



INVESTIGATION AND DEVELOPMENT OF A SMART TREAD MILL BIKE

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Abstract

Although millions of people use the bicycle every day, the design of the modern bicycle is still largely traditional, and comparatively little research work has been carried out to determine the design which is most effective physiologically. New modifications have generally been tested on the racing track where, however, many uncontrollable factors may influence the result. From both the practical and physiological point of view it is important to determine the energy output when riding different types of bicycles for a given distance at a certain speed. In our work modification of treadmill is done to better fit the requirements of users. Treadmill bicycle is designed for those humans who love to run outside. Treadmill equipped on bicycle frame and formulates a big innovation named '**Treadmill bike**'. This bicycle runs perfectly on human momentum. As the rider walks on the treadmill, the belt butts up against the rear wheel propelling the bike forward. Treadmill bicycle is designed for runners as the ideal treadmill device, this device combines the best exercise running and cycling to deliver a low-impact, high performance workout outdoors. We believe it is the ideal device for healthy runners. It delivers an exercise experience that is closer to running than anything else available today.

Key words: Treadmill, Frame, welding and Sensor

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 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

Literature review

1. Kachare jaydeep1 , Wagh ganesh sadashiv2 , (2018) “Treadmill Bicycle” This paper deals with conversion of a conventional bicycle into treadmill bicycle. In this bicycle the frame of the bicycle is completely modified and the treadmill is placed in between the two wheels, on which user will walk. As the user walks or runs on the treadmill the belt moves to the rear. At the rear roller RPM Sensor is attached to the roller from where Sensor will sense the speed of the roller and accordingly it will send signal to motor. The motion of motor is transmitted to the front wheel by which we can get the motion of wheel and bicycle runs. Treadmill Bicycle is one type of bicycle in which a man walks on the treadmill and then treadmill moves backward. The motion of treadmill bicycle is depend upon the human efforts so it is also called as walking bicycle. Multipurpose treadmill bicycle consists the parts like wheels, treadmill, battery, sprocket, chain drive, and dynamo

2. Pranav gujar prabhjot singh (2018) “treadmill bicycle”, The following paper deals with conversion and combination of a conventional tricycle and the most popular home exercise equipment, the treadmill, into a commuting vehicle. In this tricycle, the frame of the tricycle is entirely modified and treadmill is placed between three wheels, on which the user will run. As the user walks or runs, the belt moves over the rollers that are attached to the shaft with a chain drive. This chain drives the rear wheels of the tricycle which produces motion for the front wheels and thus the tricycle runs “Treadmill Bicycle” is a work which is

done to save our precious environment which is destroying and disturbed day by day with the increase in pollution emitted by vehicles and industries. While the innovations are going all around, our team has applied innovation to the vehicle makes it more unique than any vehicle currently in the mainstream markets

3. V. R. Gandhewar1 Priyanka H. Kakade2 , (March 2017) “A review paper on concept and utility of treadmill”, There has been great deal of research on this treadmill bicycle fabrication. The origin and use of the treadmill bicycle system began from several years ago and develop throughout the new concept revolution. At the late first century AD Roman Empire introduce first treadmill, as they need to lift heavy weight they incorporate this new invention. The workers walk within the treadmill having large diameter they could lift double the weight with half the crew. Nicholas potter also work in this field and invented a treadmill which is powered by animal 407 | P a g e and reduce human effort with more output. In 18’s new concept of treadmill for prisoners as a punishment, this idea was brought in goal 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.

4. Prabhjot Singh1 , Sukhwinder Singh2 ,(2018) “Treadmill Bicycle”, “Treadmill Bicycle” is a work which is done to save our precious environment which is destroying and disturbed day by day with the increase in pollution emitted by vehicles and industries. While the innovations are going all around, our team has applied innovation to the vehicle makes it more unique than any vehicle currently in the mainstream markets As we all know ozone is depleting day by day , we thought to make such vehicle which is free from the Exhaust of

particulate matter (PM) and harmful gases such as NO_x (oxides of nitrogen), CO (carbon monoxide) etc. Our works basically an Eco-Friendly Bicycle. It is based on Future innovative vehicles. We just want to create “A New Way of Moving”. It is a fun and environmental friendly way of transport. We have moto behind this project that everyone can jog without getting their shoes dirty. A person from any age can drive this bike. Moreover it has the same looks for both the Men and Women. People can drive this bike in any dress rather a traditional Indian dress or Western dress. The idea behind this bike is how we can use treadmill outside the Gym. It takes no more effort to walk “than a walk in a park”. All other innovations in transport results in increasing costs of Vehicles but our motive is to bring back the basic mode of transport back on roads i.e. bicycle in a newer way in an affordable price as compare to other vehicles

5. Dr. Ravikiran Kisan MD, Dr. Swapnali Ravikiran Kisan MD, Dr. Anita OR MD & Dr. Chandrakala SP MD,(June 2012)“Treadmill and Bicycle Ergometer Exercise: Cardiovascular Response comparison :Body response to exercise depends on the type of exercise. Cardiovascular changes again depend on the type of exercise and severity of exercises. Cardiovascular responses differ in bicycle ergometer exercise and treadmill exercise as the method of exercise, exercising muscles and others (as listed below) differ. Other studies have shown that increase in heart rate was more in treadmill exercise compared to bicycle ergometer exercise (2;4-6). Systolic blood pressure will increase more in treadmill exercise compared to bicycle ergometer exercise (3;5). Diastolic blood pressure decreases in both type of exercises but the decrease was same in both groups (3;5;7). Change in blood pressure and heart rate response in treadmill exercise was more compared to bicycle ergometer exercise for a given equivalent oxygen uptake values due to more sympathetic activation.

6. Chetan Mahadik, Sumit Mahindrakar and Prof. Jayashree Deka,(June 2014) “An Improved & Efficient Electric Bicycle system with the Power of Real- time Information Sharing” This paper presents the development of an associate degree Electric Bicycle System with an innovative approach. The aim of this paper is to show that the normal bi-cycle can be upgraded to electric one by some means that including the development of a regenerative braking system and innovative BLDC motor control but also uses realtime sensing and the powers of crowd sourcing to improve the cycling experience; get more people riding bikes; and to aid in the design and development of cities. Electric bikes have simultaneously gained popularity in many regions of the world and some have suggested that it could provide an even higher level of service compared to existing systems. There are several challenges that are related electric bike design: electricassisted range, recharging protocol, and bike and battery checkout procedures. This paper outlines system requirements to successfully develop and deploy an electric bike, focusing on system architecture, operational concepts, and battery management. Although there is little empirical evidence, electric bike could be feasible, depending on demand and battery management, and can potentially improve the utility of existing bike systems.

7. Prof. V. Sekar and Prof. V. Thiyagarajan had studied on,(2012) “Controlling of brushless DC motor in electric bicycle using electronic based circuit with 8 bit microcontroller” This paper deals with conversion of a conventional bicycle into treadmill bicycle. In this bicycle the frame of the bicycle is completely modified and the treadmill is placed in between the two wheels, on which user will walk. As the user walks or runs on the treadmill the belt moves to the rear. At the rear roller RPM Sensor is attached to the roller from where Sensor will sense the speed of the roller and accordingly it will send signal to motor. The motion of

motor is transmitted to the front wheel by which we can get the motion of wheel and bicycle runs. The cycle 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.

8. Prof. Pradeep M. Ingole ,(April2018) “Design of bicycle handle using ergonomic aspects.” This paper discusses the ergonomic aspects that can be incorporated in the design of a bicycle handle. The first step is to determine which factors contribute to comfort when riding a bicycle which results in human performance and fatigue. It has been found out by means of a survey with enthusiast cyclists that comfort is influenced by factors related to the cyclist (driver position, handle adjustments, body parts). This paper classified ergonomic aspects of bicycle handle, factors responsible for fatigue and analysis for the comfort positions. The most of the researchers presents there work in change seating position whereas this work focuses on the comfort position of bicycle handles. Hence there is a scope to find out the fatigue develop during riding for a particular region

9. Sr. Prof. Lecturer Shivaji Bhandarkar,(June 2013) “Vehicular Pollution, their effects on human health and mitigation measures” Pollution from vehicles especially automobiles is responsible for about two third of air pollution in the urban area. Main sources of emission from automobiles are as described Crankcase Emission Crankcase Emission (also called running loss emissions) is unburnt or partially burned fuel components that, under pressure, escape from the combustion chamber, pass the pistons and enter the

crankcase. This mixture is called blow-by. The main constituent of blow-by emission is HCs. If uncontrolled, it may constitute 13– 25% of total emissions. Since diesel engines compress only air, blow-by contain very low levels of pollutants. Evaporative Emissions Evaporative Emissions HC vapours, lost constantly and directly to the atmosphere due to volatile nature of petrol, mainly from the fuel line’s, fuel tank and carburettor depending upon fuel composition, engine operating temperature and ambient temperature. Losses from the carburettor, called Hot Soak Emissions, occur when a hot engine is stopped. It should be noted that, out of total emissions, which is much more in case of petrol than diesel, 20-32% of the total emissions are due to evaporation losses, of which the HCs happen to be the chief constituents. Exhaust Emission Automotive exhaust is the major source constituting about 60% of the total emission. Automobile exhaust consists of wide range of pollutants from simple to carcinogenic substances such as (1) Hydrocarbons (Unburnt), (2) Carbon monoxide, (3) Oxides of nitrogen (NOx), (4) Lead oxides, (5) Particulate matters e.g. lead, carbon, alkaline earth compounds, iron oxide, tar, oil, mist (6) Traces of aldehydes, esters, ethers, sulphur dioxide, peroxides, ketones benzene (C₆H₆), 1, 3 butadiene, Poly Aromatic Hydrocarbons (PAH), metal dust, asbestos fibre, dioxin, furon, ammonia, organic acids , chlorofluorocarbons (CFCs) etc. Hydrocarbons and CO appears in the exhaust gas products of incomplete combustion. Oxides of nitrogen result from the reaction of nitrogen and oxygen contained in the combustion air at high temperature prevailing during combustion. Further, many of these primary pollutants react with each other to form secondary pollutants. Chief among these includes HC, CO, NOx when mixed with atmospheric water vapours in the presence of sunlight form ozone and variety of complex organic gases and resultant particulates known as Photochemical Smog.

10. Larry C. Papadopoulos, North Plains, Jennifer D. Hole, North Plains, (2005) "Bicycle Treadmill Having Automatic Speed And Resistance Adjustments" A treadmill assembly that includes a frame and a treadmill belt. In addition, a sensor produces a signal representative of an aspect of the user's position relative to at least one point on the frame. A belt rotation assembly turns the belt with a speed related to the signal. In one preferred embodiment the speed of the belt is inversely proportional to the distance between the user and the front of the treadmill. In another preferred embodiment the treadmill is sized to support a cycle.

11. Pia Hua Lo,(Dec 2007) "Linkage Structure of Treadmill" A treadmill machine is used for walking or running. 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. In later times, treadmills were used as punishment devices for people sentenced to hard labour in prisons. The terms treadmill and tread wheel were used interchangeably for the power and punishment mechanisms. Recently, treadmills are not used to harness power generation, but it use as an exercise machine 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. When a user walks on the belt it moves to the rear. he rate at which belt moves is same as user walking or running. So that the speed of running and walking may be controlled and measured. The more expensive, heavy-duty versions are motor-driven (usually by an electric motor). The latter is known as manual treadmills. The treadmill is a largest selling exercise equipment According to Sports & Fitness Industry Association. So the treadmill industry counts with hundreds of manufacturers throughout the World.

12. Shah Bn. On (1793- 1794), The 50th Anniversary Of The First Description Of A Multistage Exercise Treadmill Test: ReVisiting The Birth Of The "Bruce Protocol".This calendar year, 2013, marks the 50th anniversary of the publication of an article which, unbeknown to the authors, was the first report of what would become one of the most widely used and researched tests in clinical cardiology throughout the world during the 20th century—the Bruce protocol exercise treadmill test (ETT).¹ This editorial describes the historical background to the introduction of the ETT, the rationale for a multistage protocol, the first account of the 'Bruce protocol' and provides a brief discussion on the late Professor Robert Bruce himself.

13. Nicholas Potter (1881), North Plains, "Bicycle Treadmill Having Automatic Speed And Resistance Adjustments" In an ancient days concept of treadmill was invented for generating mechanical energy with the help of animals such as horse, dogs etc. First treadmill was introduced by Roman Empire for heavy loading like conveyer belt which we use in industries. Some of those invention required electric power for initial torque. After study the history of treadmill bicycle we get idea to develop new concept of treadmill which will manually operated so that no external energy source is required to run treadmill bicycle. Our main objective while developing this concept is 'A Treadmill with more outputs in less time along with surface cleaning'. As we all know a manual treadmill does not consume any electricity, thus using treadmill and some arrangements of gears and chain drive, we make a treadmill bicycle. With a less effort this bicycle can be drive as well as a new format of the bicycle design can be launched in the market for exercise with cleaning. As the user walk on the treadmill the belt moves to the rear side and rotates rollers of treadmill which gives the starting torque. Gear assembly is connected with roller shaft by which whole assembly get sufficient torque and moves

treadmill ahead. Brake system is provided for speed control. Treadmill walking platform is slightly inclined for better torque. This inclination is done by different diameter of front wheel and rear wheel or framing arrangement. Spraying arrangement for cleaning purpose is placed at bottom side of treadmill. Spraying will be done by hand lever arrangement. Floor cleaner mops also placed at bottom side of treadmill. As the treadmill moves, mop will clean the floor. Several mops are provided for better cleaning.

14. S. R. Pandian, —2004 A human power conversion system based on childrens play, in A method is proposed for harnessing of human power based on children's play in playground and public places, on devices such as the seesaw, merry-go-round and swing. When large numbers of children play in a playground, part of the power of their play can be usefully harnessed resulting in significant energy storage. This stored energy can then be converted to electricity for powering basic, low-power appliances such as lights, fans, communications equipment, and so on. The method provides a low-cost, low-resource means of generation of electricity, especially for use in developing countries. The paper discusses the basic theory behind the method. Results of experiments on a laboratory prototype compressed air human power conversion system using a teeter-totter are presented to illustrate the practical effectiveness of the proposed method..

15. Atterhög JH, Jonsson B, Samuelsson R. (1979) Exercise testing in Sweden: a survey of procedures. This report surveys the techniques of exercise testing of patients in twenty out of twenty-four (83%) Clinical Physiological Departments in Sweden. The study shows that bicycle ergometry is the predominant technique used. In the vast majority of hospitals, the standards of practice employed are high and adequate safety precautions are observed. However, criteria for exclusion from and interruption of exercise testing

differ from one hospital to another. Limit values for heart rate, breathing frequency and blood pressure are by no means standardized. The criteria for distinguishing between normal and pathological electrocardiographic response vary. We conclude that in order to reduce complication rates and prevent accidents there is a need for further evaluations of the optimal use of exercise stress testing.

Working principle

Whenever the person starts walking on the belt coupled on the rollers it starts rotates one after another and finally the last roller which gets coupled to the crank wheel also rotates. The rotation obtained is transferred to the rear wheel by means of sprocket which is coupled with crank wheel by means of chain drive because of this transformation the speed gets increased and it is stored by means of flywheel and finally a processed rotation is given to the driven rear wheel to move the vehicle from one place to another.

Major components

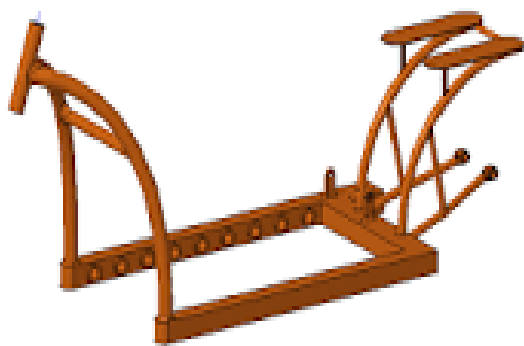
1. Frame
2. Shaft
3. Bearing
4. Chain drive
5. Conveyor belt
6. Conveyor roller
7. Wheel
8. Fly wheel
9. D c motor
10. Battery

Frame

It seems like you might be asking about the frame of a treadmill or exercise bike. The frame is the main structural component that supports the entire machine. The design and materials used in the frame are crucial for the overall durability and stability of the equipment. Treadmill frames are typically made of steel or aluminum to provide strength and stability. The frame

design may vary between different models and brands, but it generally includes a base, uprights, and handrails. The base supports the running deck, motor, and other components, while the uprights connect the base to the console and handrails. Exercise bike frames, whether for upright or recumbent bikes, are also commonly made of steel or aluminum. The frame design will differ between the two types of bikes, with upright bikes resembling traditional bicycles and recumbent bikes featuring a more laid-back, reclined position.

When considering a treadmill or exercise bike, it's essential to evaluate the frame's quality, stability, and weight-bearing capacity. A sturdy frame contributes to the overall safety and longevity of the equipment, especially during intense workouts. If you have a specific question about treadmill or exercise bike frames, or if you are looking for information about a particular brand or model, please provide more details so I can offer more targeted assistance



Frame

Shaft

Specifications

Shaft diameter: 12mm

Material: mild steel

Length: 26 inch

Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission. The shaft is generally acted upon by bending moment, torsion and axial force. Design of shaft primarily involves in determining stresses at critical point in the shaft that is arising due to aforementioned loading. Other two similar forms of a shaft are axle and spindle. Axle is a non-rotating member used for supporting rotating wheels etc. and do not transmit any torque. Spindle is simply defined as a short shaft. However, design method remains the same for axle and spindle as that for a shaft. 8.1.2 Standard sizes of Shafts Typical sizes of solid shaft that are available in the market are, Up to 25 mm 0.5 mm increments 25 to 50 mm 1.0 mm increments 50 to 100 mm 2.0 mm increments 100 to 200 mm 5.0 mm increments 8.1.3 Material for Shafts The ferrous, non-ferrous materials and non metals are used as shaft material depending on the application. Some of the common ferrous materials used for shaft are discussed below. Hot-rolled plain carbon steel. These materials are least expensive. Since it is hot rolled, scaling is always present on the surface and machining is required to make the surface smooth. Since it is cold drawn it has got its inherent characteristics of smooth bright finish. Amount of machining therefore is minimal. Better yield strength is also obtained. This is widely used for general purpose transmission shaft.



Shaft

Ball bearing

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. It achieves this by using at least three races to contain the balls and transmit the loads through the balls. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.



Ball bearing

Chain drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

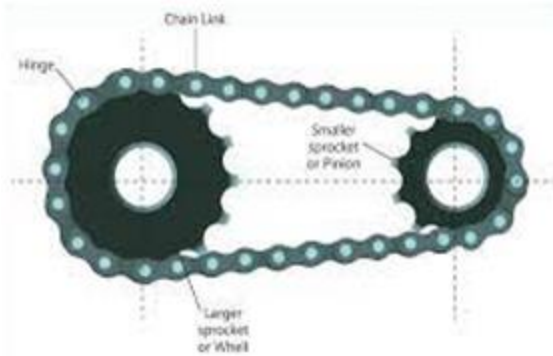
Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotate once, it causes the gear that drives the wheels to rotate more than one revolution.

Characteristics:

- High axial stiffness
- Low bending stiffness
- High efficiency
- Relatively cheap



Conveyor roller



Chain drive

Conveyor roller

A lineshaft roller conveyor or line-shaft conveyor is, as its name suggests, powered by a shaft beneath rollers. These conveyors are suitable for light applications up to 50 kg such as cardboard boxes and tote boxes.

A single shaft runs below the rollers running the length of the conveyor. On the shaft are a series of spools, one spool for each roller. An elastic polyurethane o-ring belt runs from a spool on the powered shaft to each roller. When the shaft is powered, the o-ring belt acts as a chain between the spool and the roller making the roller rotate. The rotation of the rollers pushes the product along the conveyor. The shaft is usually driven by an electrical motor that is generally controlled by an electronic PLC (programmable logic controller). The PLC electronically controls how specific sections of the conveyor system interact with the products being conveyed.

DC motor

DC motor is an electrical machine that utilizes electric power resulting in mechanical power output. Normally the motor output is a rotational motion of the shaft. The input may be direct current supply or alternating supply. But in case of DC motor direct current is used. The mechanism of dc motor is like a bar wound with wire is placed in between 2 magnets having North and South Pole. When it is provided with electric supply the wire becomes energized resulting in rotational motion which leads to rotational output. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of

electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications possible in many applications.

Specification

DC motor I (12v, 3 Amp, 17.18 kg-cm, 200 rpm)

DC motor II (12v, 1Amp, 3.88 kg-cm,

In this work, gear DC motor is used. A DC motor is not the same as a "gear motor" - a "gear motor" may be an AC or DC motor coupled with a gearbox or transmission. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application.

Usually such an addition is to reduce speed and increase torque. Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.



D C Motor

Material selection

Flywheels are made from many different materials; the application determines the choice of material. Small flywheels made of lead are found in children’s toys. Cast iron flywheels are used in old steam engines. Flywheels used in car engines are made of cast or nodular iron, steel or aluminum. Flywheels made from high-strength steel or composites have been proposed for use in vehicle energy storage and braking systems.

The efficiency of a flywheel is determined by the maximum amount of energy it can store per unit weight. As the flywheel’s rotational speed or angular velocity is increased, the stored energy increases; however, the stresses also increase. If the hoop stress surpass the tensile strength of the material, the flywheel will break apart. Thus, the tensile strength limits the amount of energy that a flywheel can store.

In this context, using lead for a flywheel in a child’s toy is not efficient; however, the flywheel velocity never approaches its burst velocity because the limit in this case is the pulling-power of the child. In other applications,

such as an automobile, the flywheel operates at a specified angular velocity and is constrained by the space it must fit in, so the goal is to maximize the stored energy per unit volume. The material selection therefore depends on the application.

The table below contains calculated values for materials and comments on their viability for flywheel applications. CFRP stands for carbon-fiber-reinforced polymer, and GFRP stands for glass-fiber reinforced polymer.

Lubrication

For a bearing to operate properly, it needs to be lubricated. In most cases the lubricant is based on elastohydrodynamic effect (by oil or grease) but working at extreme temperatures dry lubricated bearings are also available. For a bearing to have its nominal lifespan at its nominal maximum load, it must be lubricated with a lubricant (oil or grease) that has at least the minimum dynamic viscosity

For a bearing where average of outer diameter of bearing and diameter of axle hole is 50 mm, and that is rotating at 3000 RPM, recommended dynamic viscosity is 12 mm²/s.

Note that dynamic viscosity of oil varies strongly with temperature: a temperature increase of 50–70 °C causes the viscosity to decrease by factor 10.

If the viscosity of lubricant is higher than recommended, lifespan of bearing increases, roughly proportional to square root of viscosity.

If the viscosity of the lubricant is lower than recommended, the lifespan of the bearing decreases, and by how much depends on which type of oil being used. For oils with EP ('extreme pressure') additives, the lifespan is proportional to the square root of dynamic viscosity, just as it was for too high viscosity, while for ordinary oils lifespan is proportional to the square of the viscosity if a lower-than-recommended viscosity is used.

Lubrication can be done with a grease, which has advantages that grease is normally held within the bearing releasing the lubricant oil as it is compressed by the balls. It provides a protective barrier for the bearing metal from the environment, but has disadvantages that this grease must be replaced periodically, and maximum load of bearing decreases (because if bearing gets too warm, grease melts and runs out of bearing). Time between grease replacements decreases very strongly with diameter of bearing: for a 40 mm bearing, grease should be replaced every 5000 working hours, while for a 100 mm bearing it should be replaced every 500 working hours. Lubrication can also be done with an oil, which has advantage of higher maximum load, but needs some way to keep oil in bearing, as it normally tends to run out of it. For oil lubrication it is recommended that for applications where oil does not become warmer than 50 °C, oil should be replaced once a year, while for applications where oil does not become warmer than 100 °C, oil should be replaced 4 times per year. For car engines, oil

becomes 100 °C but the engine has an oil filter to maintain oil quality; therefore, the oil is usually changed less frequently than the oil in bearings.

Direction of load

Most bearings are meant for supporting loads perpendicular to axle ("radial loads"). Whether they can also bear axial loads, and if so, how much, depends on the type of bearing. Thrust bearings (commonly found on lazy susans) are specifically designed for axial loads. For single-row deep-groove ball bearings, SKF's documentation says that maximum axial load is circa 50% of maximum radial load, but it also says that "light" and/or "small" bearings can take axial loads that are 25% of maximum radial load. For single-row edge-contact ball bearings, axial load can be about 2 times max radial load, and for cone-bearings maximum axial load is between 1 and 2 times maximum radial load.

Often Conrad-style ball bearings will exhibit contact ellipse truncation under axial load. That means that either the ID of the outer ring is large enough, or the OD of the inner ring is small enough, so as to reduce the area of contact between the balls and raceway. When this is the case, it can significantly increase the stresses in the bearing, often invalidating general rules of thumb regarding relationships between radial and axial load capacity. With construction types other than Conrad, one can further decrease the

outer ring ID and increase the inner ring OD to guard against this.

If both axial and radial loads are present, they can be added vectorially, to result in the total load on bearing, which in combination with nominal maximum load can be used to predict lifespan. However, in order to correctly predict the rating life of ball bearings the ISO/TS 16281 should be used with the help of a calculation software.

Manufacturing process

Metal for frame

The metal frame is generally made of **mild steel** bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. It can be case-hardened to improve wear resistance. They are available in bright rounds, squares and flats, and hot rolled rounds



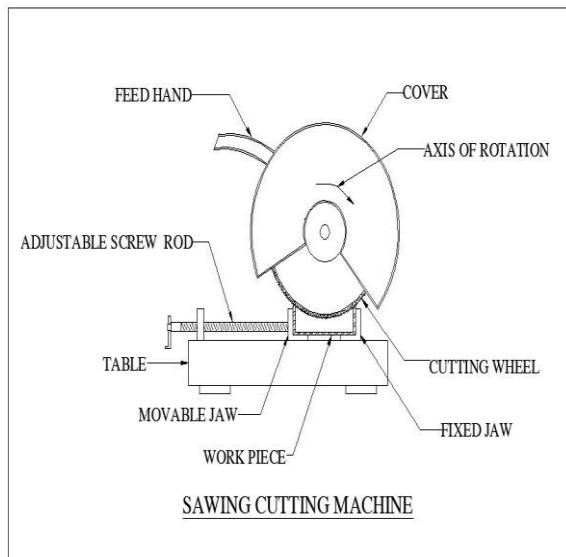
Mildsteel

Suitable machining allowances should therefore be added when ordering. It does not contain any additions for enhancing mechanical or machining properties. Bright drawn mild steel is

an improved quality material, free of scale, and has been cold worked (drawn or rolled) to size. It is produced to close dimensional tolerances. Straightness and flatness are better than black steel. It is more suitable for repetition precision machining. Bright drawn steel has more consistent hardness, and increased tensile strength. Bright steel can also be obtained in precision turned or ground form if desired.

Sawing:

Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered with electricity and is usually a stationary type of saw machine rather than a portable type of saw.

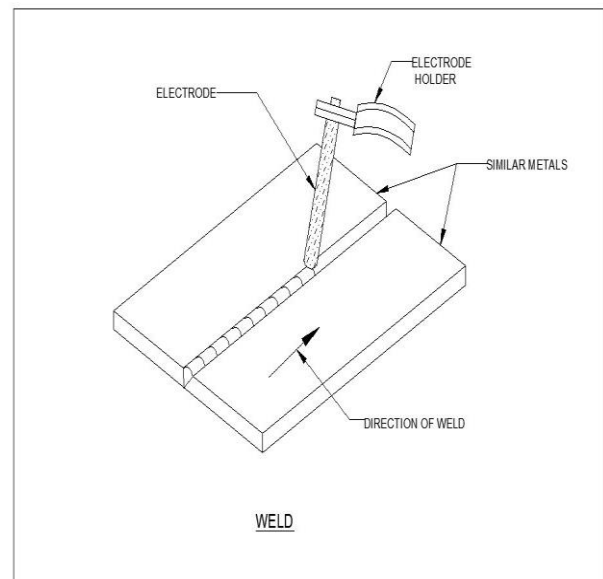


The circular saw blades used with a cold saw are often constructed of high speed steel. Steel

blades of this type are resistant to wear even under daily usage. The end result is that it is possible to complete a number of cutting projects before there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal.

Welding:

Welding is a process for joining similar metals. Welding joins metals by melting and fusing **1**, the base metals being joined and **2**, the filler metal applied. Welding employs pinpointed, localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined.



Welding is used for making permanent joints. It is used in the manufacture of automobile bodies,

aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

OPERATION:

Several welding processes are based on heating with an electric arc, only a few are considered here, starting with the oldest, simple arc welding, also known as shielded metal arc welding (SMAW) or stick welding.

In this process an electrical machine (which may be DC or AC, but nowadays is usually AC) supplies current to an electrode holder which carries an electrode which is normally coated with a mixture of chemicals or flux. An earth cable connects the work piece to the welding machine to provide a return path for the current. The weld is initiated by tapping ('striking') the tip of the electrode against the work piece which

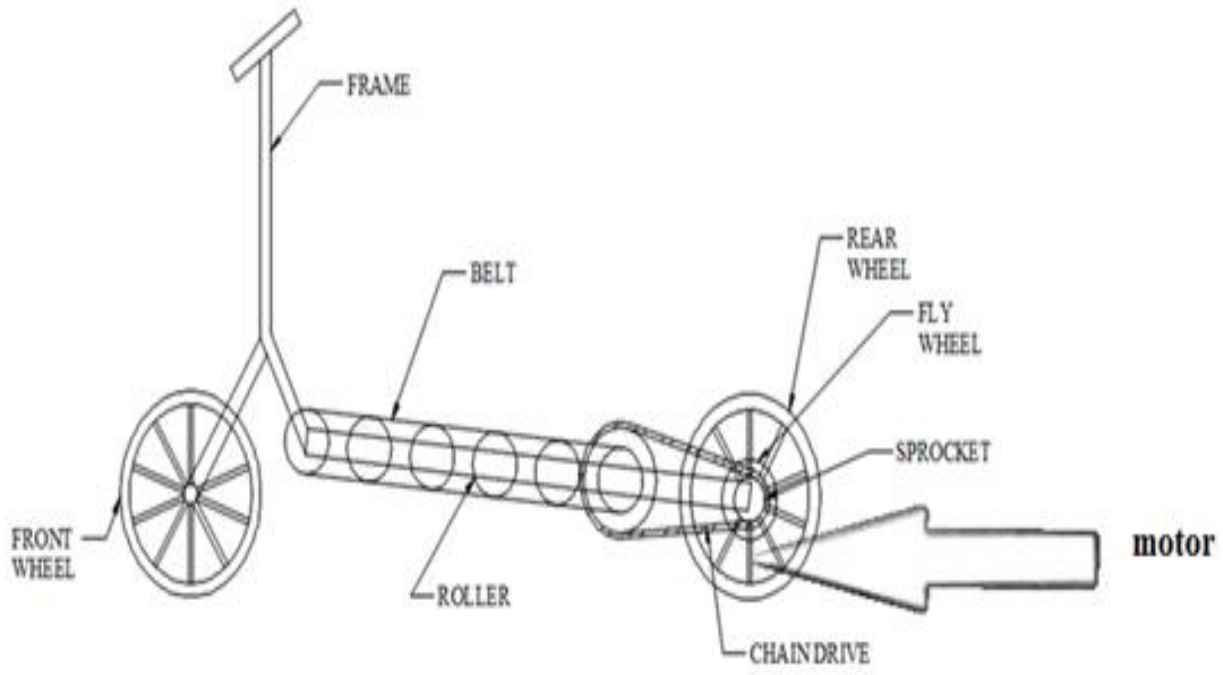
initiates an electric arc. The high temperature generated (about 6000°C) almost instantly produces a molten pool and the end of the electrode continuously melts into this pool and forms the joint.

The operator needs to control the gap between the electrode tip and the work piece while moving the electrode along the joint.

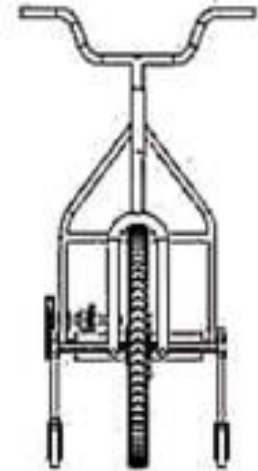
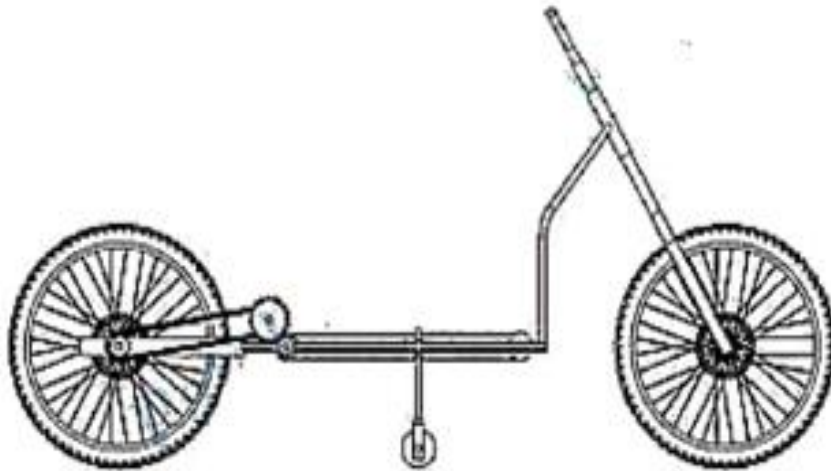
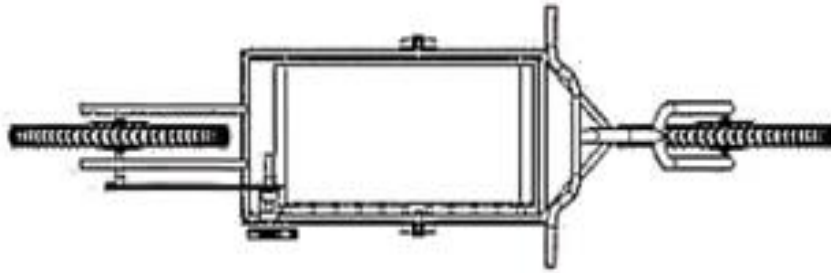
Drilling:

Drilling is a cutting process that uses a drill bit to cut or enlarge a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool, often multipoint. The bit is pressed against the work piece and rotated at rates from hundreds to thousands of revolutions per minute. This forces the cutting edge against the work piece, cutting off chips (swarf) from the hole as it is drilled

2d layouts of model



Front, top and side view



Model picture



Advantages

- 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.
- 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.
- One can also exercise while travelling over short distance.
- Treadmill bicycle does not require any fuel. Therefore it does not emit any pollutants. So it is an eco-friendly vehicle

Application

1. It can be used as an indoor locomotive device infrastructure with large roof span i.e. malls, warehouse, open markets, large office spaces, etc.
2. . By using such product pedestrian cops can save themselves from getting exhausted.
3. Pedestrians in large campuses can benefits from this product the same way.
4. .Can replace cycle as an energy efficient vehicle for those who cannot drive a cycle

Conclusion

We have described a new way of travelling as well as exercise with the help of a new model of bike which is combination of treadmill and bicycle. It can be used in place of regular bike at cheaper cost and without use

of fuel. The treadmill bicycle will prove to be a future vehicle as no fuel is used for travelling through this and it is pollution free. The treadmill which is used for walking helps to keep us fit as exercise is also one of the important tasks for a person to be fit and healthy for day to day life. Treadmill bicycle is cheaper than the normal bike which also makes it efficient and economic..

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