

IMPROVEMENT IN DESIGN OF FLYWHEEL TO INCREASE EFFICIENCY OF HUMAN EFFORTS TO GENERATE ELECTRICITY

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Abstract

Power Generation using Human Effort is a force for the future. With increasing demand for fuel and a new source of energy, development of human powered generators become a necessity. The most famous human powered generator is dynamo. On similar lines various human powered generators like backpack generators, biomechanical energy harvester and shoe generator are being developed. These harvesters are under development and are considered one of the best inventions of recent times. One such way is to develop alternate source of energy which will help us to save energy. Geothermal energy, biogas, solar energy, wind energy are various forms of energy which are used alternatively today. One such source of energy is Human Power. Human power is an endless source of energy which has been wasted. The energy is stored in a mechanical form and retransmitted to the wheel in order to help the acceleration. Electric vehicles and hybrid have a similar system called Regenerative Brake which restores the energy in the batteries. The device recovers the kinetic energy that is present in the waste heat created by the car's braking process. It stores that energy and converts it into power that can be called upon to boost acceleration. There are principally two types of system - battery (electrical) and flywheel (mechanical). Electrical systems use a motor-generator incorporated in the car's transmission which converts mechanical energy into electrical energy and vice versa.

Key word: X- Crossection Flywheel, Battery (electrical), Geothermal energy, Pulley, Paddle, polar moment of inertia.

1. INTRODUCTION

The cost of fossil fuel is increasing day by day as well as government policy is also towards the minimization of atmospheric pollution. Bicycle is an economical and pollution free vehicle for controlling the atmospheric pollution, which is not depending on crude oil. Government is also taking many steps to make use of renewable resources. The use of fossil fuels and other non-reusable sources of energy must be reduced to keep emissions low and alleviate the use of diminishing resources. The idea of human powered generation has been implemented in many different situations. Some examples include hand-crank radios, shaking flashlights, and receiving power from gym equipment. The use of exercise equipment for a clean source of energy would be an even more fun experience for participants and provide a means to exercise and generating power. The flywheel based bicycle generator utilizes human energy to produce electricity quickly and efficiently. The goal is to provide technological solution to problem in the rural world by using detailed opportunity recognition, evaluation, and development of prototype. The prototypes are then turned over to the developing world for manufacturing, distribution and use. Less commonly, pedal power is used to power agricultural and hand tools and even to generate electricity. Some applications include pedal powered laptops, pedal powered grinders and pedal powered water wells. Some third world development projects currently transform used bicycles into pedal powered tools for sustainable development. Human powered generation gives a power source that is not directly derived from natural sources. An example is a human powered generator operated in absence of solar irradiation, wind and water. The power generated from pedal is perfect for remote areas, hilly regions, strategic location, Islands etc., where electricity

generation is scanty if not nil. In these situations, a small portable power generating unit would be of great help to provide power supply to charge battery-operated gadgets like mobile phones, lamps, radio, communication devices, etc. A new way to bring power to the people as population continues to grow and power shortages continue to occur. This design relates to very compact and easily portable power-generating unit, besides being used as a power generator can also be used as cycle exerciser. It serves dual purpose of power generation and helping the person to maintain physical fitness through exercise of muscles of legs. It can be pedaled or cranked by hand/foot to charge 12 volt batteries and run small appliances. In our project we are optimizing the previously made project by our seniors. There project was capable of only developing the potential of 9.2 volts. We are modifying it by adding an extra flywheel due to this performance of the previously made project is improved and thus the we will get the potential of about 12volts.

2. LITERATURE SURVEY

Flywheels are having energy storing capabilities. It finds always every mechanism that involves gears and centrifugal motion. the flywheels are generating 10 to 15 percent more efficient in storing the energy when compared to the batteries. But If the stored energy would get dissipated and would be of no use at any time. But in the case the lithium-ion, alkaline batteries and some chemical batteries energy can be stored and can be used in near future. In bicycle technology operator uses mostly pedal to operate machine and transmits power through crank, chain and freewheels to the working unit. This machine is widely used to generate electric power, to operate various home appliances, to drive water pump, harvesting activities in agriculture sector and simultaneously useful for physical fitness of operator. If you want to stay fit and healthy at the same time it is important that you keep yourself active all the time. With cycling you can overcome the serious illnesses and in the way you can even escape the condition of obesity. Cycling will help you get rid of the heart diseases and you can stay safe from cancer and mental ailments. It is the best solution for arthritis and diabetes. When you ride the bicycle on regular basis you can get rid of the primary health problems and this has got to do with the sedentary life style. Cycling is the healthiest and the sort of low impact exercise and it is enjoyed by people of all age groups. Both adults and children love to go for cycling and this is the great way you can really enjoy exercising. Different devices are being used to transmit human energy into electrical energy and are analyzed with proper lubrication to achieve maximum output. This work would be useful for development of human power machine producing electrical energy quickly and easily at remote locations also.

3. OBJECTIVES

- a. Efficient design of flywheel to generate electricity.
- b. Effective utilization of human power as an energy source.
- c. Ergonomical and eco-friendly design of human power operated machine for human exercise.
- d. Economical design and development of human power operated machine.

4. METHODOLOGY

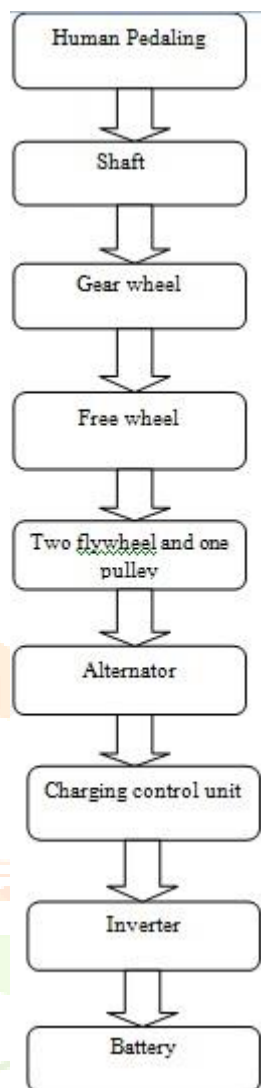


Fig. 1.

5. MATERIAL COMPONENTS

- a. X-Crosssection Flywheel.
- b. Frame Design.
- c. Paddle.
- d. Bicycle Rim.
- e. Alternator: 12 VOLT.
- f. Pulley.
- g. Shaft.

6. BLOCK DIAGRAM

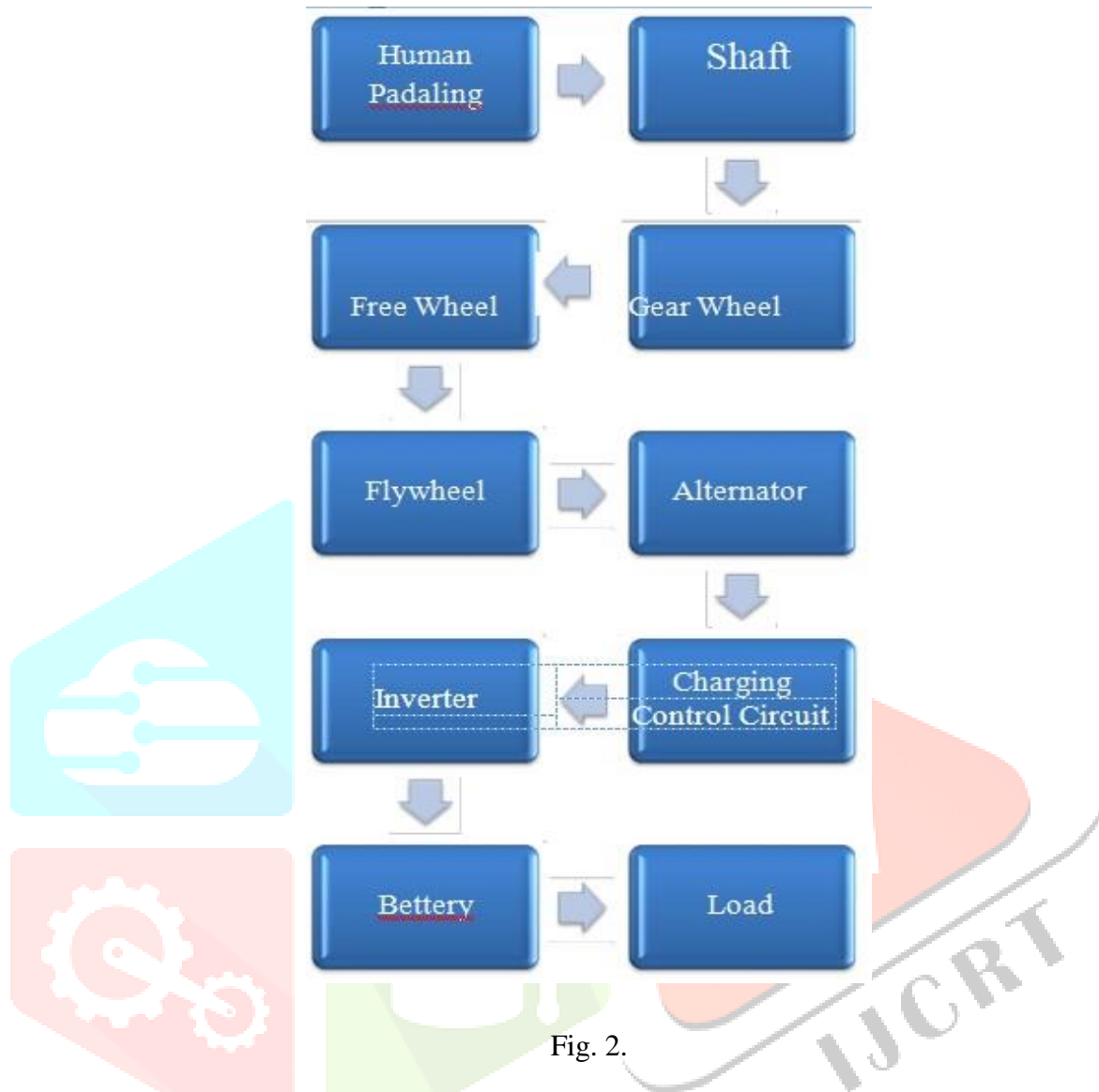


Fig. 2.

7. FLYWHEEL DESIGN

Flywheels are designed to store and release kinetic energy. A Flywheel is disc-shaped, and true to its weight on all sides and locations of the disk. The flywheel is designed to provide a more steady flow of momentum. The size and weight of the flywheel will determine the amount of energy that can be produced from peddling the bike. The mechanical advantages of using a flywheel is that its energy output is consistent and, depending on the size of the flywheel, it is able to store and release great amounts of energy even after the peddling has ceased. The kinetic energy stored in the flywheel is given as: $K.E = \frac{1}{2} I \omega^2$
Where I = polar moment of inertia.

ω = angular velocity of the flywheel.

Weight of Flywheel = 21.525kg.

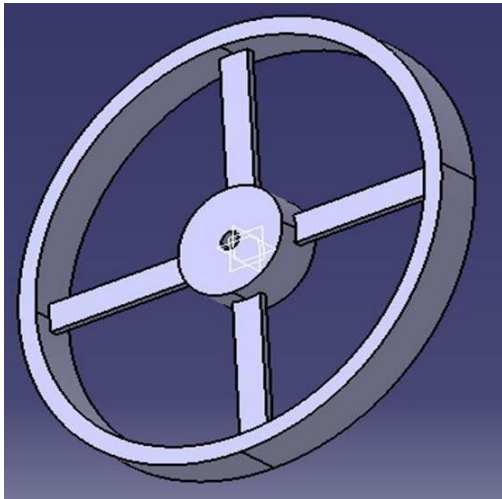


Fig. 3. Flywheel Model in CATIA V5 Software



Fig. 4. Diameter of the flywheel is 61 cm

8. WORKING PRINCIPLE

The rotation of the shaft is given by applying human effort of the pedal by transferring motion through chain and sprocket arrangement. This motion of the shaft is given to gearwheel and thus transfer the motion to freewheel and through belt and pulley arrangement this rotational motion transfer to the flywheel where the flywheel stored this energy in the form of kinetic energy and this energy is then transfer to the alternator. This continuous rotation of the alternator generates electricity and this electrical energy is stored in battery through inverter.

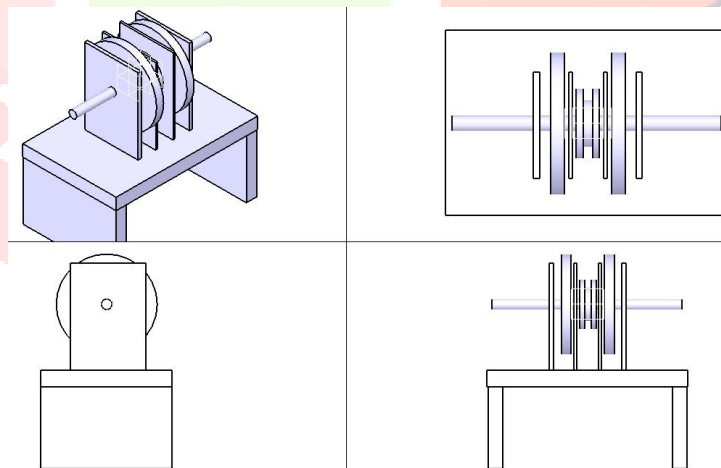


Fig. 5.

9. ADVANTAGES

- The energy produced is extremely clean source of energy.
- It benefits the health by exercise point of view.
- Benefits for your peace of mind.
- Time and effort required is medium.
- Saves money which are used for batteries.
- Power generation is simply pedaling on this arrangement.

- g. Power also generated by sitting on the machine.
- h. Simple in use.
- i. No need fuel input.
- j. This is a Non-conventional system.
- k. Battery is used to store the generated power.
- l. Pollution Free.

10. APPLICATION

- a. Useful for rural area there is scarcity of electricity.
- b. Used save Environment from Pollution.
- c. For glowing of LED bulbs & CFL bulbs.
- d. House hold purpose eg. Mixer.
- e. Gymnasium.
- f. Use to charge small chargeable batteries.

11. CONCLUSION

Human power there is vast scope in economical use of Bicycle mechanism as an alternative energy Source. This means renewable energy generation as well as exercising for good health cause. Adopting the proper drive system for transmission of human energy into electrical energy through maximum conversion efficiency designed systems. Thus lubrication of machine would make it comfortable to operate this already well designed machine. These machines are also ergonomically designed for trouble free operation both for human operator and electric generation efficiently. Thus we are improving the performance of our project by adding an extra flywheel and we are focusing to obtain the desired result.

REFERENCES

1. Modak, J. P. and Bapat, A. R., "Formulation of Generalized Experimental Model for a Manually Driven Flywheel Motor and its Optimization", Applied Ergonomics, U.K., Vol.25, No. 2, pp 119- 122, 1994.
2. Modak J. P. and Bapat A. R. "Various efficiency of a Human Power Flywheel motor".
3. Human Power, USA International Human Power Vehicle Association No. 54, pp 21-23 Spring 2003.
4. "The Human-Powered Home: Choosing Muscles Over Motors", Tamara Dean, New Society Publishers, 2008.
5. Proc. of the Intl. Conf. on Future Trends in Structural, Civil, Environmental and Mechanical Engineering □FTSCEM 2013, ISBN: 978-981-07-7021-1 doi:10.3850/ 978-981-07-7021-1_47 pg no.31.
6. M. P. Mohurle, Dr. D.S. Deshmukh, P. D. Patil "A Review on Human Power Utilization for Direct and Electricity Generation" PRATIBHA: INTERNATIONAL JOURNAL OF SCIENCE, SPIRITUALITY, BUSINESS AND TECHNOLOGY (IJSSBT), Vol. 4, No. 1, Nov. 2015.
7. Dr.D.S.Deshmukh, P.D.Patil, "Review on Human Power Utilization forDirect and Electric Generation,"PRATIBHA: International Journal of Science,Spirituality, Business and Technology (IJSSBT), Vol. 4, No. 1, Nov 2015, ISSN (Print) 2277-7261.

8. Mayur Mohurle, Dr. D. S. Deshmukh, P. D. Patil, “Human Power Using Bicycle Mechanism as an Alternative Energy Source: A critical Review ”, Global Trends in Engineering, Technology and Management (ICGTEM 2016), 4-6 Jan, 2016, ISSN: 2231-5381.
9. M.P. Mohurle, Dr. D.S. Deshmukh, Prof. P.D. Patil, “ A Review On Ergonomic Considerations In Development Of Human Powered Electric Generation System”, International Journal Of Science, Spirituality, Business And Technology(IJSSBT) VOL.4, No.2 ISSN(Print) 2277-7261.
10. M.P. Mohurle, Dr. D.S. Deshmukh, Prof. P.D. Patil, “ Human Powered Electric Generation machine”, preceding to publish in journal PRATIBHA: INTERNATIONAL JOURNAL OF SCIENCE, SPIRITUALITY, BUSINESS AND TECHNOLOGY (IJSSBT), Vol. 4, No. 1, Nov. 2015, ISSN (Print) 2277—726.
11. M.P. Mohurle, Dr. D.S. Deshmukh, Prof. P.D. Patil, “ A Review on Ergonomic Considerations in Development of Human Powered Electric Generation System” , PRATIBHA: INTERNATIONAL JOURNAL OF SCIENCE, SPIRITUALITY, BUSINESS AND TECHNOLOGY (IJSSBT), Vol. 4, No. 2, May 2016 ISSN (Print) 2277—726160.
12. K. Bansal Laxmi Publication (P) Ltd.– Reference book.
13. Machine Design (S. I. Units) By R.S. Khurmi & J. K. Gupta– Reference book.
14. Rai. G.D. “Non Conventional Energy Sources”, Khanna Publishers, Delhi.

