



PEDAL LESS CYCLE

**Shivam Singh¹, Virendra Sonkar², Tuhin Biswas³, Shashibhusan Tiwari⁴,
Saurabh Agrahari⁵**

^{1,2,3,4,5} Student, Mechanical Engineering, BIT, GIDA, Gorakhpur

ABSTRACT

This paper deals with conversion of a conventional cycle 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 operator will walk. As the operator walks or runs on the treadmill the belt moves to the rear side. The mechanism which is used in this walking cycle is various of its kind in which, the cycling pedals are replaced with a treadmill belt. This treadmill belt drives the bicycle forward by introducing free wheels and shafts mechanism. This design requires treadmill belt, shafts, the frame of treadmill, the free wheels, gears, chain-drive and gear-chain. Treadmill bicycle is designed for those humans who like to run outside. Treadmill equipped on bicycle frame and formulates a big innovation named 'Treadmill Bicycle'. This bicycle has mechanical parts and runs perfectly on human momentum. We believe that it is the ideal device for healthy runners. This design delivers an exercise experience which is closer to running than anything else available today. Our main aim while making this concept is 'A Treadmill with more outputs in less time along with surface cleaning'.

Keywords: *Treadmill, Freewheel, Roller, Bicycle. Bearing, Walking Belt*

1. INTRODUCTION

As we all know that a manual treadmill does not require any electrical energy, so that using treadmill and some arrangements of gears and chain drive, we make a treadmill bicycle. There is a brake system is provided for speed control. Treadmill walking platform is somewhat inclined for better torque. This inclination is done by different diameter of front wheel and rear wheel or framing arrangement. The walking bicycle has a simple mechanism, operated with free wheels, gear, chain, bearing shaft and links arrangement. As by the linear walking motion is converted into rotary motion which indeed done by the gear chain and free wheel mechanism of the linkages, which takes a very simple movement. The walking bicycle is the one, which is the combination of walking and cycling into one activity. The walking bicycle combines the two activities into a straight motion, allowing you to move yourself forward at required speed, easily by walking on the belt provided.

1.1 TREADMILL

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 Chain-drive. 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.

1.2. SHAFT

A shaft is a rotating machine element that is used to transmit power from one place to another place. The power is transmitted to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft which allow the power to be transferred to various machines linked up to the shaft. In order to deliver the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it.



Figure1: Reverse Osmosis

1.3. ROLLERS

Bicycle rollers are a type of bicycle trainer which is use to make itfeasible to ride a bicycle indoors without moving forward.However, dissimilar to other types of cycle trainers, rollersdo not confine to the bicycle frame, and the rider mustbalance him or herself on the rollers while training.

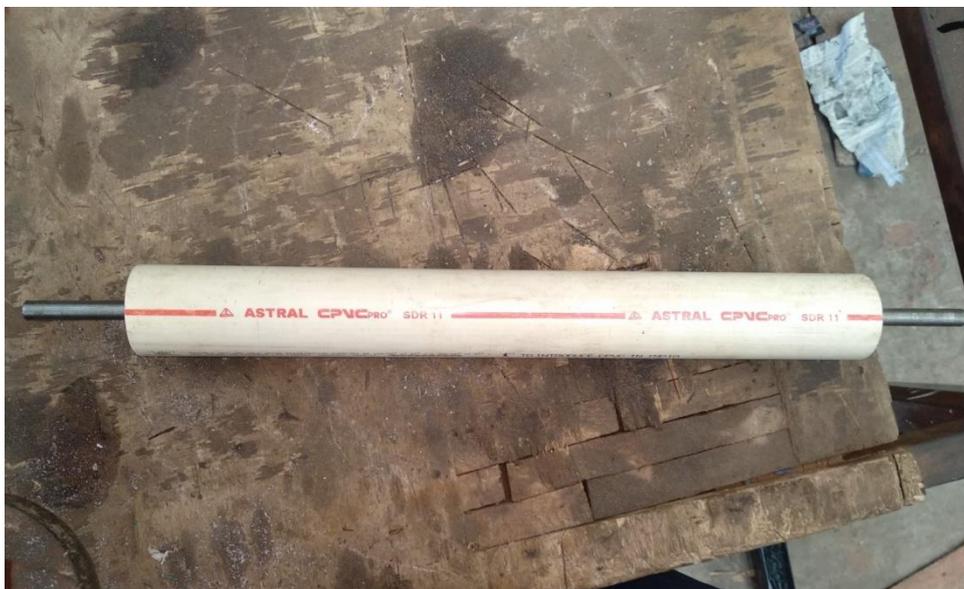


Figure 2: Roller

1.4. Flat Belts

Flat belts were largely used in the 19th and early 20th centuries in line shafting to deliver power in factories. They were also used in farming, mining, and logging applications such as sawmills, threshers, blowers, conveyors for filling corn cribs or haylofts, balers, water pumps, and electrical generators. Flat belts are still used today, although not nearly as much as in the line-shaft era. The flat belt is a simple system of power transmission that was well suited for its day. It can transfer high power at high speeds in cases of wide belts and large pulleys. But these wide-belt-large-pulley drives are bulky it takes lots of space while requiring high

tension, leading to high loads, and are badly suited to close-centers applications, Flat belts were traditionally made of leather or fabric. Today most are made of rubber or synthetic polymers.

1.5. Wheels

A wheel is a circular component which is made to rotate on an axle bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels along with the axles, permit heavy objects to be moved easily allowing movement or transportation while supporting a load or performing labor in machines. Wheels are also used for other objectives such as a ship's wheel, steering wheel, potter's wheel and flywheel.



Figure3: Wheels

1.6. Sprocket

A sprocket or sprocket wheel is a profiled wheel which has teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. For the motion 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 consists of supportive rollers and two main rollers at extreme ends for movement of the belt. On the extreme last roller sprocket is fitted. The name 'sprocket' applies usually to any wheel upon which radial projections retain a chain passing over it. It is different from a gear in that sprockets are never conjugated together directly, and differs from a pulley, in that sprockets teeth and pulleys are smooth.



Figure4: Sprocket

1.7. BEARINGS

A bearing is a machine element which reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. A bearing is machine element which holds another moving machine element. The moving machine element called as a journal. Bearing permit a relative motion between the contact surfaces of the members while delivering the load. There is a certain amount of power is wasted in removing frictional resistance. So as to decrease frictional resistance and wear and to carry away the heat generated, a lubricant may be utilized. A bearing is a machine element that constrains relative motion to only the desired motion, and or rollers, or by forming flexure bearings. A rolling-element bearing, also known as a rolling bearing, is a bearing which carries a load.



Figure5: BEARINGS

1.8. Chain Drive

Chain drive is the way of transmitting mechanical power from one place to another place. It is often used to deliver power to the wheels of a vehicle, particularly bicycles and motorcycles. Chain drive is also used in a wide variety of machines besides vehicles. The power is output by simply rotating the chain, which can be used to lift or drive the objects with its mechanism.

1.9. BRAKE

A brake is a mechanical device that inhibits motion by absorbing energy from a moving system. It is used for slowing or stopping a moving vehicle motion.

1.9.1 Rim brakes

In Rim brakes, braking force is applied by friction pads to the rim of the rotating wheel, thus slowing the bicycle.

1.9.2. Rim

The rim is the "outer edge of a wheel holding the tire. It makes up the outer circular design of the wheel on which the inside edge of the tire is mounted on vehicles such as automobiles.

1.9.3. Hub

The hub is the center of the wheel, and typically houses a bearing, and is where the spokes meet. The axle is hollow, following the wheel at very close tolerances. A hub less wheel (also known as a rim rider or centre less wheel) is a type of wheel with no centre hub.



Figure6: Hub

1.9.4. Frame

A frame is the main component of any kind of cycle, onto which wheels and other components are fitted. Frames are required to be strong, stiff and light, which they do by combining different materials and shapes.

1.9.5. Belt Selection Criteria

Belt drives are built under the following required conditions: speeds of and power transmitted between drive and driven unit; suitable distance between shafts; and appropriate operating conditions.

The equation for power is

$$\text{Power [kW]} = (\text{torque [N-m]}) \times (\text{rotational speed [rev/min]}) \times (2\pi \text{ radians}) / (60 \times 1000)$$

2. MEHOLOGY

The working of the treadmill cycle is majorly based on the principle of conversion of the linear motion applied by the human being on the treadmill into the rotary motion of the wheels with the help of gear system and motor mechanism. In addition to the liner motion applied by the human being, energy from the sun will also be converted with the help of solar panels. The main chassis of the treadmill consist of square pipes welded together to for the outer portion of the chassis. In the inside of the chassis are the two types of rollers- cast iron and steel rollers that will have a rolling motion when the forward motion is applied on the belt over the rollers. The big rollers are present at the front and rear part of the chassis provide a tightening effect on the belt due to which a proper grip is maintained between the belt and the rollers. As the human being moves straight ahead on the treadmill it causes the belt to move in the anticlockwise direction when seen form the left. The rollers will also move in the same direction as the belt. The big end roller also consists of gear mechanism at its either ends. On the shaft of the big end roller are mounted the small gears on the either side of the roller. Bearing present on the inner of the small gear makes the rotation of the same smooth and frictionless. With the help of the ball bearings(size taken) on the either side of the chassis near the end roller causes a smooth and easy mounting of the big gear mounted on the shaft above it. There is also a small chassis extending from the main chassis to the wheels. This chassis also consists of the sub assembly for mounting of the pedestal bearings, and similarly on this bearings is mounted a hollow shaft which is connected to the hub of the two rear wheels. The rotation of the hollow shaft causes the wheel to move in the direction of motion. To this shaft is mounted the sprockets as well at the center of the shaft, these sprockets are also grub screwed to the shaft and, also welded to the shaft so that the position of the sprockets do not change on the shaft and remain at the same place. Also these sprockets are connected with the sprockets on the shaft of the big gear with the help of chains. This mechanism is called as the chain sprocket mechanism.

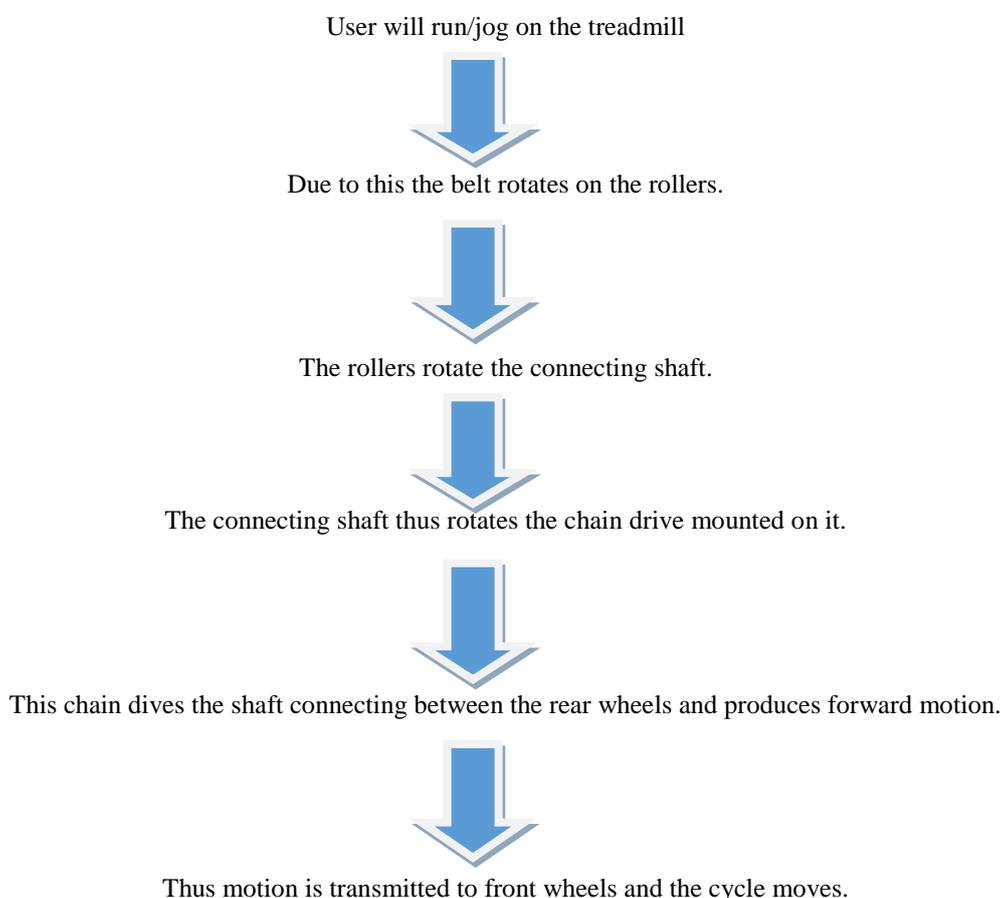


Figure7: Working Flowchart of Cycle



3. Design and Calculation

Power Calculation

$$\text{Power} = T \times \omega$$

$$\omega = 2\pi \times N/60$$

$$\text{Torque} = \text{Force} \times \text{Radius of wheel}$$

$$\text{Human force required for sliding rollers} = 220 \text{ N}$$

$$\text{Radius of cycle wheel } R_o = 250\text{mm}, R_i = 200\text{mm}$$

$$\text{Torque} = \text{Force} \times \text{Radius of wheel} = 220 \times 250 = 55000 \text{ N} - \text{mm}$$

Without considering the rolling resistance and air drag

$$\text{Average velocity of bicycle} = 11.5 \text{ km/hour} = 3.19444 \text{ m/sec}$$

$$\text{Velocity} = \text{angular velocity} \times \text{Radius of wheel}$$

$$3.19444 = (2\pi \times N)/(60 \times 1000)$$

$$\text{Speed } N = 122 \text{ rpm}$$

Power required to the drive a cycle

$$P = 55000 \times 0.0127777 = 702.7778 \text{ W}$$

$$P = 0.702777 \text{ Kw}$$

4. CONCLUSIONS

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.

5. Result

The design was focused on all the processes of conception, invention, visualisation, calculation, refinement and specification of details that determine the form of the product. The design has gone under force analysis so that its performance criterion will not fail in any sense. It can be seen from the design analysis that the rate of discharge per occlusion is considered reasonable. The power required to drive the pump is 0.702777 Kw and Speed $N = 122 \text{ rpm}$ achieved.

6. ACKNOWLEDGEMENT

The authors are thankful to Assistant Prof. Jawed Rafiq, workshop superintendent and all the Faculty member of Buddha Institute of technology Gida Gorakhpur, for his valuable comments and suggestions.

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Volume 5, Special Issue 04, Feb.-2018 (UGC Approved) e-ISSN (O): 2348-4470 p-ISSN (P): 2348-6406