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Fabrication and Experimental Study of Handle Powered System for Battery Charging

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Abstract—*In this paper authors, fabricate and experimentally studied a handle powered system for battery charging. It has unique features of using human power as prime mover for electric generator. Muscle energy in form of high-torque low-speed can be converted into low-torque high-speed through speed increaser to energize the electric generator. The electricity generated is stored in the batteries of different capacity and used when required. This equipment is emission free, low cost and has long life. Also this equipment needs less maintenance and any person can run either skilled or unskilled.*

Keywords*: Muscle energy, handle power, electric generation, dc battery.*

1. INTRODUCTION

Over 1.5 billion people rely on kerosene for light. Lack of suitable home lighting is directly linked to illiteracy, poverty and health problems. The current widespread burning of kerosene also results in environmental pollution. It is very difficult and very costly to available grid power everywhere specially at remote isolated communities in developing countries. There are many renewable power sources like solar power, wind power, hydropower, bio-energy, geo-thermal power, tidal energy etc, but all have their limitations. Although from beginning of mankind human have been doing for domestic works, but the electricity generation by muscle power is a novel technology.

Human power is a work or energy that is produced from the human body. It can also refer to the power (rate of work per time) of a human. Power comes primarily from muscles, but body heat is also used to do work like warming shelters, food, or other humans. A trained cyclist can produce about 400 watts of mechanical power for an hour or more, but adults of good average fitness average between 50 and 150 watts for an hour of vigorous exercise. A healthy well-fed laborer over the course of an 8-hour work shift can sustain an average output of about 75 watts. The yield of electric power is decreased by the efficiency of the human-powered generator [1-9]

2. FABFRICATION DETAILS

(i) Muscle Power: The authors' main object is to use the muscle power for generating electricity for domestic use. The two person of 52 kg and 51 kg of age 21 year were worked alternate as an energy source.

(ii) Handle power system: Authors uses the bicycle with some modification. In bicycle there is only chain- sprocket system to increase speed. The chain sprocket system has the speed ratio of 1: 3, for converting muscle power received from a mechanical link (handle) in the form of a high-torque low-speed to low-torque high-speed. One pulley (Ring) of 30 inch is mounted on the output shaft of the chain sprocket system and counter pulley of 3 inch is mounted on car alternator thereby stepping up the speed in the ratio 1:10 when connected with belt and alternator is fabricated on the frame with the help of mechanical linkage.

Fig. 1: Handle power system.

(iii) Belt and Pulley transmission unit: According to Indian Standard Code (IS: 2494-1974), the A type of belts are selected which has power ranges 0.7kW – 3.5 KW.[10] There is one set of pulley and belt system. One pulley (Ring) of 30 inch is mounted on the output shaft of the chain sprocket system and counter pulley of 3 inch is mounted on car alternator thereby stepping up the speed in the ratio 1:10 when

connected with belt and alternator is fabricated on the frame with the help of mechanical linkage.

(iv) Generator: In this experimental study authors select the car alternator to generate electricity. Lucas-TVS car alternator of 12V and 40 AH is used. Car alternator needs high rpm to work efficiently. It produces constant voltage but current depends on rpm and produce high as rpm is high. The direction in which the alternator is oriented to spin does not affect its output power. The alternators rotor can be rotated either clockwise or counter clockwise and achieve the same output values.

(v) Storage system: In this experiment a typical 12V, 40 AH Lead-acid automotive battery is used. An automotive battery is a type of rechargeable battery that supplies electric energy to an automobile. Charging time depends on the capacity of that battery and the resting voltage of that battery when you begin to charge it.

3. FABRICATION AND PROCEDURE

In the fabrication is done very carefully because there are three shafts which are supported by ball bearing. The chain sprocket system has the speed ratio of 1: 3, for converting muscle power received from a mechanical link in the form of a high-torque low-speed to low-torque high-speed. One pulley (Ring) of 30 inch is mounted on the output shaft of the chain sprocket system and counter pulley of 3 inch is mounted on car alternator thereby stepping up the speed in the ratio 1:10 when connected with belt and alternator is fabricated on the frame with the help of mechanical linkage. Authors select the car alternator for generating electricity. Car alternator starts to work about 1500 rpm. If human rotates the starting chain sprocket with average 80 rpm then the bicycle ring of 30 inch rotates with 240 rpm. The counter pulley of 3 inch mounted on car alternator thereby stepping up the speed in the ratio 1:10; hence the car alternator rotates at 2400 rpm [11].

80*3*10 = 2400 rpm

Fig. 2: Handle power system for battery charging.

The system is tested by means of handle power for many times and it is recognized that the initial force (torque) to rotate alternator at idle speed is very low, it can easily operated by using single hand. Before staring the experiment the alternator is connected with battery and ampere meter is jointed in series. When human applied force through handle at handle the first chain sprocket start rotate and drive the second as well as pulley one. The pulley one transmits power to counter pulley and so on. At the starting the rpm is very low hence the alternator was not responding but as well as speed is increasing the alternator start to generating power. Human are need to applied force to maintain average speed. The rpm and generated current were taken after every minute. The battery was 50% discharge. First time the battery was 50% discharge and it took approximate 1.5 hours to charge fully (multimeter indicate 12.6V). Second time battery was 25% discharge and it took 2.5 hours. Parallel the time required to discharge the battery at different percentage when 120 watt AC load (two 60W bulb) is subjected to battery through inverter had taken. The experiment had done 8 times.

4. RESULT AND DISCUSSION

The humans' effort and speed depend on the load subjected. Human speeds are change very quickly and abruptly. Experimental result shows that human take very little time to get working speed of 2000 rpm. Alternator generates constant voltage of 12V as specified after reaching ideal speed. The readings are taken after every minute. Speed vs. Current shows that at low rpm at starting motion it is not generating current by alternator, but as well as rpm is increasing and reaches to ideal working rang alternators producing high value of currents. First time the battery was 50% discharge and it took approximate 1.5 hours to charge fully (multimeter indicate 12.6V). Second time battery was 25% discharge and it took 2.5 hours. Parallel the time required to discharge the battery at different percentage when 120 watt AC load (two 60W bulb) is subjected to battery through inverter had taken. The experiment had done 9 times

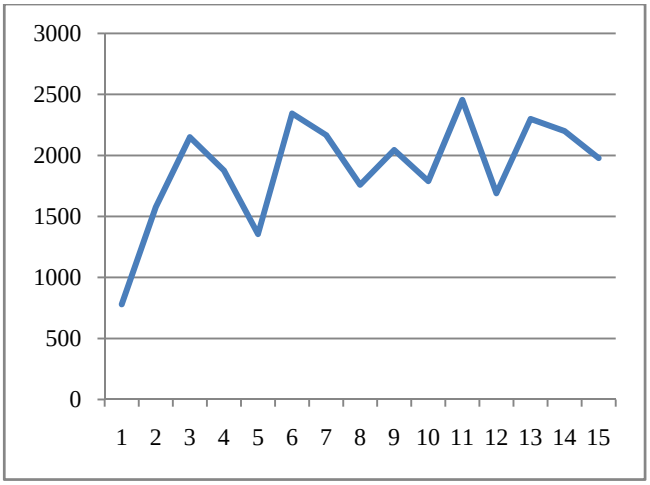

Fig. 3: Time (in minutes) vs. RPM of alternator

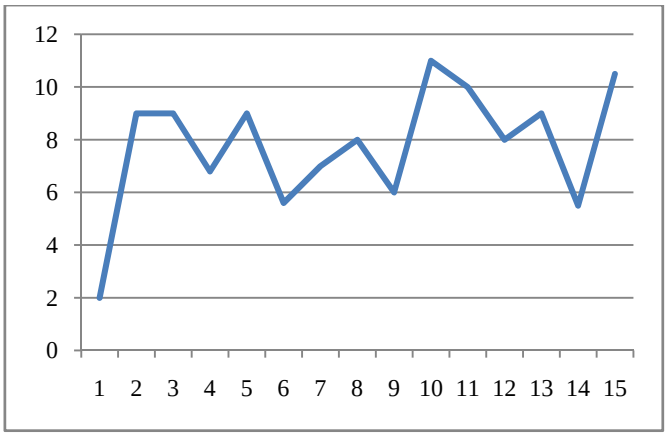

Fig. 4: Time (in minutes) vs. Current in AH.

5. CONCLUSIONS

The present work provides a mechanical device for producing electricity for home lighting using the biological energy of the muscles of human. The project goal was to design, fabricate and experimentally studied of mechanical device to charge a battery with a 12 volt DC output for 1.5 billion people who rely on kerosene for light. This goal had to be met within the constraints of a low production cost and high safety. The project has to offer a durable product with relatively good efficiency. This is also concluded that fabricated mechanical device is itself a very small scale industry for charging batteries at rural and isolated areas.

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