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Power Generation Using Forearm Gym Equipment

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Abstract: Energy has become the most vital part of the lives of all the people in the entire world. Power consumption is very high in highly populated countries like India and China. Thus, the increasing energy demand has made companies around the world invest more in the research and development of eco-friendly harvesting of energy. Solar, wind, and nuclear energy have been successful to some extent. Humans can produce electricity through their day-to-day activities but all this energy is getting wasted. In this modern life, hitting the gym has been increasing. Since the majority of the people spend their time in the gym this human energy can be used to generate power i.e., by modifying the gym equipment. This project harnessed the mechanical energy of the machine and converted it to electrical energy by the means of a generator-based system. This is the time to think of alternative sources of energy. This project uses the rack and pinion method along with the alternator to generate electricity.

Keywords: Alternator, Spring, Rack and pinion mechanism, human-powered electricity generation, mechanical energy, electrical energy, etc.

I. INTRODUCTION

Energy neither be created nor be destroyed but can be converted from one form of energy to another. Energy is everywhere and drives everything. Today's modern life has become more dependent on energy and there is no limit to utilizing it. We have used energy at an increasing rate ever since we have come on this earth a few million years ago. We have come a far way without realizing how much energy we have wasted. In this modern life, we have many electronic gadgets and even vehicles that run on electric power. The following document outlines an investigation of the benefits of implementing a human-powered energy harvesting system that will be housed within a gym and used to offset the gym's requirements. The energy harvesting system in this project will be based on a rack and pinion mechanism by converting vertical motion into rotational motion. The pinion attached to the shaft rotates the alternator which generates electric power.

Whenever the person is allowed to pass over the forearm gym equipment the spring attached to it gets compressed and as the rack attached at the bottom moves down the reciprocating motion is converted into the rotary motion with a certain RPM. The alternator connected to the pinion will generate electric power. The great outdoor gym (TGO) company in the United Kingdom has been producing energy-generating gymnasium equipment for cardio charge and lightning [1]. World net electricity generation increased by 45%, rising from 23.4 trillion kilowatt-hours (kWh) in 2015 to 30.4 trillion kWh in 2040 [2]. The proposed forearm gym equipment will produce energy from the moving parts of the gymnasium machinery increasing the potential of renewable energy sources. Due to the development of modern technology, it would be possible to use human power more efficiently [3].

II. PROBLEM IDENTIFIED

The main aim of this project is to generate power by humans while hitting the gymnasium equipment in the gym. We are using forearm gym equipment to achieve this. In addition to the equipment, there will be a rack and pinion, battery, alternator, and spring to complete the project.

A. Objectives

- 1) To make use of human efforts to generate electrical energy.
- 2) To construct user-friendly and compact forearm gym equipment with power generation and storage.

III. LITERATURE REVIEW

A. Power Generation through Gym Equipment.

Ansari Saddam Husain, Gujja Govardhan, Gund Kumar, Mohd Ahmed, Vivek Tiwari, Yakub Khan, (2012), ISOR Journal of Engineering.

In this paper, the main objective is to develop power using Gym Equipment. The amount of power is less than nearly 30-40w and the power generation is not continuous. They have used more mechanical parts which result in less power generation.

B. Lat Pull-Down Machine Power Generation.

M. Muttu Subash, S. Prathiban, (2016), International Journal of Engineering Science and Computing.

In this paper, the main intention of the project is to generate power in the smart and maximum amount of power generation with minimum effort. Many calculative methods are used to design shaft, chain, and sprocket to get the required output power. The fabricated model is tested practically and corresponding graphs are obtained to generate more power fitness centers.

C. Power Generation by Gym Pull-Up Machine.

Roshan Ojha, Shravan Kumar, Rahul Raj, T. Hari Prasad, Naveen Kumar, Dr. K.S. Bhadrinarayan (2016), International Research Journal of Engineering and Technology. In this paper, the project is developed by the integration of all the hardware components such as rack, gears, springs, and dynamo. The presence of every model is reasoned out and placed carefully to contribute to the best working unit.

D. Turning Workout into Electricity Using Lat Pull-down Machine

Saylee Bidwai, Amruta Jaykar, Shivani Sinda, (2017), International Journal of Engineering and Technology.

In this paper, the main objective of the project is to contribute a vital role in reducing the energy demand and rectifying the villages with the help of cycling equipment. Prime mover is the main part of the equipment which is used to run 250W, 24V, 2650rpm motor. A 12V, 7.5Ah battery is used to convert DC Voltage to AC Voltage. The energy from the equipment is used for light bulbs, laptops, mobile charging, etc, and helps in reducing electricity shortages in villages.

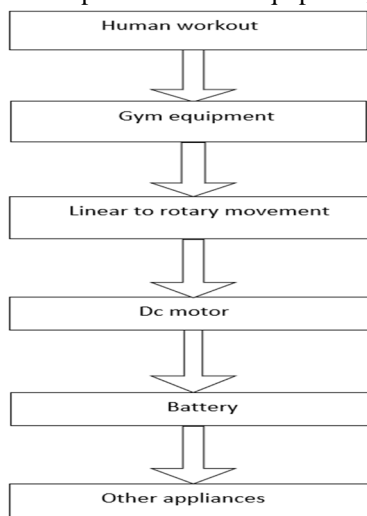
E. Energy Harvesting from Gym Equipments.

Madhup Kumar, Dr. G S Mundada, (2017), International Journal of Innovative Research in Electrical, Electronics, Instrumental, and Control Engineering. The main objective of this paper is to harvest energy from Gym equipment. Power generated by a single exercise machine is saving 288 rupees per month for a ceiling fan.

IV. METHODOLOGY

Most people go to the gym, to maintain their fitness, they work on exercise equipment. This amount of energy they spend on the equipment can be utilized to generate power by the means of modified stationary gym equipment. The work done by our forearm while working out on the forearm gymnasium equipment can be converted into electrical energy.

In this project, we have used rack and pinion gears which comprise a circular gear (the pinion) meshes to the linear gear (the rack), which operates to translate linear motion into rotational motion. Our system makes use of a gripping rod that is connected to a spring-based mechanism having a rack and pinion which converts linear to rotary motion to generate power and the system provides resistance to the exercise movement during power generation hence it is a dual-purpose machine (exercise equipment as well as for power generation). Hereby we make use of an energy harvester system which is used to convert the kinetic energy of the human efforts on the machine to electrical energy. To generate power from the equipment, a DC motor has been used.



V. COMPONENTS DESCRIPTION

- 1) *Rack And Pinion*: A rack and pinion gear that comprises a circular gear (the pinion) meshes to the linear gear (the rack), which operates to translate linear motion into rotational motion. Both helical and straight gears can be used in the gear drive.



Figure 1 Rack and Pinion

- 2) *Spur Gear*: Spur gears, also called straight-cut gears are the simplest type of gear, and consist of a cylinder or disk with teeth projecting radially. The tooth faces are straight and aligned parallel to the axis of rotation when the gear is viewed at 90 degrees from the shaft length. At moderate speeds performance of the spur gear is excellent but at high speeds it is noisy.



Figure 2 Spur Gears

- 3) *Compression Spring*: A compression spring is an open-coil helical spring that offers resistance to a compressive force applied axially. Usually, the compression springs are coiled as a constant-diameter cylinder.



Figure 3 Compression Spring

- 4) *Dc Motor*: DC motors are very easy to use and available in standard size. Nut and threads on the shaft are provided to easily connect and internally threaded shaft for easily connecting it to the wheel.



They are also known as Centre Shaft DC Geared Motors because their shaft extends through the center of their gearbox assembly.

VI. ADVANTAGES

- 1) Power generation through a simple mechanism.
- 2) Non-conventional method of power generation.
- 3) Power generated can be stored in the battery and utilized later.
- 4) Cost of electricity consumption can be minimized.

VII. DISADVANTAGES

- 1) Lot of mechanical components resulting in losses.
- 2) Initial cost of investment is high.

VIII. APPLICATIONS

- 1) Power-generating gymnasium equipment can be used in schools, colleges, gym centers, houses, public parks, etc.
- 2) This equipment can be used to glow LED lamps, and charge electrical devices, and also power can be stored.

IX. CONCLUSION

The Forearm Power Generating Gym Equipment is not a Primary source of energy, but rather can be used as a secondary source same as solar harvesting devices and this setup can be used in Private Gym, Public Gym, etc. In this method only the Pinion and Rack play a major role, thus the method is quite easy to maintain and implement. But to implement this project in gyms, more equipment in the gym should be designed and remodified to generate power. This project aims to show that this method is quite sufficient to generate enough power to charge small-scale devices.

X. FUTURE SCOPE

Our Project helps to generate power using human efforts, which doesn't cost any money. This Project reduces the use of Natural resources to generate power and control the pollution caused by them. Global electricity demand is growing faster than renewable, driving a strong increase in generation from fossil fuels. Coal-fired electricity generation is set to increase by 7% this year and 2% more in 2023. Our project helps to meet these demands for a smaller range, for now, the main objective of this project is to implement it on large scale. This project is cost-efficient and can be built with minimum components.

This system can generate more power, only if the upcoming generation makes use of this mechanism and improve it further to increase the efficiency of the power-generating gymnasium equipment.

XI. ACKNOWLEDGEMENT

It is our privilege to express wholehearted gratitude and thanks to our Project Guide **Dr. UMESH M DAIVAGNA** for his valuable guidance and constant encouragement behind the successful completion of this project work. In spite of his extremely busy schedule in college, he was available to share with me his deep insights, wide knowledge, and extensive experience.



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- [1] <https://www.tgogc.com/>
- [2] [International Energy Outlook Executive Summary \(eia.gov\)](#)
- [3] <https://www.worldenergy.org/>



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