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EFFICIENT MECHANICAL RICKSHAW

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ABSTRACT

The objective of our project is to utilize the mechanical energy stored in **spiral(coil) spring s**in a cycle rickshaw. The idea of making this project comes from the fact that **starting torque** required by the rickshaw-man is very high when rickshaw is loaded. To reduce this high starting or que we have installed certain spiral springs in the rickshaw. These spiral springs gets charged when the pedals are rotated in opposite direction i.e., we are utilising the idle pedalling go frickshaw-manto charge the spiral springs. The spiral springs gets fully charged from just four full rotations of pedals when being rotated in the opposite direction.

When the spiral springs gets charged, the stored energy then released which along with the human effort reduces the starting torque. Only half of human effort is required now as comp are to applying effort on a normal rickshaw. After the initial stage i.e., when starting torque is required is comparatively high ,the torque is not required so much after that.

I. INTRODUCTION

In India there are several rural and urban areas where the manual cycle rickshaw is mostly used as a transporting medium in almost every part of the country. The people of those rural areas are not fit enough to operate it continuously or they are aged one. The old peoples have the worst condition in operating the rickshaw continuously as the starting torque required is very high when the rickshaw is loaded. The problems faced by the rickshaw-puller to operate manual rickshaw are:

a. High starting torque
b. Starting from sudden stopping
c. Going uphill
d. Slow Speed
d. Operating in case of overload

Fig. 1 Problem faced by Rickshaw puller

Keeping all these problems in mind we have installed a small mechanism of spiral springs in rickshaw which is low in cost and can help the rickshaw-puller to overcome these above stated problems.

The working of this mechanism is based on the fact that the energy gets stored in the spiral springs when the pedals are rotated in reverse direction which is a idle step in normal rickshaw i.e., on pedaling clockwise the rickshaw gets going in forward direction, but on pedaling in counter-clockwise we get nothing. So we have eliminated the idle step and use it to store strain energy in the spiral springs.

II. CONCEPT

The idea of making this project comes from the fact that starting torquerequired by the rickshaw-man is very high when rickshaw is loaded. To reduce this high starting torque we have installed certain mechanism & spiral springs in the rickshaw. These spiral springs gets stored energy when the pedals are rotated in reverse direction. Ratchet control mechanism is used to maintain stored energy within spring and allow to use the same energy when required by rickshaw puller. The stored energy released along with or without human effort result in less fatigue to the man.

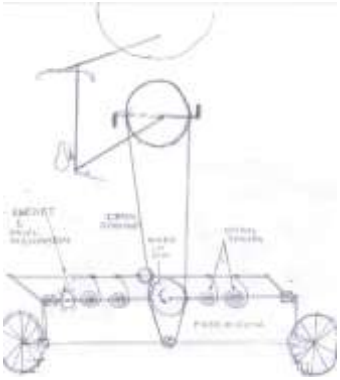

Fig. 2 Sketch of Mechanism of EMR

3. Estimate of spring energy stored, supplementary torque and distance travelled

A calculation has been done to show about supplementary torque generated and distance travelled for given assumptions

For spiral spring

Length (l)= 1.5 meter

Width(b) = 20 mm

Thickness(t) = 0.8 mm

No. of Spiral Spring =10

Young's Modulus(E)=207 Gpa

Bending Stress of Spring(Music Wire) (σ_b) = 1500 Mpa

For Rickshaw

Total Weight along with 2 passenger =200 kg

Coefficient of Rolling Friction= 0.001

Weight of rickshaw puller=60 kg

Pedal arm = 15 cm

Energy stored in spiral spring, $E= [(\sigma b)^2/24E] \times btl$

$=(1500x10^6)^2 \times 0.020 \times 0.0008 \times 1.5)/(24 \times 207 \times 10^9)$

= 10.87 N m

Total Energy stored by 10 spiral springs (E_{total}) = 10 × E

= 10 × 10.87

=108.7 N.m

Energy Required to move against friction = μ F X d

108.7 = 0.001X200X9.81Xd

Distance travelled (d) = 55.46 m

Therefore distance travelled by a rickshaw puller with two passenger only by the energy of spiral spring is 55 m.

Max. Torque generated by each spring $M = \sigma_b \times bt^2 /12$

$= 1500\times10^6\ 0.020\times(0.0008)^2 /12$

=1.6 **m**

Total Torque generated by 10 spiral Springs = 10 X 1.6

= 16 N .m

Starting Torque required by rickshaw puller with carrying 2 passenger

= Max. Force X Length of pedal arm

= Weight X Pedal arm

= 60 X 9.81 X 0.15

=88.3 N m

Therefore Percentage of supplementary torque provided by springs

= 16 X 100/ 88.3 = 18.2 %

1. Features of Efficient Mechanical Rickshaw

- Provide Supplementary Torque
- Less fatigue
- Pollution Free
- Economical
- Simplicity in operation
- Easy to Run (For Physically weak person)

Figure -4(a) **Figure -4(b)**

III. MARKET COMPETITORS

There are several competitors in the market.Some of our competitors are

- Battery Operated Covered Rickshaw

Unique design with normal frame, forks, wiser, covered rooftop. Also available with Stainless Steel Frame and fork. Capable to carry 2-4 passengers with ease. Heavy Duty Motor, Batteries and standard material. Warranty covers for longer period.

Figure 5.a. Battery Operated Covered Rickshaw **Figure 5.b. Battery E-Rickshaw**

- **Battery E-Rickshaw**

Battery E-Rickshaw is robust and sturdy for indian roads. The In-house manufacturing makes it durable, maintenance free with Indian components. The Service to Electronic and Electrical Parts is provided in-house. The product comes with low cost in ready-built and knock-down condition. Customised colour requirement is met on order. Extra facilities are also available such as FM Radio with Pen Drive Facility, hanging Curtains, Body Covers etc.

- **Solar Rickshaw**

Solar Rickshaw is equipped with heavy duty motor, batteries, wheels and solar panels to give reliable service for longer period of warranty. The prices are competitive, frame and fork are made of Stainless Steel, seating capacity 2 adult and 1 child.

Figure 5.c. Solar Rickshaw 5.d Cycle Rickshaw

- **Cycle Rickshaw**

The cycle rickshaw is a small-scale local means of transport; it is also known by a variety of other names such as bike taxi, velotaxi, pedicab, bikecab, cyclo, beca, becak, trisikad, or trishaw. As opposed to rickshaws pulled by a person on foot, cycle rickshaws are human-powered by pedaling. They are a type of tricycle designed to carry passengers on a for hire basis. Cycle rickshaws are widely used in major cities around the world, but most commonly in cities of South, Southeast and East Asia. Cycle rickshaws were found in every south and east Asian country by 1950

- **Auto Rickshaw**

Auto rickshaws are used in cities and towns for short distances; they are less suited to long distances because they are slow and the carriages are open to air pollution. Auto rickshaws (often called "autos") provide cheap and efficient transportation. Modern auto rickshaws run on

Figure 5.e. Auto Rickshaw

CNG and are environmentally friendly compared to full-sized cars. It is also not uncommon in many parts of India (including major cities like Delhi) to see primary school children crammed into an auto-rickshaw, transporting them between home and school. To augment speedy movement of traffic, Auto rickshaws are not allowed in the centre part of Mumbai.

In all of the above discussed competitors one thing has to be noticed that almost all of them uses some form of energy to operate like electrical energy, fuel energy like petrol, CNG etc. which ultimately costs. But, in our project we haven't used any type of energies apart from the little amount of mechanical effort required to charge the springs which was wasting in the idle pedaling of rickshaw. Hence only capital cost is required in our project which itself is a huge thing.

IV. RESULT AND CONCLUSION

The project is in working condition. While performing the initial test in loaded state we observed that all the components installed in the rickshaw are working satisfactorily and the rickshaw was able to cover a distance of 100(approx.) meters without applying any human effort.

We with our sincere efforts are able to materialize the idea as conceptual working model. The device with further refinements and modifications shall prove as an asset for poor rickshaw puller. Our team was able to test this machine successfully.

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