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Power Generation using SwingMotion

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Abstract

Energy is the most important of all resources, while sustainability concept is focuses on the long term survival of communities. Energy need of the world is growing day by day because of consumption of energy at a larger extent with the population growth. Energy resource mainly decides the development of any nation. Hence we need to look at various different means of power generation. This project is about generating power by using a swing, which is used by children for playing that will produce electricity when being used. In such a way that when it swings the mechanical energy is generated and it is converted into electrical energy by a commutator and is stored in a battery. The construction is such a way that, the swinging action makes the horizontal beam rotating through an angle. This shaft is connected to a sprocket to transfer the motion to the free wheel which rotates proportionally with respect to the angle of motion of the swing. The angular movement is converted into a complete rotation with the help of a chain drive connecting both sprocket and free wheel. The free wheel is connected to a shaft which in turn rotates the cycle wheel the dynamo arrangement to generate electricity.

Keywords—*Swing; energy; bearings; sprocket; freewheel; chain drive; dynamo; eco- friendly.*

1.INTRODUCTION

Energy is the ability to do work. It is a driving force of modern societies and generation and utilization of energy are essential for the socio economic development. Per capita consumption of energy levels are often considered a good measure of economic development. In recent years, energy scarcity has become a serious problem due to depletion of non-renewable energy sources, increasing population, globalization of energy intensive economic development, environmental pollution, and global warming. In this paper, it is proposed to harness the human muscle power of children playing in public spaces such as school playgrounds, on equipment such as teeter totters, swings, and merry-go-rounds. Such an energy conversion is playful and hence does not require deliberate effort. For human power conversion systems to be useful in the context of developing countries, several constraints need to be considered like low cost, low-resource and limited-skills requirements, low-maintenance, safety and comfort to humans, and environment-friendliness. Human power conversion is easily achieved from children's play under conditions where the children are static relative to the

moving playground mechanism, such as seesaw, swing, and merry-go-round. Where the children are in a dynamic state relative to a static mechanism (e.g., swing) it will be difficult to employ cost-effective human power conversion techniques due to considerations of safety and simplicity.

A variety of mechanisms are used for conversion of human power to usable electrical or mechanical energy like springs, hydraulic components, electric generators, piezoelectric, compressed air systems, flywheels, and so on. The factors affecting the choice of the most suitable conversion mechanism are similar to those for the general energy conversion problem. Human power was perhaps the earliest source of energy known to mankind. Its first uses were in tool-making, rowing boat, and so on. Mechanized uses of human power were achieved in the form of hand cranking by the Romans. However, pedaling which is a simpler and less tiresome means of human power conversion did not come about until the 19th century with the invention of the bicycle.

Human power was widely used in the developed countries in the late 19th and early 20th centuries for purposes such as irrigation, operating machinery, and as a source of electricity for watching/listening to television and radio. In many developing countries, human power is still widely used in agriculture, industry, and services.

It is clear that the systems proposed in literature are unsuited to power basic domestic appliances such as fluorescent lights, desk fans, television sets, or communications equipment (e.g., fax machines). These are among the basic needs of a majority of the population in developing countries. The low-cost requirement also imposes a trade-off between cost and efficiency of the energy conversion system. Improving the efficiency of the conversion system is often essential in the case of individual human power conversion – generally would result in increased cost of the overall system. In the case of several children playing on playground equipment, power is produced as a by-product. Therefore, a low-cost system can be designed and implemented without seriously affecting efficiency, since a large number of children are involved in the play.

2.OBJECTIVE

The objective of the project is to convert obtained mechanical energy by the angular twist of the shaft during the movement of seating of swing set into electrical energy using dynamo along with no added effort and also storing the electricity thus generated into a battery, which can be utilized whenever needed.

3.METHODOLOGY

During the forward stroke of swing some torque is induced in shaft. This torque produces motion in the spocket attached to the shaft which produces motion in the smaller Free Wheel connected, which is in turn connected to the motor by which electricity is generated.

The shaft is mounted between two bearings. At one end of the shaft a is attached to Sprocket rigidly, this Sprocket pivots over shaft axis when the shaft is displaced. The Sprocket is attached to a smaller free wheel using chain Drive. The smaller wheel is mounted on a motor shaft, on which generator is mounted with help of screws. When the seating of the swing set moves in forward directions only, some torque is induced in the shaft by the holding bars of swing set. This torque displaces the Sprocket which is pivoted over axis of shaft causing the angular displacement. This angular movement is converted to rotational motion of smaller free wheel by

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chain attachment. The wheel runs the generator, thus producing the electricity. This electricity is converted by a bridge rectifier and voltage amplifier. The electricity thus produced is stored in a battery by using electric circuits

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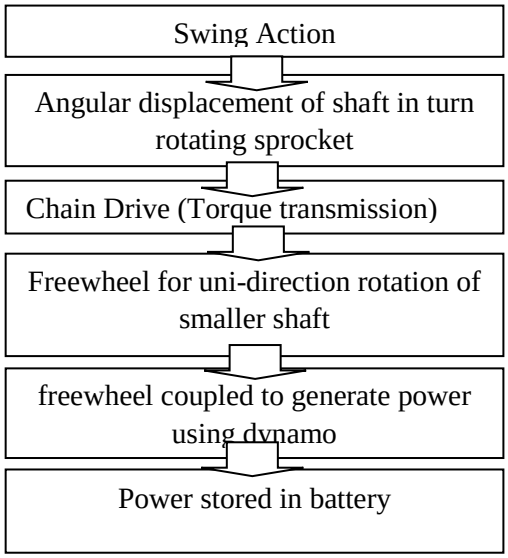

4.DESIGN

A traditional swing consists of swing frame and main frame. A fixed rod is there between two leg braces and the swing seat is hung using roller chain from the fixed rod. In actual swing the person who swings with his force and hence the swing seat moves forward and backward that is swingaction.

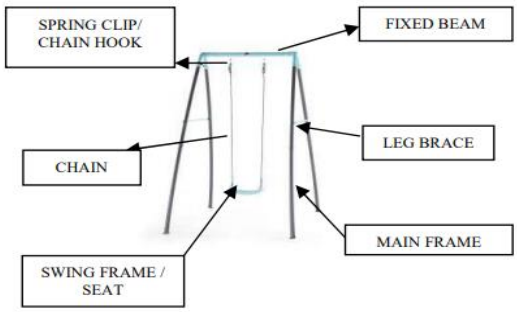

Fig 1. Design

Our project removes the fixed beam and replaces with a rotating shaft between two bearings each motion is in single direction, power generated is less. So, new model is designed to generate electrical power based on bi-directional swing motion with Chain sprocket, freewheel, arrangement and dynamo. Two end side of the main shaft as driver sprocket which is fixed and below it drives a freewheel which is connected by chain drive and there using another roller bearing and small shaft arrangement which is coupled with the spur gear arrangement which drives the dynamo. The swing is designed using solid bars instead of chain in order to allow maximum torque to the bearings which will result in effective power generation. Here as we are using freewheel on dual side of swing frame power generated is effective and more. placed at leg braces.

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Project Schematic diagram

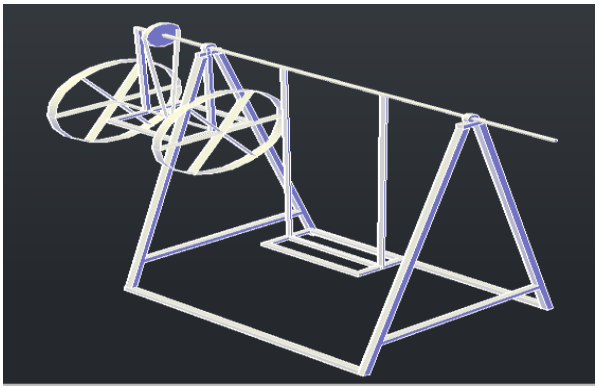

Fig 2.

5.COMPONENTS REQUIRED

The main components used to fabricate the model are:

- Main frame
- Shaft
- Sprocket
- Free wheel
- Chain drive
- Bearing
- Dynamo
- Light emitting diode / Battery

6.PART ASSEMBLY

The assembly of the various components like sprocket, chain drive, free wheel, spur gear, dynamo and battery is as follows:

6.1 Sprocket assembly

Here the sprocket is placed on the shaft and it can be welded or coupled by a pin joint. But in this case it is welded to the shaft, so as to impart the motion of the swing to the sprocket transferred to the smaller sprocket (Free wheel) via a chain coupled.

Fig.3

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6.2 Free wheel assembly

This free wheel is welded on the outer ring to avoid the free moment of the free wheel and it is converted into a smaller sprocket. The free wheel is used for transmitting the rotary motion to the shaft on which a freewheel is mounted which in turn is connected to a dynamo.

Fig.4

6.3 Chain drive assembly

Here a chain drive is placed between a larger sprocket and a smaller sprocket (free wheel) to transmit the oscillating motion of the swing to the dynamo to produce electricity. It is a way of transmitting the mechanical power from one place to another. Fig. 11 shows the assembly of a chain drive between larger sprocket and a smaller sprocket.

Fig.5

6.4 Dynamo assembly

Dynamo is an electrical generator. This dynamo produces direct current with the use of a commutator. The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current. Here the dynamo is mounted on the main swing frame and it is meshed externally to a spur gear by using a smaller spur gear. Dynamo produces direct current due to the motion of the swing and this electricity is stored is shown using LED.

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Fig.6

6.5 Swing Frame

Swing frame is made up of mild steel of rectangular shape with rectangular tubes as outer frame and sheet metal is spread over the swing seat. This swing seat is welded with the shaft at two points with two side rods of swing frame and swing is placed at centre of shaft

Fig.7

7.WORKING PRINCIPLE

During the forward stroke of swing some torque is induced in shaft. The shaft is mounted between two bearings. At both end of the shaft a large sprocket is attached rigidly, this sprocket pivots over shaft axis when the shaft is displaced. The larger sprocket is attached to a smaller sprocket (freewheel) using chain. The shaft in which smaller sprocket is mounted in other shaft which is placed in another ball bearing which in turn connected with the Free Wheel arrangement. With this arrangement power is generated in the dynamo and can be stored in the battery.

When the seating of the swing set moves forward & backward some torque is induced in the shaft by the holding bars of swing set. This torque displaces the larger sprocket which is pivoted over axis of shaft causing the angular displacement. This angular movement is converted to rotational motion of smaller sprocket by chain attachment. The sprocket rotates the freewheel arrangement which runs the dynamo, thus producing the electricity. The electricity thus produced is stored in a battery. Here in this project we are showing production of

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electricity using LED. In this project the production is in both directions for that we have used which arrests the motion in only one direction. That freewheel is placed under both sprockets in opposite direction. Hence when swing action happens when moving in forward one side freewheel rotate spur gear arrangement when backward the arranged is ideal. Same happens vice versa on other side of frame and hence motor gets rotated in both direction of movement and power will be produced.

8.RESULT AND CALCULATIONS

Testing Result

1] O/P Voltage from Dynamo = 12 Volt

2] O/P Current from Dynamo = 0.8 Amp

Calculations: Formula to Calculate Current Required for Ignite Tube

Watt = Voltage * Current

W = V*I 3W = 12 V * I

I = 0.25A

So, it is sure that the output current from dynamo is min. 0.25A.

Load (LED Bulb) = 3W

If we use 3watt bulb for 2 hours per day the watt required for per day is equal to,

3W*2h = 6Wh

Battery (Rechargeable) = 6V 6Wh = 6W*I

I = 1 Ah

The output voltage from dynamo is 6-8 volt so, as per review paper the value of dynamo wheel speed is 660-880 rpm. Compare wheel speed with current & value of current is 0.4 A.

So, O/P current from dynamo is 0.4 A

Battery Charging Current and Battery Time Formula

Charging Time of Battery = Battery Ah / Charging Current

T = Ah / A

T = 1/0.4

T = 2.5 hrs

From calculations, if we use 3watt LED bulb 2 hours per day the battery charging will be done 2.5 hours per day.

RANGE OF SWING ANGLE (deg)	OUTPUT VOLTAGE(V)
20-30	**9**
30-60	**13**
60-90	**17**
90-120	**20**

Table 1. The following table shows the output voltage at different ranges of swing angle

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RANGE OF SWING ANGLE (deg)	OUTPUT CURRENT(Amps)
20-30	0.3
30-60	0.42
60-90	0.5
90-120	0.65

Table 2. The following table shows the output current at different ranges of swing angle:

9.FINAL ASSEMBLY

Fig.8 Power generation using swing motion

10.ADVANTAGES & APPLICATION

ADVANTAGES

The merits of developed model are:

- Pollution free electricity generation.
- This power can be stored in battery array so as to use it further.
- Can be installed at places such as schools, playgrounds where mass transit of children is sighted e.g. hotels, fairs etc.
- Easy installation and maintenance.
- It can be used in remote areas where power supply is not available.
- It does not require no running cost because it does not required any fuel.
- It can be installed in any place quickly as compare to solar, wind and other plant.

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- It is portable; it can be used as portable power generator.
- It is simple in construction like other conventional part.
- It required small area for installation.

APPLICATIONS

Applications of the developed model are:

- Schools
- Nurseries
- Parks
- Gardens
- Playgrounds

11.CONCLUSION

With the demand for energy increasing tremendously, different methods of extracting energy from the available environment is focused and world is in search of alternative sources. The way of producing power from the mechanical energy that can be wasted is persevered for the future purpose which is having a great scope. So, swing power generator is considered as a promising alternate for exhausting energy sources. In this project, a new method for human power conversion based on children's play on playground equipment has been proposed. If it is employed in every garden with proper designing it could acquire sufficient power from it. To create awareness of electrical energy conservation in children. It will be a useful device which can be used in countryside area or in the agriculture field where electricity is not easily available. In the coming days the demand for energy resources will be increasing every day's the aim of this research is to develop the world by enriching. By utilizing its resources more. Now time has come for using this type of innovative ideas and it should be brought into practice. It is full independent system. It outlines the need for cost effective technology in rural region.

12.FUTURE SCOPE

- The extent of power generation can be increased by improving the design the charging circuit or by controlling the flexibility of the swing
- Swing it can be designed as weather proofing and also adopt different types of safety measures.

13.ACKNOWLEDGMENTS

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