

DESIGN AND FABRICATION OF TREADMILL BICYCLE

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Abstract—This paper deals with the 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 the RPM Sensor is attached to the roller, from where the Sensor senses the speed of the roller and sends the signal to the motor. The motor on receiving the signal transmits its motion to the front wheel which leads to the rotation of the wheel and thus the bicycle runs.

Index Terms—treadmill, bicycle, R.P.M Sensor, motor, walk.

I. INTRODUCTION :-

The treadmill bicycle is completely a new way of moving which is designed mostly for runners. Basically, using a treadmill is similar to running, hiking or walking. Think about the last time you were riding a bike over a few obstacles such as train tracks, potholes, speed bumps etc. The 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, people using treadmill bicycles can roam around freely on roads as well. This project overcomes the drawback of the conventional treadmill which is stationary and moreover the jogger gets exposed to the natural atmosphere too. So this proposed methodology provides an ultimate solution by making use of the wheels and making the treadmill bicycle a walking cycle.

The walking cycle has a simple mechanism, operated with free wheels, gear chain, bearing shaft and links arrangement. The conversion of the linear motion into rotary motion is done by the gear chain and free wheel mechanisms of the linkages, which involves very simple movements. The rotary motion is again converted into linear motion of the cycle through mechanical linkages (gear chain and free wheels) arrangement. The conveyor system is either a continuous movement or intermittent which depends on the person's usage. So a basic free wheel mechanism with bearings is designed with time delay which can be used to halt the movement when necessary.

This invention relates to improvements in transport devices, and it relates particularly to devices for transferring people, small in number like that of a bike or a cycle. The Walking Bicycle is the one, which combines walking and cycling into one activity. The Walking Bicycle combines the two activities into a linear motion, allowing you to propel yourself forward at desired speed, simply by walking on the belt provided. Usually, the operation of the walking cycle machine is controlled by the user itself by simply walking on the treadmill belt and also balancing the cycle. The operating speed of the walking cycle differs on the amount of force applied by the user.

1.2 CYCLE

A bicycle, often called a bike or cycle, is a human powered, pedal-driven, single-track vehicle, having two wheels attached to a frame, one behind the other. Two-wheeled bicycles come in a range of designs. Some resemble traditional two-wheeled bikes with frame modifications to accommodate a wider axle and additional rear wheel. Others are recumbent, supporting the rider in a chair-type seat, with a frame that is low to the ground. Two-wheeled cycles is known for their stability and ease of riding. They are the principal means of transportation in many regions. They also provide a popular form of recreation, and have been adapted for use as children's toys, general fitness, military and police applications, courier services, and bicycle racing. A treadmill is a device generally for walking or running 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 tread wheel to grind grain.

1.3 TREAD MILL

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. As a result, the treadmill industry counts with hundreds of manufacturers throughout the World.

Treadmills as power sources originated in antiquity. These ancient machines came in three major designs. The first was to have a horizontal bar jutting out of a vertical shaft. It rotated around a vertical axis, driven by an ox or other animal walking in a circle pushing the bar. Even humans were used to power them. The second design was a vertical wheel that was powered through climbing in place instead of

walking in circles. This is similar to what we know today as the hamster wheel. The third design also required climbing but used a sloped, moving platform instead. Treadmills as muscle powered engines originated roughly 4000 years ago. Their primary use was to lift buckets of water. This same technology was later adapted to create rotary grain mills and the tread wheel crane. It was also used to pump water and power dough-kneading machines and bellows.

Components used in walking cycle: Cycle, Treadmill, Bearings, Chain and sprockets, Free wheels, Shafts, and the Operations performed are Arc welding and cutting, Brazing, Lathe operation (turning, threading, knurling).

1.2.1 As an indoor activity

Many users find treadmills monotonous and lose interest after a period. Treadmills do not offer the psychological satisfaction some runners get from running in new locations away from the distractions of home.

1.2.2 As a machine

May cause personal injury if not used properly. Of particular concern are children who reach into the treadmill belt while it is running and suffer severe friction burns that may require multiple skin grafts and result in lasting disability. Injury to children can be avoided by removing the safety key when the treadmill is not in use, without which, the treadmill belt will not start. Costs of purchase, electrical costs, and possible repair are significantly greater than those of running outside. Takes up space in homes.

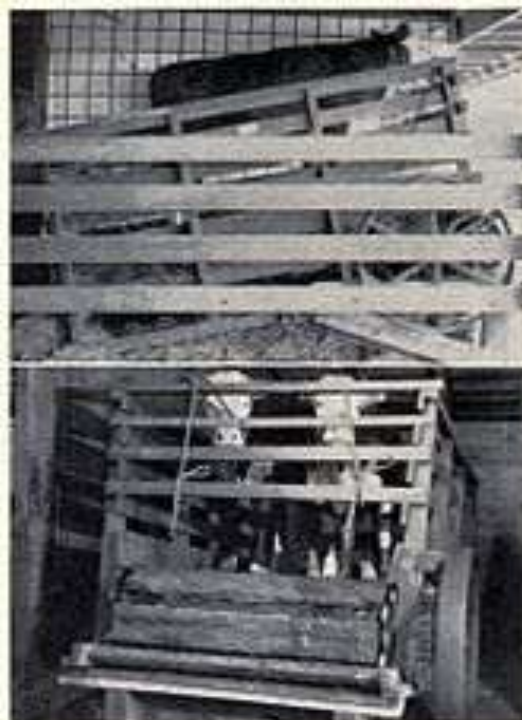
1.2.3 Exercise treadmills

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. 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. Treadmill ergometers are now mainly motor driven. Most treadmills have a running table with sliding plate. Before and after the race table, there are two shafts. The running belt is stretched between the shafts and the running deck. Safety standards for treadmills are the IEC EN 957-1 and IEC EN 957-6.

For medical treadmills applicable norms, standards and guidelines are the Medical Device Directive (MDD), European Guideline 93/42 EEC, European Guideline 2007/47 EEC, IEC EN 60601-1, EN 62304, EN 14971 and the machinery directive 2006/42/EC. Medical treadmills are class IIb active therapeutic devices and also active devices for diagnosis. With their very powerful (e.g. 3.3 kW = 4.5 HP) electric motor powered drive system treadmills deliver mechanical energy to the human body through the moving running belt of the treadmill. The subject is not changing his horizontal position and is passively moved and forced to catch up with the running belt underneath his feet. The subject can also be fixed in safety harnesses, unweighting systems, various supports or even fixed in and moved with a robotic orthotic system utilizing the treadmill.

Medical treadmills are also active measuring devices. When connected through an interface with ECG, ergospirometry, blood pressure monitor (BPM), or EMG, they become a new medical system (e.g., stress test system or cardiopulmonary rehabilitation system) and can also be equipped to measure VO₂max and various other vital functions. Most treadmills have a "cardio mode", where a target heart rate is defined and the speed and elevation (load) is controlled automatically until the subject is in "heart rate steady state". So the treadmill is delivering mechanical energy to the human body based on the vital function (heart rate) of the subject. A medical treadmill which is also used for ergometry and cardiopulmonary stress test as well as performance diagnostics is always a class IIb medical device either when used as stand-alone device in a medical environment or when used in connection with an ECG, EMG, ergospirometry, or blood pressure monitoring device.

1.2.4 Other uses



Steers on a treadmill

As it is basically a conveyor belt, the treadmill can be used for activities other than running. If horses are being tested (especially in jockey racing) they will be put on a specially constructed treadmill. Large treadmills can also accommodate cars. Treadmills can also be used to exercise dogs that are accustomed to running on a conveyor; however tying the leash to the treadmill should be avoided as it can cause serious injury.



Military working dog, walks on a underwater treadmill to recover from an injury Dog/Pet and underwater pet treatment treadmills are available for both home and clinical use. A variety of makes and models are available, but key features of treadmills designed for pet use include a longer running surface, open front and back entries and side rails to prevent the pet from falling off the treadmill. None are designed to be used without human supervision. Many veterinary and animal rehabilitation clinics also offer underwater treadmill therapy as part of their services provided to clients' pets.

1.2.5 Omnidirectional treadmill



Advanced applications are so called omnidirectional treadmills. They are designed to move in two dimensions and are intended as the base for a "holodeck". There are several solutions which were proposed and research continues because some issues remain unsolved, such as large size, noise and vibration. There are parallel developments being conducted by researchers working on projects sponsored by the Department of Veterans Affairs to create virtual reality environments for a wheelchair trainer in order to promote therapeutic exercise.

1.3 PROBLEM DEFINITION

While working out in the gym people use treadmill for the purpose of jogging and running. The main drawback of treadmill is that it is stationary. That becomes boring for user to run in a still surrounding with natural exposure to environment. Similarly cycling in the conventional way is common and not possible for all age groups as old people prefer walking. Even for travelling short distance people prefer vehicles that cause pollution and wastage of energy in terms of fuel. So, we came up with the concept of walking tricycle.

- 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 results.

1.4 OBJECTIVE

Treadmill cycle is the new way of locomotion. It makes workout more interesting and competitive. There is no need to get stuck in the gym at a corner when you can roam while you workout. Secondly, looking from the ever-growing problem of pollution, this cycle turns out to be eco-friendly without emission of harmful pollutants. Moreover it saves fuel thus helping in saving the natural resources. Lastly, in this metropolitan world, people are ignoring their health and fitness. This cycle would be a boon for such fitness deprived people having hectic schedule.

- Useful for exercise purpose.

- To reduce the use of non-renewable energy sources.

1.5 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.

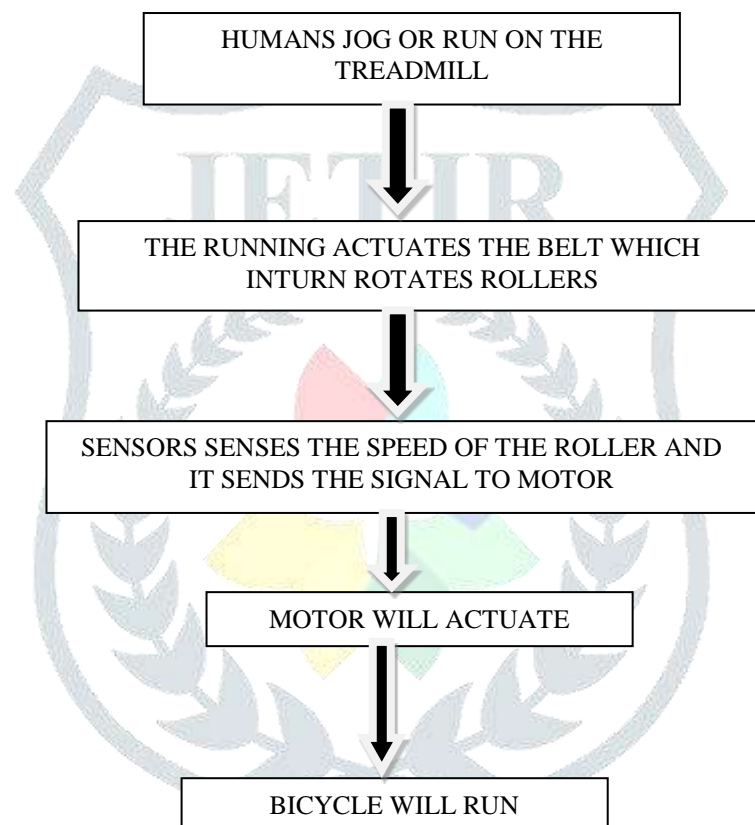
Based on study, Men burn 124 calories running roughly a mile on a treadmill, and 88 while walking. Women, on the other hand, burn 105 and 74 respectively. It allows you to stay physically active while travelling at the same time. You can practically exercise at any time of the day.

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.

2.1 METHODOLOGY



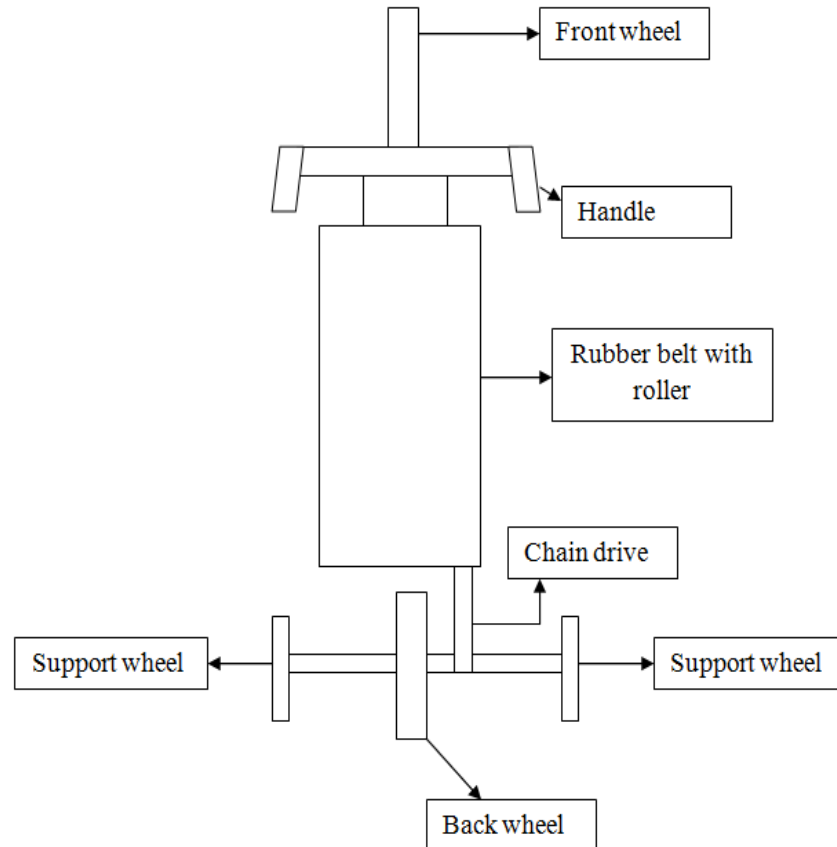
We are using DFM for our paper. Design for manufacturability also known as design for manufacturing. DFM is the general engineering art of designing products in such a way that they are easy to manufacture. The concept exists in almost all engineering fields. Depending on the manufacturing technology 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.

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--- plastic 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 pedestal bearings 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. With proper measurement the big gear can be kept in mesh with the smaller gear for the smooth operation of the gear system. Since the gear system are in mesh it causes the big gar to rotate in the anti-clockwise direction, which is the desired motion required for the cycle to move ahead. 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. Hence as the big gear shaft rotate in the anticlockwise direction, it causes the sprockets too to rotate in the same direction, and with help of the chain drive mechanism it causes the sprockets on the hollow shaft also to rotate in the same direction and hence causes the wheels to move ahead in the desired direction of the motion.

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

COMPONENTS DESCRIPTION



3. The Main components are:-

1. Cycle
2. Tread Mill
3. Tread Belt.
4. Motor

3.1 Tread Mill



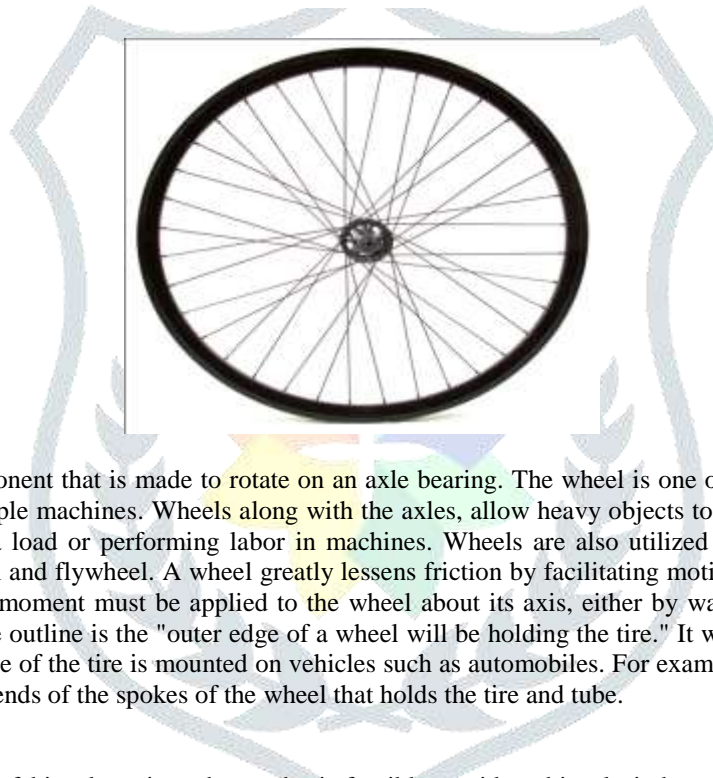
There are majorly two different types of frame materials with standard treadmills having steel frames and newer and premium treadmills with aluminum frames. Aluminum frames will hold up better if you are preparing on keeping your treadmill for several years or if you are near to the weight capacity of the treadmill. The treadmill rails (also known as bars or grips) should be used for providing stability when you are starting or stopping the treadmill or if your treadmill is well equipped with a grip heart monitor, this is where you will take your heart rate measurements. Rails are not meant to be held the complete time that you are using the treadmill, so be sure that they are in a convenient but also out of the way location. You also want the grips to provide comfort and easy to reach for when you do need them.

3.2 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. The extra width will permit for this swaying without you hitting into the frame and the longer length will permit you to jog with your normal stride without any fear of falling off of your treadmill.



3.3 Wheels



A wheel is a circular component that is made to rotate on an axle bearing. The wheel is one of the major components of the wheel and axle which is one of the six simple machines. Wheels along with the axles, allow heavy objects to be moved easily allowing movement or transportation while supporting a load or performing labor in machines. Wheels are also utilized for other objectives such as a ship's wheel, steering wheel, potter's wheel and flywheel. A wheel greatly lessens friction by facilitating motion by rolling together with the use of axles. For rotations of the wheel, a moment must be applied to the wheel about its axis, either by way of gravity or by the application of another external force or torque. The outline is the "outer edge of a wheel will be holding the tire." It will construct the outer circular design of the wheel on which the inside edge of the tire is mounted on vehicles such as automobiles. For example, on a bicycle wheel, the periphery is a large hoop attached to the outer ends of the spokes of the wheel that holds the tire and tube.

3.4 Rollers

Bicycle rollers are a type of bicycle trainer that make it feasible to ride a bicycle indoors without moving forward. However, dissimilar to other types of bicycle trainers, rollers do not confine to the bicycle frame, and the rider must balance him or herself on the rollers while training. Bicycle rollers normally comprise of three cylinders, drums, or "rollers" (two for the rear wheel and one for the front wheel), on top of which the bicycle runs. A belt joins one of the rear rollers to the front roller, causing the front wheel of the bicycle to spin when the bicycle is pedaled. The spacing of bicycle rollers can normally be adjusted to match the bicycle's wheelbase. Generally, the front roller is adapted to be slightly ahead of the hub of the front wheel.



3.5 Bearings



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.

3.6 Fly wheel



A flywheel is a rotating mechanical device that is used to accumulate rotational energy. Flywheels have an inertia called the moment of inertia and thus withstand changes in rotational speed. The amount of energy present in a flywheel is proportional to the square of its rotational speed. Energy is transmitted to a flywheel by the application of a torque to it, thereby improving its rotational speed, and hence its accumulated energy. Conversely, a flywheel releases stored energy by implementing torque to a mechanical load, thereby reducing the flywheel's rotational speed.

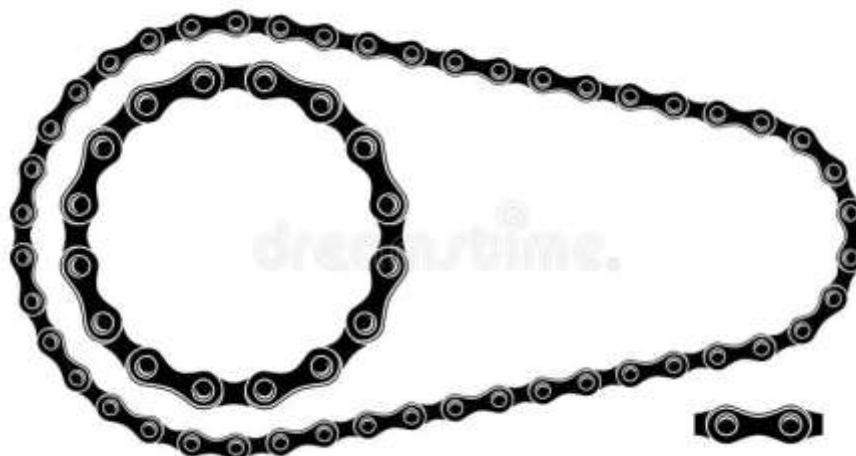
3.7 Sprocket

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. 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 such a way that sprockets are never conjugated together directly, and differs from a pulley, the sprockets which have teeth and pulleys are smooth.



3.8 Chains

A chain is a series of connected links which are typically made of metal. A chain may consist of two or more links. Those designed for lifting, such as when used with a hoist; for pulling; or for securing, such as with a bicycle lock, have links that are torus shaped, which make the chain flexible in two dimensions (The fixed third dimension being a chain's length.) Those designed for transferring power in machines have links designed to mesh with the teeth of the sprockets of the machine, and are flexible in only one dimension. They are known as roller chains, though there are also non-roller chains such as block chain.



3.9 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 leads 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 drive easily.

DC motors for electric scooters and other electric devices

Voltage: 24V

Wattage: 350W

Rotation: 2650 RPM

Torque: 2.5 N.M to 4 N.M

Efficiency(%): >75

Dimension(Width x Length) = 101*69



4 MANUFACTURING METHOD

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.

4.1 Arc welding

Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, or slag. Arc welding processes may be

manual, semiautomatic, or fully automated. First developed in the late part of the 19th century, arc welding became commercially important in shipbuilding during the Second World War. Today it remains an important process for the fabrication of steel structures and vehicles.

4.2 Types of Arc Welding

- Consumable electrode method
- Non-consumable electrode method

4.3 Consumable electrode methods

One of the most common types of arc welding is shielded metal arc welding (SMAW), which is also known as manual metal arc welding (MMAW) or stick welding. An electric current is used to strike an arc between the base material and a consumable electrode rod or stick. The electrode rod is made of a material that is compatible with the base material being welded and is covered with a flux that gives off vapor that serve as a shielding gas and provide a layer of slag, both of which protect the weld area from atmospheric contamination. The electrode core itself acts as filler material, making separate filler unnecessary. Gas metal arc welding (GMAW), commonly called MIG (for metal/inert-gas), is a semi-automatic or automatic welding process with a continuously fed consumable wire acting as both electrode and filler metal, along with an inert or semi-inert shielding gas flowed around the wire to protect the weld site from contamination. Constant voltage, direct current power source is most commonly used with GMAW, but constant current & alternating current are used as well. Flux-cored arc welding (FCAW) is a variation of the GMAW technique. FCAW wire is actually a fine metal tube filled with powdered flux materials. An externally supplied shielding gas is sometimes used, but often the flux itself is relied upon to generate the necessary protection from the atmosphere. The process is widely used in construction because of its high welding speed and portability.

Submerged arc welding (SAW) is a high-productivity welding process in which the arc is struck beneath a covering layer of granular flux. This increases arc quality, since contaminants in the atmosphere are blocked by the flux. The slag that forms on the weld generally comes off by itself and, combined with the use of a continuous wire feed, the weld deposition rate is high. Working conditions are much improved over other arc welding processes since the flux hides the arc and no smoke is produced.

4.4 Non-consumable electrode methods : Brazing

Brazing is a metal-joining process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a lower melting point than the adjoining metal.

4.5 Flux

Unless brazing operations are contained within an inert or reducing atmosphere environment (i.e. a vacuum furnace), a flux such as borax is required to prevent oxides from forming while the metal is heated. The flux also serves the purpose of cleaning any contamination left on the brazing surfaces. Flux can be applied in any number of forms including flux paste, liquid, powder or pre-made brazing pastes that combine flux with filler metal powder. Flux can also be applied using brazing rods with a coating of flux, or a flux core.

4.6 Lathe machine

Lathe is a machine that helps in shaping several material pieces in the desired shapes. A lathe is a machine that rotates the piece on the axis in order to perform various operations like cutting, facing, knurling, deformation and more. Metal spinning, thermal spraying, woodturning and metalworking are the common operations performed with a lathe machine. One can even shape pottery with this working wonder. Whatever material used in lathe machine whether metal or wood is molded first. The most commonly used lathes are the woodworking lathes.

4.7 Lathes Operations

The general operations done with the lathe are grooving, turning, cutting, sanding and etc. if anyone wants to operate the lathe machine then he must first know about the feeds, cutting speed, depth of the cut and usage of tool should be considered. Each lathe operation has got its own factors that need to be considered before doing the work. The factors should be used properly so that one can avoid from mishandling and mishaps while performing any kind of lathe operation. With every cut desired the speed, depth and feed of the lathe machine is changed for precision.

4.8 Types of Lathe Operation

The working of the lathe machine changes with every operation and cut desired. There are a lot of operations used for using the lathe machine. Some of the common lathe operations are: Facing This is usually the first step of any lathe operation on the lathe machine. The metal is cut from the end to make it fit in the right angle of the axis and remove the marks.

4.9 Tapering

Tapering is to cut the metal to nearly a cone shape with the help of the compound slide. This is something in between the parallel turning and facing off. If one is willing to change the angle then they can adjust the compound slide as they like.

4.10 Parallel Turning

This operation is adopted in order to cut the metal parallel to the axis. Parallel turning is done to decrease the diameter of the metal.

4.11 Parting

The part is removed so that it faces the ends. For this the parting tool is involved in slowly to make perform the operation. In order to make the cut deeper the parting tool is pulled out and transferred to the side for the cut and to prevent the tool from breaking.

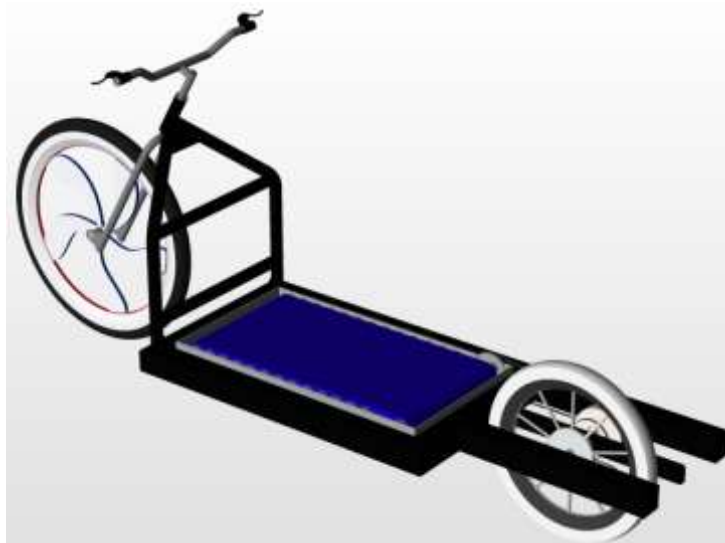
4.12 Lathe Cutting Tools

There are several lathe cutting tools that help in cutting with the lathe machine. The commonly used tools are mentioned below: Carbide tip tools, Grooving tool, Cut-Off blade, Parting blades, boring bar.

4.13 Design of the cycle

This can be constructed by the simple arrangements of the gears, belt and frame on a normal bicycle. The cycle is to be divided into three parts. The first part consists of the front wheel and handle, the second part consists of the seat, pedals, gear & gear chain. The third part consists of rear wheel. Now coming to the design of walking cycle, the second part (seat, gear, gear chain & pedals) is to be replaced with a belt drive similar to that of a treadmill and the rear roller of this belt is to be welded with a gear.

5. DESIGN AND CALCULATION



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.

5.1 System 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.

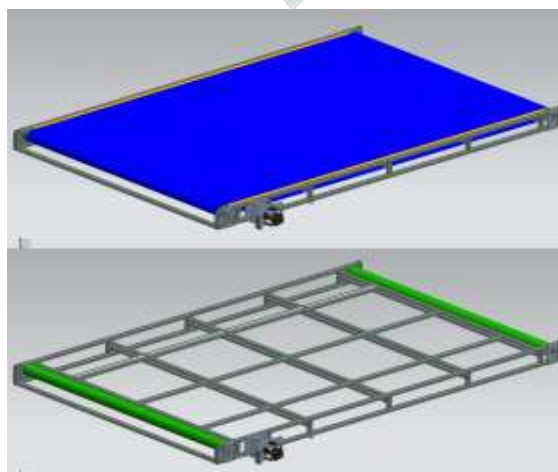
- Design Parts
- Parts to be purchased.

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.

5.2 DESIGN OF MAIN FRAME COMPONENTS

5.2.1 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. 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.



5.2.2 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.

5.2.3 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 $\frac{3}{4}$ 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.

5.3 CALCULATIONS

Calculation for Chain Drive

Parameters taken from standard specification of sprocket:

No. of teeth on the sprocket = 18

Speed of sprocket = 24.8 RPM

Outside diameter of the sprocket $D_o = 76$ mm

Pitch circle diameter of the sprocket $D_p = 70$ mm

Centre to center distance = 540mm

$$= 360 / 18 = 20$$

Pitch of the chain

$$p = 72 \sin (180/18)$$

$$p = 12.5 \text{ mm}$$

Diameter of the chain roller d_1

$$D_o = D_p + 0.8d_1$$

$$d_1 = 7.5 \text{ mm}$$

Tooth flank radius r_e

$$r = 0.008 d_1 (T_2 + 180)$$

$$r_e = 30.24 \text{ mm}$$

Roll seating radius r_i

$$r_i = 0.505 d_1 + 0.069$$

$$r_i = 3.92 \text{ mm}$$

Roll seating angle α Maximum roll seating angle = $140^\circ - 90^\circ / T$

$$= 2.77^\circ$$

Minimum roll seating angle = $120^\circ - 90^\circ / T$

$$= 1.66^\circ$$

Tooth Height of the above pitch polygon (h_a)

$$h_a = 0.5 (p - d_1)$$

$$h_a = 2.5 \text{ mm}$$

Root diameter (D_f)

$$D_f = D - 2r_1$$

$$D_f = 64.16 \text{ mm}$$

Velocity ratio of the chain drives

Here both the sprockets have the same diameters and same no. of teeth

Speed of the sprocket 1 is same as speed of the sprocket 2

So, Speed of the chain driven $N_2 = 24.8$ RPM

Average velocity of the chain

$$V = \pi D N / 60$$

$$V = 93.44 \text{ mm /sec}$$

$$V = 0.0933 \text{ m/s}$$

Length of the chain:

Let us assume

Central distance between the chain sprocket and chain Driven $X = 762$ mm

The length of the chain must be equal to product of the number of chain links and pitch of the chain

$$L = k \times p$$

Number of chain links

$$K = (T_1 + T_2) / 2 + (2X/p) + ((T_2 - T_1) / 2\pi)^2 (p/x)$$

$$K = 139.92$$

Length of the chain $L = k \times p$

$$L = 1749.5 \text{ mm}$$

$$L = 1.75 \text{ m}$$

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.

A treadmill based human power generator was developed using an electromagnetic dynamo generator coupled to a manual treadmill's flywheel. The final circuit delivering power to a heavy duty battery was found to be able to deliver 140W peak for a short period

of time. Regression equations were obtained to relate the power generated to the belt speed, covering values ranging from an average $10.8 \pm 0.36W$ at $1.83 \pm 0.045m/s$ to $90.3 \pm 3.04W$ at $2.38 \pm 0.054m/s$. The variation of angle of inclination was not determined to have a significant impact on energy generation. These results were compared to energy expenditure values predicted by the American College of Sports Medicine (ACSM) metabolic relations at various speeds and angles of inclinations. The maximum average system efficiency obtained through this study for the system was $37.9 \pm 2.63\%$ by finding the ratio between the obtained and predicted power output, and assuming a 25% gait efficiency. Furthermore, analyses were done on the possible applications for the treadmill generation concept. In the gym environment, it was found that a human power treadmill generator could help reduce energy consumption significantly. In isolated areas such as rural countryside or developing countries, the treadmill generator can provide for a low-cost, quick to implement, simple to operate, and low maintenance solution. In any application, the treadmill can be used as an educational tool to give people a physical perspective on quantities in energy, helping realize the importance of energy conservation. In space, the treadmill generator is not as feasible as current establishments such as the International Space Station do not face a scarcity of energy and the process would entail high costs of implementation. However, the need for exercise to inhibit bone and muscle atrophy in low gravity makes the treadmill generator a possible concept for future extraterrestrial environments as a secondary source of power. In this day where the world is challenged to be more responsible in its sourcing of electrical power, the method of human power generation could be a solution that also helps mitigate the issue of obesity and overweight. If additional design and study of this concept proves it effective in energy use reduction, localized energy delivery and sustainability education, it could efficiently answer the two great challenges.

By this project we are creating a platform in which mechanical energy is converted into linear motion. By using our simple walking nature we are changing it to a good running speed by which we are not only saving energy but also recreating a formula of using small investment to a big amount of achievement. This prototype can be a good promoted area to use the energy being wasted on treadmills in fitness centers. By using this prototype we can not only save energy but also create a new idea of energy distribution in electrical field which is a common need to everyone in the future.

- 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.

6.2 FUTURE SCOPE

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.

The treadmill bike is totally new way of moving it is done by the new way of electric and mechanical part assessment battery and gear. Motion of bike from one place to another place will be done by human effort. The electric assist is in the combination with the gear. The three gear pair boosting your walking pace up the regular bike. As we know the bike works on more on human effort it helps to eliminate a health issues like obesity and lungs diseases, driving it daily through as short distance can help to maintain good health as we know it does not use any fuel of which the cost is increasing frequently nowadays becoming very costly this will be a good option for travelling in the near future. It can be driven by any person of different edges. Due to scarcity of fuel, treadmill bike will benefit e great extend to human life. It also helps in exercising which is required for a person to be fit, so treadmill bike also saves time for exercising.

6.3 ADVANTAGES

- It is used to reduce the weight of the human body
- It produces electric power
- It is environmental friendly
- It is very economic

DISADVANTAGES

- Some treadmill runners develop bad running habits that become apparent when they return to outdoor running.
- In particular a short, upright, bouncy gait may result from having no wind resistance and trying to avoid kicking the motor covering with the front of the foot.
- Imposes a strict pace on runners, giving an unnatural feel to running which can cause a runner to lose balance. Treadmill running is not specific to any sport, i.e., there is no competitive sport that actually utilizes treadmill running. For example, a competitive runner would be far better off running outdoors through space since it is more specific and realistic to his event.

6.4 APPLICATION

- It is used in gym to reduce the weight
- It is used to charge battery

PHOTOGRAPHS OF THE BICYCLE TREADMILL DESIGNED AND MADE:-



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