

Development and Analysis of Gym Bicycle with Comfort Facilities and Power Generation

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Abstract

Nowadays, health hazard have been increased in human species. So, more concentration is to be given on awareness of regular exercises and workouts. Since, a user of any gym equipment feels tiredness after a wild being because of fatigue. Therefore, some cooling devices should be installed to provide comfort to the user. Therefore, we have installed mechanically driven fan on gym bicycle prototype to give more comfort to the user. Lots of calories have been burned by the person while working out on gym equipments. We have utilized these human burn calories to convert it into electrical energy. Therefore, we have installed DC motor which runs as a generator. Smallest air-cooler available in market is not economical to give comfort to single user. Hence a low cost air-cooler has been developed for the single user which runs when the person is peddling on the developed gym bicycle.

Keywords: Gym Bicycle, Electromotive force, Direct current, vee belt, air cooler

I. INTRODUCTION

Whatever your age physical activity plays an important part in your health and well-being. Some people think it is only sportsmen and women who need to build physical activity into their lives. However everyone needs to keep their bodies working well in order to be healthy. Physical activity is necessary to stimulate the body's own natural maintenance and repair system. Your bones, joints and muscles - especially your heart - will actually stay younger if you keep them busy. If you are not physically active you increase your health risks in many ways. Risks to you- Coronary Heart Disease, strokes, high blood pressure, breathlessness, flabby body, little energy, stiff joints, osteoporosis, poor posture, and overweight.

Everyone is different and people do not have equal opportunities to achieve and maintain high levels of health and physical involvement. People are born with different characteristics, they live in different social, economic, cultural, emotional and physical environments, and they make different decisions about how they will behave. It is these factors that interact to determine a person's individual scale of health and how they will move along it. The factors also determine the level of activity and exercise, and other health-related behaviors, that a person will embrace. Put simply, health and physical activity are influenced by many factors – lifestyle, education, and environment, and heredity, access to health services, motivation and personal priorities. In today's world, electricity is the main source of every equipment to run. Power consumption has keep on increasing with the ages. As the population of the world is continuously being increasing with their living standard, uses of electric equipments go on increasing day by day. To produce this electricity, large conventional methods are being employed like power plants run by coal, hydro power plants run by water, nuclear power plants. All these power plants are continuously consuming our natural resources.

In order to save the earth, there is continuous development regarding the production of electricity using renewable source of energy. Solar energy has been utilized from small scale to large scale to generate power. Wind energy is used in rural areas for the generation of power. Tidal energy has been utilized in coastal regions for generation of power.

Now coming to small scale, basically in home, gym, shop we can see that large amount of electricity is being used daily in different electric devices like music system, air-conditioning, lights etc. We can see that in gym, large amount of amount of calories are being burn by humans on various gym equipments for their fitness. The energy produced by while burning these calories is being wasted. This waste energy can be utilized for the production for electricity which in turn helps to run various electric devices installed in the gym.

II. PRINCIPLE

If you use mechanical energy to rotate the coil (N turns, area A) at uniform angular velocity ω in the magnetic field B, it will produce a sinusoidal emf in the coil. emf (an emf or electromotive force is almost the same thing as a voltage).

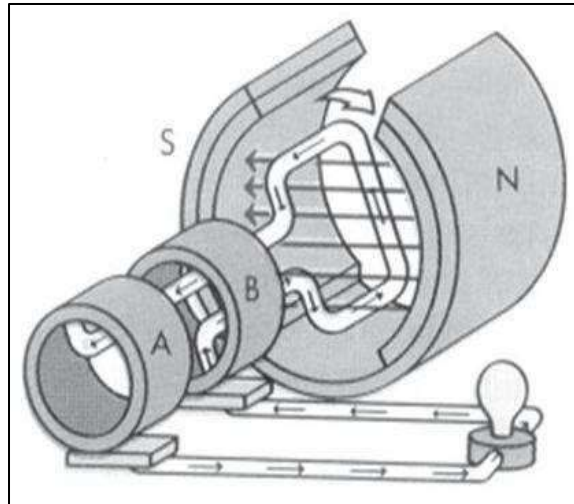
Let θ be the angle between B and the normal to the coil, so the magnetic flux ϕ is $NAB \cos \theta$.

Faraday's law gives: $emf = -d\phi/dt$

$$= - (d/dt) (NBA \cos \theta)$$

$$= NBA \sin \theta (d\theta/dt)$$

$$NBA\omega \sin \omega t.$$



The above figure would be called as DC generator.

III. COMFORT FACILITY

It has a mechanically driven fan to provide comfort to the user. We have developed a low cost gym bicycle using a scrap cycle and centre stand is being provided to restrict the movement of the cycle. Then the chain drive is shifted from rear wheel to front wheel to give same mechanism provided in conventional gym cycle.

To provide comfort to the gym user, a mechanically driven fan is installed. For installation, another chain drive is connected from the front free wheel to vertically installed free wheel over the truss. Then a bevel gear is provided to change the axis of rotation to keep the fan in the front of the user. As the user runs the bicycle, this fan starts running at higher rpm than the user peddling speed.

IV. POWER GENERATION

It has a d.c motor which runs as generator to produce electricity.

We have developed gym cycle which includes fan along with power generation. Initially a d.c motor (d.c dynamo 12VDC) is chosen to work as generator and a suitable vee belt is chosen which can fit perfectly on front wheel rim. Suitable wooden base is bolted on to front wheel to align motor and front wheel rim on the same base. A pulley is chosen as per the width of the belt. Motor is kept on a wooden base provided at the front left end of the front wooden base. Motor is clamped to the wooden box using clamp to restrict the axial movement of the d.c motor. Hence as the user pedals front wheel rotates which in turn runs the motor shaft at higher rpm and hence power is generated. D.C bulb is connected to indicate the power generation.

We have developed a low cost air cooler using d.c fan (12V, .65amp) which is being installed at back side of the sheet metal duct. This fan is run by the d.c motor. A sheet metal stand is made to give correct alignment to the user. A wet husk is provided in between the duct. Two holes being drilled at the top and the bottom centre of the pipe. Funnel (bottle) is used to supply the water to the wet cloth. Seals being used to avoid the drained water to scatter. As the gym cycle user runs the cycle, motor starts generating the power. This power is used to run the d.c fan which in turn sucks the air axially and made it to pass through the wet cloth. Wet cloth adds the moisture content in the air and blows it over user body. This will produce breezing effect over the user.

V. COST ANALYSIS

Cost of conventional gym cycle (Material cost)

Cost of gym cycle = Rs. 7000

Cost of ceiling fan (25 W) = Rs. 1000

Cost of smallest air cooler (185 W) = Rs. 3500

Cost of bulb = Rs. 12

Total material cost

= adding all above costs Therefore, total material cost

= Rs. 11512

Operating cost (for 2yrs without considering maintenance cost)

Cost of electricity = (kilowatts x hours used) x (price / KWhr)

Total hrs used for fan and air cooler by considering 2hrs/day usage of gym cycle =1464hrs

Assuming lowest price for cost of electricity = Rs. 5/KWhr.

1) Total energy consumed by ceiling fan for 1464 hrs =

$(25/1000) \times 1464 = 36.6$ KWhr Therefore, cost of electricity for fan to run for 2 years

= $36.6 \times 5 =$ Rs. 183

2) Total energy consumed by air cooler for 1464 hrs =

$(25/1000) \times 1464 = 36.6$ KWhr

Therefore, cost of electricity for air cooler to run for 2years =

$36.6 \times 5 =$ Rs. 183

3) Total energy consumed by 1bulb for 1464 hrs = $(21/1000) \times 1464 = 30.74$ KWhr

Therefore, cost of electricity for bulb to run for 2yrs= Rs. $30.74 \times 5 = 153.72$

Total operating cost = adding all above cost of fan, air cooler and bulb

Hence, Total operating cost = Rs. 519.72

TOTAL COST (DURING INSTALLATION)

= Rs. 11512

TOTAL COST (AFTER TWO YEARS)

= Rs. 12031.72

Developed gym cycle cost(Material cost)

Cost of scrap cycle = Rs. 1500

Cost of installing fan and bevel gear

= Rs. 500

Cost of belt and pulley = Rs. 500

Cost of D.C motor = Rs. 3000

Cost of duct=Rs. 500

Cost of D.C fan for air cooler (15.6 watts)

=Rs. 500

Cost of D.C bulb =Rs. 12

Cost of Duct stand =Rs. 200

Miscellaneous cost =Rs. 1000

Therefore,

Total material Cost =Rs. 7712

Operating cost (for 2 years excluding maintenance cost) Since motor generates power there is no operating cost Therefore, operating cost = Rs. 0

In fact total cost after 2 years get reduced and there will be saving for Rs.519.72, which being spent in conventional gym bicycle

TOTAL COST (DURING INSTALLATION)

= Rs. 9500

TOTAL COST (AFTER 2 YEARS)

= Rs. 7192.28

VI. COSTCOMPARISON

| S/No | Type of gym cycle | Material Cost in Rs | Operating cost in Rs. | Saving in Rs. | Total cost (installation cost) in Rs | Total cost (after 2 years) in Rs |
|------|-------------------|---------------------|-----------------------|---------------|--------------------------------------|----------------------------------|
| 1. | Conventional | 12700 | 801.54 | 0 | 12700 | 13219.72 |
| 2. | developed | 9500 | 0 | 801.54 | 9500 | 7192.28 |

VII COMPARISON

| SL.NO | CONVENTIONAL GYM CYCLE | DEVELOPED GYM CYCLE |
|-------|---------------------------------|----------------------------|
| 1. | No power generation | Generates power |
| 2. | No mechanical fan for comfort | mechanical fan for comfort |
| 3. | High material cost | Lower material cost |
| 4. | Calories burnt not utilised | Calories utilized. |
| 5. | Total cost increases with time. | Total cost decreases. |

VIII. CONCLUSION

We have successfully developed a low cost gym bicycle. This bicycle has additional features for the user. From this work, we conclude that Normal person burns 500 calories to 1100 calories per hour on conventional gym bicycle, using developed bicycle 21166.348 calories.

- Total material cost of conventional gym cycle is more than the developed cycle without any provision for the comfort of gym user.
- Total operating cost of conventional gym cycle increases with time while no operating cost in developed gym cycle (excluding maintenance cost).
- A very low cost air cooler can be developed than the conventional air cooler for the comfort of single gym user. While loading i.e. increasing the friction during peddling, energy which is being wasted can be utilized optimally.
- After workout for a while being, a user requires more comfort to reduce the tiredness from fatigue. Hence extra provision needs to be included in conventional gym equipment.

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