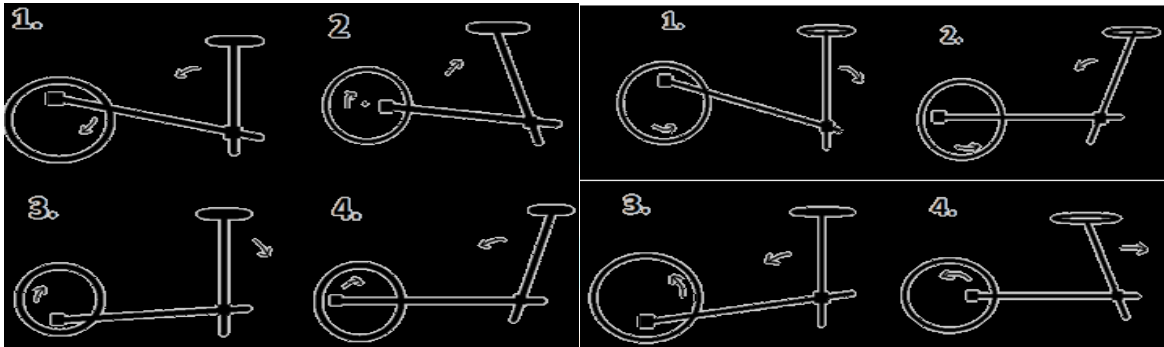


Fig.3. Different position for forward direction.

Fig.4. Different position for reverse direction.

CALCULATION WORK

[1] CALCULATION OF EFFORT REQUIRED

Calculation with total weight

Wt. of tricycle = 30 Kg

Wt. of disable people = 80 Kg (maximum condition)

Diameter of wheel = 60cm = 0.6m

N = 100 rpm (maximum condition)

$$\begin{aligned} \text{Angular velocity } (\omega) &= \frac{2\pi N}{60} \\ &= \frac{2 \times \pi \times 100}{60} \\ &= 10.47 \text{ rad/sec.} \end{aligned}$$

$$\begin{aligned} \text{Velocity } (v) &= \omega * r \\ &= 10.47 * 0.3 \\ &= 3.14 \text{ m/s} \\ &= 11.304 \text{ km/hr.} \end{aligned}$$

Where, r = radius of tricycle wheel.

$$\begin{aligned} \text{Total force} &= \text{Total weight of tricycle (110 kg.)} \\ &= 110 * 9.81 \\ &= 1080 \text{ N (approx.)} \end{aligned}$$

$$\text{Force on each wheel } (F) = f_1 = f_2 = f_3 = 360 \text{ N}$$

$$\begin{aligned} \text{Torque } (T) &= F * r \\ &= 360 * 0.3 \\ &= 108 \text{ Nm} \end{aligned}$$

$$\begin{aligned} \text{Effort required} &= \frac{\text{Torque}}{\text{Distance of link}} \\ &= \frac{108}{0.730} \end{aligned}$$

$$\begin{aligned} &= 147.94 \text{ N} \\ &= 15.08 \text{ kg.} \end{aligned}$$

For half revolution = 7.54 kg.

$$\begin{aligned} \text{Power} &= \frac{2\pi NT}{60} \\ &= \frac{2 * \pi * 100 * 108}{60} \\ &= 1130.97 \text{ watt} \end{aligned}$$

[2] CALCULATION OF DIAMETER OF CONNECTING ROD

Diameter of connecting rod (d)

$$T = \frac{\pi * s_{us} * d^3}{16}$$

For the shaft material: Mild steel

Properties are: $s_{ut} = 379 \text{ M}_{pa} = 379 \text{ N/mm}^2$ We have relation = $\frac{s_{us}}{s_{ut}} = 0.75$ So, $s_{us} = 284.25 \text{ N/mm}^2$

So, Diameter of connecting rod:

$$T = \frac{\pi * s_{us} * d^3}{16}$$

$$108 * 10^3 = \frac{\pi * 284.25 * d^3}{16}$$

$$d^3 = \frac{108 * 10^3 * 16}{\pi * 284.25}$$

$$d = 12.46 \text{ mm}$$

We take 14 mm diameter for connecting rod (standard)

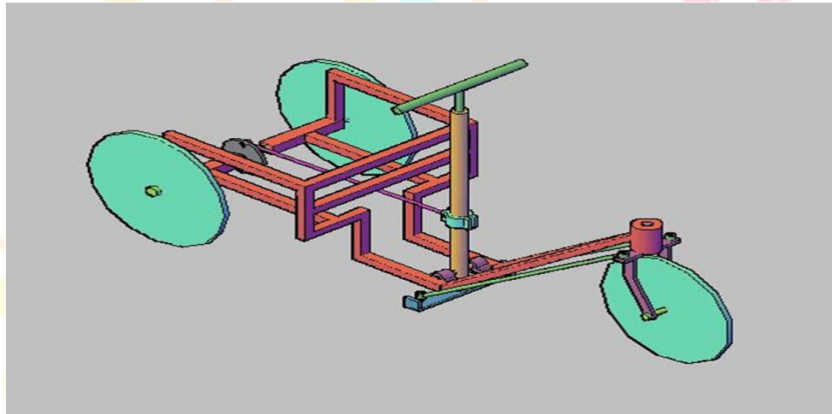
OVERALL VIEW OF TRICYCLE

Fig.5.3D view of modified delta tricycle

SPECIFICATION OF TRICYCLE

Table no.1.Specifications of modified delta tricycle:

Frame material	Cast iron
Pipes used for frame	25* 25 mm
Wheel size	(60 x 4.5) cm with tyre and tube
Overall length	1360mm
Overall width	560 mm
Overall height	510 mm
Drive	Rear drive
Mechanism used	Single slider crank mechanism
Connecting rod length	470 mm
Seat Width	400 mm
Seat height	408 mm
Tricycle weight	30 kg
Load capacity	110 kg
Maximum Speed	11-12 km.

COMPARISON BETWEEN MODIFIED DELTA TRICYCLE AND CHAIN DRIVE TRICYCLE

Table no.2.Comparison of modified delta tricycle and chain drive tricycle:

Sr.no.	Modified delta tricycle	Chain drive tricycle
1	Required less effort to drive	Required more effort to paddling
2	Only with one hand controlling of tricycle is possible	Required both hand to control tricycle
3	This tricycle provides the advantage of wheelchair	Used as tricycle only
4	More speed and power	Less speed and power
5	More economical	Less economical
6	More efficiency	Less efficiency

CONCLUSION

Chain drive mechanism is replaced by Single slider mechanism is used to transmit power for driving tricycle which is most useful and economical as compared to the other tricycle. This tricycle is mostly useful for elder and handicapped people. Design of tricycle is simple, easy to operate and maintenance is very less. The operational efforts required less and hence single slider mechanism is an advantage of the tricycle. This modified tricycle gives the both advantages of wheelchair (for short distance use or in-door) as well as tricycle (for long distance use) in one machine.

The purpose of single slider linkage installed on rear wheel of tricycle, which therefore can capable to accelerate with suitable comfortable motion. A single slider mechanism for rear wheel is ensured through an easily controlled motion, and compactness of mechanism design makes it suitable for wheelchair cum tricycle for aiding people with disabilities.

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