International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES),(UGC APPROVED)
Impact Factor: 5.22 (SJIF-2017),e-ISSN:2455-2585
National Conference on
Recent Trends in Mechanical Engineering (NCRTIME2K19)
Volume 5, Special Issue 07, June-2019.

DESIGN AND FABRICATION OF BALANCED TREAD MILL BICYCLE

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Abstract— Treadmill cycle has runs perfectly on human effort and batteries with dc motor. As the rider walks on the treadmill belt, the belt indirectly rotates the rear wheel propelling the bicycle forward with the help of gear change mechanism. The purpose of this project was to design and develop a human manual treadmill cycle. A sprocket mechanism with gear box and additional components are used to run the treadmill cycle without external sources. For having better balance while riding we are using two supporting wheels fixed near the rear wheel. It is believed that treadmill bicycle will also be the ideal device for healthy runners. It delivers an exercise experience that is closer to running that anything else available today.

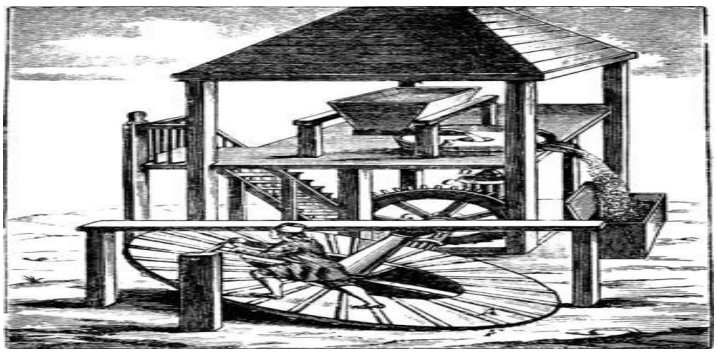
Keywords— Treadmill cycle, gear wheels, Sprocket and chain, supporting wheels dc motor .

I. INTRODUCTION

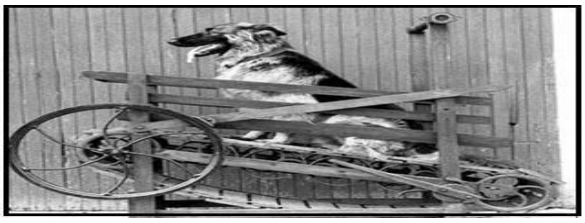
The treadmill bicycle is completely a new way of movement completely designed for runners. Typically using a treadmill basically is similar to running, hiking or walking. Think about the last time you were riding a bike over some kind of obstacles such as train tracks, potholes, speed bumps. Possibilities are you stood up on the pedals to improve your balance when crossing the obstacle. Basically, the treadmill bicycle will provide the rider a well-balanced position the entire time. It is a combination of amalgamation of DC motor with different components upgrading your walking speed to a much higher pace. Since it uses no fuel it a very conventional option for people in their busy schedule to take care of their health completely. People with a busy schedule will also be able to take care of their health and physical fitness. Above all, it is not a conventional treadmill to make use of only in closed rooms, person using treadmill bicycle can roam on roads also. This project overcomes the drawback of the conventional treadmill which is stationary which in fact does not provide the jogger to get exposed to the natural atmosphere. So this proposed methodology provides an ultimate solution by making use of wheels and making the treadmill bicycle a walking cycle.

II. LITERATURE REVIEW

In 18's new concept of treadmill for prisoners as a punishment, this idea was brought in gaol by Sir William Cubitt. Before the development of Bruce protocol there was no safe, standardized protocol that could be used to monitor cardiac function in exercising patients. To address these problems Dr. Robert Bruce and Dr. Paul Yu began work on developing exercise test.



Nicholas Potter- He invented "Dog Power Treadmill" to tackle domestic work and produce rotary and reciprocating motion for use with light machinery. To run the treadmill animals like horses and dogs energy are used. Nicholas Potter, of Troy PA noted as the father of the first dog treadmill this machine is then marketed as a practical devise for dogs. The first patent issued in 1871 and the final patent in 1881.



William Cubitt(1818)- He invented prison treadmill for punishment. The prisoner would simply work the wheel to produce power to grinding and pump water. The main motto behind this invention want to punish the prisoner.

William Staub (1968) - A Mechanical Engineering William Staub and Dr. Kenneth H. Cooper brought the first household exercise treadmill to market. He called his first treadmill "The PaceMaster 600" at his plant in Clifton, New Jersey

III. **THE TREADMILL**

While working out in gym people use treadmill for jogging and running. The main disadvantage of this treadmill is, it is stationary at particular place so sometimes people get bored by jogging at same place without any exposure to natural atmosphere. For travelling over short distances people often use a commercial vehicle which causes pollution and unnecessary wastage of fuel. So, we came to a solution for this type of problem by providing wheels to the treadmill and the concept is termed as walking bicycle.

OBJECTIVES

The treadmill bicycle is a totally new way of moving. With the electric assist it takes less effort to walk then "a walk in the park". It is the combination of the DC motor, Hall Effect Sensor and amplifier boosting your walking pace up to the higher speed. Increased use of fuel has resulted in increase of pollution and degradation of natural resources. With increasing population and their need, it has become necessary to control the use of fuel and decrease the pollution; so as to make it avail it's important to our coming generation. Due to heavy busy schedule people are not able to give attention to their health and physical fitness. As it uses no fuel so it saves energy simultaneously it can be used as treadmill and Bicycle. No need to use it as conventional treadmill in closed room; you can roam on roads also.

WORKING

This is working of treadmill bicycle

- Treadmill
- Cycle wheel
- Chain wheel
- Dynamo
- Sprocket
- Roller
- Square frame

TREADMILL

A treadmill is a device generally for walking or running or climbing while staying in the same place. Treadmills were introduced before the development of powered machines, to harness the power of animals or humans to do work, often a type of mill that was operated by a person or animal treading steps of a treadwheel to grind grain. In later times, treadmills were used as punishment devices for people sentenced to hard labour in prisons. The terms treadmill and treadwheel were used interchangeably for the power and punishment mechanisms.

More recently, treadmills are not used to harness power, but as exercise machines for running or walking in one place. Rather than the user powering the mill, the machine provides a moving platform with a wide conveyor belt driven by an electric motor or a flywheel. The belt moves to the rear, requiring the user to walk or run at a speed matching that of the belt. The rate at which the belt moves is the rate of walking or running. Thus, the speed of running may be controlled and measured. The more expensive, heavy-duty versions are motor-driven (usually by an electric motor). The simpler, lighter, and less expensive versions passively resist the motion, moving only when walkers push the belt with their feet. The latter are known as manual treadmills.

According to Sports & Fitness Industry Association, treadmills continue to be the largest selling exercise equipment category by a large margin.[1] As a result, the treadmill industry counts with hundreds of manufacturers throughout the World

The forerunner of exercise treadmills was designed to diagnose heart and lung disease, and was invented by Dr. Robert Bruce and Wayne Quinton at the University of Washington in 1952.[11][12] Dr. Kenneth H. Cooper's research on the benefits of aerobic exercise, published in 1968, provided a medical argument to support the commercial development of the home treadmill and exercise bike.

Among the users of treadmills today are medical facilities (hospitals, rehabilitation centers, medical and physiotherapy clinics, institutes of higher education), sports clubs, Biomechanics Institute, orthopedic shoe shops, running shops, Olympic training centers, universities, fire-training centers, NASA, test facilities and training rooms of police and army, gyms and even home users.

BEARINGS

The bearings allow the hub shell (and the rest of the wheel parts) to rotate freely about the axle. Most bicycle hubs use steel or ceramic ball bearings. Some hubs use serviceable "cup and cone" bearings, whereas some use pre-assembled replaceable "cartridge" bearings.

We are using DFM for our paper. Design for manufacturability also known as design for manufacturing. DFM is the general engineering art of designing products in such a way that they are easy to manufacture. The concept exists in almost all engineering fields. Depending on the manufacturing technology the application differs widely. DFM describes the process of designing a product for facilitating the manufacturing process and reducing its manufacturing costs.In DFM, the potential problems are fixed in the design phase which is the least expensive place to address them. Other factors which may affect the manufacturability are: type of raw material, the form of the raw material,dimensional tolerances, and secondary processing such as finishing.

BRUSHLESS DC MOTOR

Brushless DC electric motor also known as electronically commutated motor ECM. Brushless DC motors are powered by a DC electric source by an integrated inverter or switching power supply, which produces an AC electric signal to drive the motor. In brushless motors, permanent magnets rotate around a fixed armature. Commutation with electronics has large scope of capabilities and flexibility. BLDC motor known for smooth operation, and holding torque when stationary. Additional sensors and electronics control the inverter output amplitude and waveform. Therefore percent of DC bus usage/efficiency and frequency i.e. rotor speed.

EXERCISE

Treadmill bicycle helps in maintaining proper physique. Physical fitness is of utmost importance in day to day life. People often get bored while exercising in a closed room such as gym. By using treadmill bicycle one can exercise outdoors in fresh air.

FUEL SAVING

People often use vehicle for travelling over short distance. This causes unnecessary wastage of fuel. Due to use of treadmill bicycle over short distance a large amount of fuel can be saved.

TRAVELLING

Treadmill bicycle can be used for travelling over short distances. One can also exercise while travelling over short distance.

ECO- FRIENDLY

Treadmill bicycle does not require any fuel. Therefore it does not emit any pollutants. So it is an eco-friendly vehicle.

WALKING BELT

The walking surface of a treadmill comprises of the thin moving belt and a rigid plate held between the two surfaces of that belt so as to provide support when the transverse load of footfalls is applied. The treadmill belt size is an important characteristic in your treadmill if you are preparing for running or jogging on your treadmill. If you are planning on walking, the belt size is not of much importance. Standard belts run with size 19" wide by 50" long. Although this appears like a good width and length, you must note that the belt goes onto a deck, which includes part of the frame and your console. So even if your belt is 19 x 50, your running space may be 16 by 45. Again, if you are preparing on only walking on your treadmill, this size is ok. However, if you try on running you will want a wider and longer belt, since we have a capability to sway a bit while we run.

BEARING

A bearing is machine element which holds another moving machine element. The moving machine element called as a journal. Bearing allows a relative motion between the contact surfaces of the members while transferring the load. A certain amount of power is wasted in removing frictional resistance. So as to reduce frictional resistance and wear and to carry away the heat generated, a lubricant may be utilized. The lubricant used is often a mineral oil refined from petroleum. The bearing block is provided to hold the bearings. It is made up from cast iron. All the bearings are fabricated on the machine frame. Design of deep groove ball bearing :

Step 1:

$$Equivalent\ load\ \ P = [V * Fr + YFa] * S$$

Here,

V= 1.2 For inner ring stationary and outer ring rotation.

F_r= Radial loads (1500 N = 150 Kg)

F_a = Axial loads (2000 N = 200 kg)

X,Y = Radial and axial load factors.

F_a/F_r = 1.35

From data book $F_a/F_r > 0.44$

Now X = 0.56, Y = 1.0 Table [20.5]

Now S = Service factor Table [20.3]

Let us take S = 2.5 Fabric belt drive.

Now equivalent load P = [1.0 * 0.56 * 1500 + 1 * 2000]

= 7100 N

Life of bearing in million revolutions

$$L = [C/P]K \text{ mr [Table 20.6 (a)\& (b)]}$$

$$Let\ [C/P] = 1.4\ (Loading\ ratio)$$

Where,

K = 3 For ball bearing

K = 10/3 For roller bearing

L= [1.14]^3

L= [1.48 mr]

Now life of bearing in hours Lh = L * 10^6/ 60 * n hours

Let us assume speed of bearing n = 10 rpm

Lh = 1.48 * 10^6 /60 * 100

Lh = 246 hours

Dynamic capacity of bearing :

$$C = [L/L10]1/K * P$$

L_{10} = 1 mr

K = 3

$$C = [1.14/1] * 7100 = 8094$$

Now from data book 20.7 (b) deep groove ball bearing

Dynamic capacity is in between the 7355 to 9805 bearing

Then bore diameter = 20

Major diameter = 47

Bearing of basic design number = 6204

ISI number = 20 BC02

Maximum permissible speed = 1600 rpm.

WORKING PRINCIPLE

When we walk or run on the walking surface it gives rotation to rear wheel of bicycle and treadmill bicycle is moving forward. The walking surface of a treadmill consists of the thin moving belt and a rigid plate placed between the two surfaces of that belt in order to provide backing when the transverse load of footfalls is applied. The original and unmodified treadmill used a sheet of 0.75 inches pressed particle board as a support plate. This was attached to the frame of the treadmill at four points with wood screws placed near the four corners of the sheet. While resting on the rails in a lowered position, the plate received vertical support from small metal risers at the mounting points and from two rubber pads placed under the longest edge of the surface midway between the hard mounting points. According to the manual provided with the treadmill, the design intent behind this flexible multi-point mounting system was to reduce the overall stiffness of the plate by providing less support than that provided by direct attachment to two solid rails. In actual practice, the thickness and stiffness of the particle board surface were more than required to remove all discernable deflection from the system. Users were unable to distinguish the difference in stiffness when additional aluminum supports were inserted between the sheet and the rails, in order to remove the compliant effect of the rubber supports. We concluded that modifications would be necessary to achieve an ideally compliant walking surface capable of reducing the impact forces related with walking and running. Additionally, the bottom face of the particle board sheet held two outwardly angled metal brackets. These were oriented such that the belt would slide over them consecutively when the system was active.

IV. CONCLUSION

This system can be efficiently used anywhere whether it is outdoor or indoor. This utilizes highly fuel-saving technology which is a major requirement of this era. In the future, it can be used as an indoor locomotive device infrastructure with large roof span i.e. malls, warehouse, open markets, large office spaces, etc. By using such product pedestrian cops can protect themselves from getting exhausted. Pedestrians in large campuses can take benefit from this product the same way.We can replace cycle as an energy efficient vehicle for those who cannot drive a cycle.

REFERENCES

[1] Dr. Ravikiran Kisan MD, Dr. Swapnali Ravikiran Kisan MD, Dr. Anita OR MD & Dr. Chandrakala SP MD "Treadmill and Bicycle Ergometer Exercise: Cardiovascular Response comparison" Global Journal Of Medical Research, vol. 12, pp. 23-26, June 2012

[2] Chetan Mahadik, Sumit Mahindrakar and Prof. Jayashree Deka "An Improved & Efficient Electric Bicycle system with the Power of Real- time Information Sharing" Multidisciplinary Journal On Research In Engineering And Technology, vol. 1, pp. 215-222, June 2014

[3] Prof. V. Sekar and Prof. V. Thiyagarajan had studied on "Controlling of brushless DC motor in electric bicycle using electronic based circuit with 8 bit microcontroller" International Journal of Engineering Sciences &Emerging Technologies, vol. 4, pp. 26-34, Dec 2012

[4] Prof. Pradeep M. Ingole and Mukund Manas "Ergonomic design of bicycle handle." International Journal of Emerging Technology and Advanced Engineering vol.5, pp. 472-481,April2015

[5] Sr. Prof. Lecturer Shivaji Bhandarkar "Vehicular Pollution, their effects on human health and mitigation measures" Vehicle Engineering (VE) vol. 1, pp. 33-40, June 2013