` Volume 6, Issue 3 (2018) 190-191 ISSN 2347 - 3258
International Journal of Advance Research and Innovation

Design of Walkable Bike

Anmol Bhatia*, Mayank Kak , Kunal Arora, Karan Jatwani
Department of Mechanical Engineering, The NorthCap University, Gurgaon, Haryana, India

Article Info Article Info
Article history:
Received 10 June 2018
Received in revised form
20 July 2018
Accepted 28 August 2018
Available online 15 September 2018

Keywords: walkable bike, treadmill, environment, pollution

Abstract
Walkable bike is a conversion of a conventional bicycle into a treadmill cycle. It is a collaboration of two different things i.e. treadmill and electric bike. This is designed to save our environment from the harmful emissions of the vehicles which is causing a very hazardous impact on the humankind. This is designed keeping in mind that we can commute easily to different places speedily and without getting exhausted by doing some brisk walk or jogging which will eventually help us in burning some calories without leaving any carbon footprints behind , without emitting any other harmful gases , without burning any of the available fossil fuels. It does not take not more than a effort to walk in a park. This paper presents the design of Walkable bike. The idea behind this is making an affordable, eco-friendly, easy to use vehicle and using the treadmill outside the gym making the lives of people healthier and happier.

1. Introduction

In today's modern era of automation life has become so easy that physical work has become minimal we can just sit at the same place and possibly do all the work but "everything comes with the price". We paid the price by facing high risk of heart and other diseases which are caused due to increasing obesity and lethargicness levels. Walking, running or cycling have also halted from our schedules due to time constraints, space availability or may be any other cause. Observing this situation we decided to design a vehicle which can help us in doing some walk or jogging besides helping us in commuting within the city speedily also without making us tired also considering about the pollution levels of our cities, so we decided to make something innovative by combining a bicycle and a manual treadmill. The manual treadmill does not consume electricity its belt's speed is relative to the user's speed. We have used the rotational motion of treadmill roller which gets wasted. The roller of the treadmill is coupled with the gear and chain mechanism and then with electric system which helps us in moving at a significant speed.

2. Literature Review

Juned Barade et al [1] modified a treadmill to better fit the requirements of users. Treadmill bicycle is designed for those humans who love to run outside. Treadmill equipped on bicycle frame and formulates a big innovation named 'TREADMILL BICYCLE'. This bicycle has electronic parts and runs perfectly on human momentum. As the rider walks on the treadmill, the belt butts up against the rear wheel propelling the bike forward. Treadmill bicycle is designed for runners as the ideal treadmill device, this device combines the best exercise running and cycling to deliver a low-impact, high- performance workout outdoors.

We believe it is the ideal device for healthy runners. It delivers an exercise experience that is closer to running than anything else available today. Suhasinee Ravindra et al [2] Walkable Bike is a totally new way of moving. With the electric assist it takes no more effort to walk then "a walk in the park". The electric assist in combination with the gear is boosting your walking pace up to the speed of the regular bike. When you are walking on the walking bike, you push the treadmill backward with your feet. The movement of the treadmill gives the signal to the electronic device which will activate the motor. The motor now supports you to continue the walking movement. Using break motor speed will reduce slowly. The walking bike has a sturdy and balanced base. If there are little pebbles on the road it will just cruise along a regular bike.

The rubber of the treadmill has anti slip structure which will prevent you from sliding of bike. Kirtish Bondre et al [3] this paper deals with conversion of a conventional bicycle into treadmill bicycle. In this bicycle the frame of the bicycle is completely modified and the treadmill is placed in between the two wheels, on which user will walk. As the user walks or runs on the treadmill the belt moves to the rear. At the rear roller RPM Sensor is attached to the roller from where Sensor will sense the speed of the roller and accordingly it will send signal to motor. The motion of motor is transmitted to the front wheel by which we can get the motion of wheel and bicycle runs.

***Corresponding Author,**
E-mail address: anmolbhatia@ncuindia.edu

2. Design of the components

3.1. Selection of Motor

Distance to move between motor and gear via. Chain drive = 20cm or 0.2m. Mass of motor = 4 kg

Therefore, force required=Mass*9.8 = 4 * 9.8 => 39N

Torque=distance*force= 0.2 * 39 => 7.8 N-m

Given input power from battery = 650W

Efficiency = 85% = (0.85)

Therefore, Output power=650*0.85= 520W => 500W

Horsepower = 500/745.69 = 0.670511

$\therefore \omega = \frac{2\times3.41\times500}{60}$ ω = 52.33 rad/sec

Given, that Power = 500W, 1W=0.00134102 H.P i.e.500W=0.670511 H.P.

Now,

$T = \frac{0.670511\times5252}{500}$ T = 7.043N-m

Hence, after calculating the necessary parameters the below mentioned DC Brushless electric motor has been selected

- Name: BLM-500 DC Brushless gear motor
- Voltage: 48V DC
- Current: 13.5A
- Power: 500W
- Speed: 500RPM
- Torque: 77kg-cm = 7.55N-m

3.2. Selection of Rollers and Roller Belt

Length of roller belt:

Width of roller belt = 400mm

Pulley center to center distance = 1500mm

Diameter of roller = 40mm

$$Lp=2C+1.57(D+d)+\frac{(D-d)^2}{4C} \quad (1)$$

Length of roller belt = 3125.6mm or 3126mm (approx.)

Length of rollers: 500 mm

NOTE- Leaving 50 mm allowance on each side for roller belt

Roller diameter = 40 mm (commonly used and easily available)

Centre to center distance between the rollers = 1500 mm

Allowance between two rollers = 5mm

Therefore, number of rollers be = x

Hence; $(x*40 + x*5) \leq 1500$ (2)

$x*45 \leq 1500$

$x \leq 1500/45$

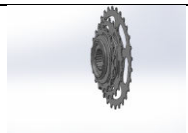
$x \leq 33.33$

Hence, 33 rollers need to be considered.

3.3 Selection of Gear System

Given, from motor specifications i.e. we have gear ratio of 6:1.Which means for every one rotation of driving gear the driven gear makes 6 rotations.

Table 1. Specifications of the designed components

S. No.	Parts name	Specification	Solid model
1	Electric Motor	Power - 500W Current - 13.5A Voltage - 48V Speed - 500RPM Torque - 7.55 N-m	
2	Steering	Mild Steel	
3	Chain	Alloy Steel (carbon, steel, nickel)	
4	Battery	Voltage - 48V Current- 14A Power - 650W	
5	Tyres	20” Ranger cycle	
6	Frame	Length - 1550mm Width - 600mm	
7	Gears	No. of teeth on Gear 1 - 7 Gear 2 - 13 Gear 3 - 19	

$\frac{75}{25}$= 3 ∴$\frac{60}{3}$ = 20 RPM

Velocity of first gear = 10km/hr = 166.67m/min

Velocity of second gear = 20km/hr = 333.33m/min

Velocity of third gear = 30km/hr = 500m/min

For gear 1

i.e. 166.67m/min tire covers 3.14m in one revolution as we have taken a 20” ranger tire

∴ 167/3.14 = 53.18 = 53 rpm

For gear 2

i.e. 333.33m/min 334/3.14 = 106.36 = 106rpm

For gear 3

i.e. 500m/min=500/3.14 = 159.23 = 160rpm

Hence, number of teeth on the gears will be calculated similarly as

The number of teeth on sprocket = 60

Therefore, 60/500 = x/53 => x = 7 (for 1st gear)

60/500 = x/106 => x =13 (for 2nd gear)

60/500 = x/160 => x = 19 (for 3rd gear)

4. Summary of the designed parts

Table-1 shows the summary of the designed components with all the specifications. These components are further assembled to get the final machine.

5. Assembly of the machine

Figure-1 shows the final assembly of the components to produce the Walkable bike. The components like the belt and the rollers are assembled in such a manner to sustain the load. The person can stand on the belt as platform. The motor can be placed on the space provided and the chain system is there to transmit the power from motor to the wheels.

Fig. 1. Assembled Machine

6. Conclusions

The paper presented the design of the Walkable bike with all the calculations. The bike will definitely be the option for the people who want to lose weight as this bike can serve as a commuting option as well as the option to exercise. The battery can be a chargeable battery.

The walkable cycle can further be modified and several improvements or advancements can be performed on it.

- Addition of dynamos / alternators to self-recharge the battery
- Addition of solar panels to recharge the battery
- Use of Lightweight materials like aluminum or it’s alloys to reduce the weight but maintaining the quality and strength of the machine
- Use of more than 1 battery set to enhance the range of vehicle
- Addition of charging ports to complement the drive
- Addition of baskets in order to allow more storage room to carry goods
- Addition of front and rear shock absorbers to provide better drive experience

References

[1] K Bondre, S Beradpatil, SJ Thorat. Design and Fabrication of Treadmill Bicycle. International Journal of Innovative Research in Science, Engineering and Technology, 5(6), 2016, 11034-11038

[2] SR Deshmukh, NV Sanap, EK Dhoble. Design Of Walking Bike, International Journal of Innovative research in Science and Engineering, 3(2) 2016, 860-868.

[3] J Barade, A Janwe, KA Nawab, S Khan. Treadmill Bicycle, International Research Journal of Engineering and Technology, 4 (3), 2017, 2207-2210

[4] PR Gajbhiye, G Dange, CS Hingnekar, RV Kondalwar, N Jamal, MG Sonwane, MG Shete. Design and Fabrication of Treadmill Cycle, IJARIIE, 3(2), 2017, 1597-1604.

[5] AK Khedkar. Designing and Fabrication of Treadmill Bicycle, International Journal of Advance Engineering and Research Development, 3(2), 2017, 250-258

[6] R Kishan, SR Kishan, OR Anitha, SP Chandrakala. Treadmill and Bicycle Ergometer Exercise: Cardiovascular Response comparison, Global Journal of Medical Research, 12, 2012, 23-26.

[7] VB Bhandari. Design of machine elements, S Chand publication, 1994.