

DESIGN OF WALKING BIKE

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ABSTRACT

Walking Bike is a totally new way of moving. With the electric assist it takes no more effort to walk than “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.

“We aspired to build a vehicle that is faster than walking and easier to ride than a bicycle”.

Keywords: 3-D Modeling, Electric Bike, Pollution Free Bike, Tread Mill, Walking Bike

I. INTRODUCTION

Exercise are advised for health promotion, and prophylaxis for many cardiovascular diseases and also for rehabilitation after an episode of disease. Among the exercises aerobic exercises are appropriate for these purposes. To do aerobic exercise many methods are available for example: running, jogging, walking, cycling and others. Among different modes of exercises in the modern busy life, the cycling and treadmill exercises are the commonest to perform as indoor aerobic exercises. In motor driven treadmill exercise which is similarly to walking or jogging or running depending upon the speed of the treadmill motor is becoming more familiar to all. Thus we made an innovation to take that treadmill in park. This is nothing but having a walk in a park.

The electric bicycle (e-bicycle) market varies greatly by product type and regional demand. The placement of electric motors for e-bicycles is also receiving increased consideration. E-bicycle can have motors in one of three locations: the front wheel hub, mid-mounted at the bottom bracket (pedals), or the rear wheel hub. The rear wheel hub is the most popular location, and most of the large Chinese market is utilising rear hub motors. Rear wheel hubs are thought to be best for throttle-controlled bikes, whereas the other locations work well with e-bicycles that only provide electric power when the pedals are being used (pedal assistance). The mid-mount motor is the fastest growing segment, in part due to strong competitors like Panasonic and relatively new competitors including Bosch and AEG. [3]

1.1 Problem Statement

- In our day to day life we see that many people's use bikes cars as a source of transportation. This results in environmental pollution and fuel consumption.
- In manual treadmill the motion of the treadmill is rough to overcome this we use a motor to rotate the rotors.
- Batteries which are widely used in automobile sector is not rechargeable thus when they disposed create pollution.
- To improve all above phenomenon we take initiative by designing something which would help to reduce these harmful phenomenons.

1.2 Objectives

- Pollution control.
- Useful for exercise purpose.
- To reduce the use of non-renewable energy sources.

1.3 Scope

What makes the walking treadmill bike with electric assist awesome? It has the same fat-burning benefits of a regular treadmill, but lets you exercise outdoors or even en route the work. Based on study, men burn 124 calories running roughly a mile on a treadmill, and 88 while walking. Women, on the other hand, burn 105 and 74 respectively.

It allows you to stay physically active while travelling at the same time. You can practically exercise at any time of the day. If you drive out often, you get to exercise just as often. You are basically killing two birds with one stone when you ride the treadmill bike. It features a rugged design and all terrain tires that let you stroll down rough roads or run through evergreen forests. If you want to explore roads less travelled, you can do so using the walking treadmill bike with electric assist.

It lets you jog or take a walk without getting your shoes dirty or modified. Because of its hard wearing belt that offers grip, you don't need to worry about slipping or falling off the treadmill.

It has a variable resistance feature that caters to people of all ages that are fit and balanced enough to ride walking treadmill bike with electric assist. But even if you are not that active, you can start with the treadmill bike. It comes with a brake that immediately shuts off the motor and a freewheel function that you can activate when going downhill. It has safety features that you would not normally find on a regular bike. [3]

II. CONCEPT OF WALKING BIKE

Figure shows the Catia model of walking Bike. For the movement of the walking bike sprockets mechanism is provided. Walking bike is a combination of treadmill and cycle. Tread belt is fixed with a frame which consist of supportive rollers and two main rollers at extreme ends for movement of the belt. On the extreme last roller sprocket is fitted.



Fig 2.1 Concept of walking bike

Sprocket fitted on rear roller is attached to the motor sprocket by means of chain drive. Motor drives the cycle and smoothen the movement of the treadmill belt. Motor drives the cycle by transferring the motion by means of idler which is used to move wheel in forward direction. Cycle wheel consists of a sprocket and on the same shaft of the idler another sprocket is fitted.

Cycle wheel sprocket is attached with chain drive to this sprocket. Motor which drives this whole mechanism drives by means of battery placed at the carriage on top portion of rear wheel. [3] [4]

III. COMPONENTS OF WALKING BIKE

Main components of Walking Bike are:

- Tread belt.
- Motor.
- Electric Bike Battery.

3.1 Tread Belt

Tread belt comes in one-ply and two-ply options. One-ply tread belts are basically the cheapest option, needing replacement over time whereas two-ply tread belts are thicker and last much longer. Some tread belts come with cushioning and impact absorption which is highly recommended for your joints and comfort level. People with muscles or joint problems or obese users are advised to opt for a more cushioned running surface. Tread belts having harder surface may be used but cushioned docks are highly recommended. This is an important feature as it will help to make impact less jarring to your joints. Many treadmills can cushion up to 23% of the impact, with 12-14% being the average.

3.2 Motor

While many people just compare the horsepower of the motor, actually look at the type of motor in addition to the horsepower. Basic treadmill motor are available with 2.5hp (horsepower) and 1440 rpm. It is not suitable for driving on roads due to traffic issues. Also it will lead to accidents so for the walking bike we use a common traction motor with 0.3 hp and 300 rpm. With this much of speed the cycle can be driven easily.

3.3 Electric Bike Battery:

Electric bike batteries typically come in 24V, 36V, 48V and 72V batteries. Here is another analogy: electricity is water. If it is water flowing through the wires (tubes), then higher voltage means that the water (energy) moves faster, and through a smaller tubes typical battery is 36V on most E-Bikes with some at 24V and some at 48V. the electric bike manufactures spec these because they provide a good power to cost ratio.

IV. MATERIAL SELECTION

The materials used in this project are detailed as follows:

- Mild Steel.
- Nylon rubber fabric.
- PVC (polyvinyl chloride).

Mild Steel:

The frame of treadmill and front & rear rollers are made up of mild steel.[2]

Reasons:

- Mild steel is readily available in market.
- It is economical to use.
- It is available in standard size.
- It has good mechanical properties i.e. it is easily machinable.
- It has moderate factor of safety, because factor of safety results in unnecessary wastage of material and heavy selection.
- It has high tensile strength.
- Low co-efficient of thermal expansion.

Properties of Mild Steel: [2] [4]

M.S. has carbon content from 0.15% to 0.30%. They are easily weldable thus can be hardened only. They are similar to wrought in properties. Both ultimate tensile and compressive strength of these steel increases with increasing carbon content. They can be easily gas welded or electric or arc welded. With increase in the carbon percentage weld ability decreases. Mild steel serves the purpose and hence selected because of above purpose.

Nylon Rubber Fabric:[2]

Standard material available for tread belt is nylon fabric. So we use this material for treadmill belt. Nylon rubber fabric is cheap and easily available, less in cost & having property of wear resistance.

PVC(Polyvinyl chloride):[2]

PVC pipes are used as a supportive roller in treadmill frame. PVC pipes are used because those are light in weight, easily available, cost is less and also having a smooth surface finish which gives smooth motion of belt on the surface of supporting rollers.

V. DESIGN METHODOLOGY

In our attempt to design a walking bike, we have adopted a very careful approach. Total design work has been divided into two parts mainly,

- System Design.
- Mechanical Design.

System design mainly concern with the various physical concern and ergonomics, space requirements, arrangement of various components on the main frame of treadmill, arrangement of tread belt and rollers, position of braking system, arrangement of motor, sprockets, ease of maintenance, scope of further improvements, ground clearance etc. In mechanical design, the components are categorized into two parts.

- Design Parts
- Parts to be purchased.

For design parts, detailed design is done and dimensions thus obtained are compared to next highest dimensions which are readily available in the market. This simplifies the assembly as well as post production servicing work. The various tolerances on work pieces are specified in the manufacturing drawing. The process sheets are prepared and passed on to the manufacturing drawing. The process sheets are prepared and pass on to the manufacturing stage. The parts are to be purchased directly are specified and selected from standard catalogue. [1]

VI. DESIGN OF MAIN FRAME COMPONENTS

6.1 Treadmill Frame design:

Material- Mild Steel.

As the standard available tread belt size is (980*340) mm. Frame design is done according to the tread belt size. As per space availability and clearance for reduction of friction, frame size is (1090*410) mm. [1] [2]

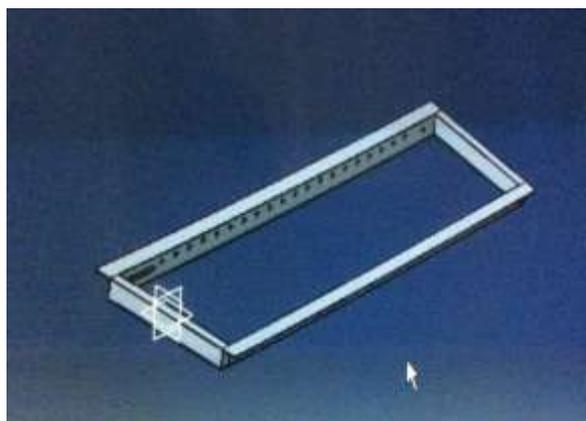


Fig. 6.1 Catia model of frame.

Frame consists of a 21 rollers, in which first and last roller is for movement of belt and other are supportive rollers. Rollers are fitted in frame by means of bush.

6.2 Design of Front and Rear Roller

Width of the frame is 410 mm. So we choose length of rollers as 400mm. To reduce the friction of belt with frame 5 mm clearance is provided on both sides.

Front roller is of diameter 58mm and that of rear one have diameter 49mm. For easy and fast movement of belt some taper should be provided to belt that's why front roller is large in diameter and rear is in small diameter.

Rollers are connected to frame by using MS rod of diameter 10 mm. PVC bush are placed in front roller and deep groove ball bearing 6000, which is use for light weight operation is used. Rear roller is directly welded to 10mm MS rod. [4]

6.3 Design of Supportive Rollers

This roller serves the purpose of support to the tread belt. 19 supportive rollers are fitted in frame structure. They are made up of a PVC material. The PVC pipes have diameter of ¾ inch that is 19.05 mm and length is 390mm.

All the design calculation of frame and rollers is done on the basis of load carrying capacity of walking bike and space availability. Load carrying capacity of walking bike is 100 kg. [4]

VII. DESIGN OF SPROCKET

1st gear reduction ratio (motor to freewheel):[1]

$$i = \frac{n_2}{n_1} \qquad i = 1.909$$

Component	Speed	No. of teeth
Motor	50 rpm	42
Free wheel	95.45 rpm	22

Table7.1 First Gear Reduction Ratio.

2nd gear reduction ratio (motor to roller):[1]

$$i = \frac{n_2}{n_1} \qquad i = 1.235$$

Component	Speed	No. of teeth
Motor	50 rpm	42
Free wheel	61.75 rpm	34

Table 7.2 Second Gear Reduction Ratio.

3rd gear reduction ratio (freewheel to freewheel of cycle):[1]

$$i = \frac{n_2}{n_1} \qquad i = 0.74$$

Component	Speed	No. of teeth
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Freewheel	95.45 rpm	22
Freewheel of Cycle	70.68 rpm	16

Table 7.3 Third Gear Reduction Ratio.

- 0.74 Gear ratio is used to control the speed of cycle to 70.63 rpm and also to get more torque.
- We get more torque using this ratio and we can carry more weight on cycle.

Primary gear reduction ratio	Secondary gear reduction ratio	Final gear reduction ratio
1.909	1.235	0.74

Table 7.4. Final Output Ratios.

Primary Speed	Secondary Speed	Final Speed
50 rpm	61.75 rpm	70.63 rpm

Table 7.5. Final Output Speeds.

VIII. ACCESSORIES ATTACHED

For easy access of bike we installed various components that made the running of bike with ease. These are as follows;

- CONTROLLER



Fig. 8.1. Controller

- THROTTLER



Fig. 8.2. Throtller

- BATTERY LEVEL INDICATOR:



Fig. 8.3. Battery Level Indicator

- It's used to give the spark to battery to start the vehicle.
- It indicates the battery level.
- Also it consists of a head light.

IX. FUTURE IMPROVEMENTS

Walking bike has some advantages and some disadvantages. the main disadvantage of walking bike is its discharging battery. Due sudden discharge of battery in between of travelling leads to face many problems to overcome this disadvantage we can do some improvements in present model.

To overcome this discharge problem we can install a solar panel to the system it will recharge the battery and continuous movement of walking bike can be possible. Solar panel is one of the simplest ways to charge the battery.

Another way is generation of electricity by using dynamo generator. The mechanical energy generated by human due to walking on tread belt is converted to electrical energy by using dynamo generator. It will produce a small amount of energy. Small increment of energy in rechargeable battery will move the bike continuously.

X. CONCLUSION

We developed a branch and bound approach which is coupled with quick, effective bounds to optimize the “Walking Bike” which serves the purpose of exercise and travelling and also reduce the use of non- renewable energy resources.

The design of control architecture was an important aspect of study because a strong interaction between the many different parts was needed. We know that the “Walking Bike” cannot be used on roads due to some drawbacks. But we will correct the drawbacks in the cycle & will be used on road. So we are satisfied with our project.

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