Impact Factor (SJIF): 4.542

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 4, Issue 3, March-2017

Energy generation in exercise pedals by using 3-speed sprockets – A Review Paper

Nishant Bhatt, Vishal Parmar, Parag Chauhan, Bhatt Parth (B.E Mechanical- ITM Universe, Vadodara)

Mrs Sweety Patel (Asst. Prof Mechanical Dept- ITM Universe, Vadodara)

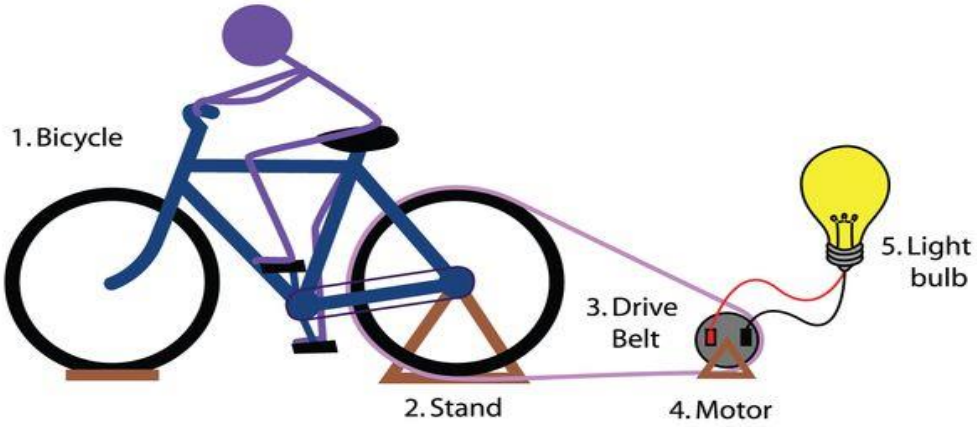
Abstract: - *This project is to generate energy by exercise bicycle and gives importance of human power as an alternative energy source. Here, we present our idea to attach two extra sprockets and increase output speed. This could be joined with generator to produce electricity and so by increasing output speed, electricity production can be increased. This can be used for mass production so that more energy can be produced. Also can be used to charge batteries so that energy can be utilized later, operate various home appliances, water pump, harvesting activities in agriculture sector and simultaneously useful for physical fitness of operator. The design was originally conceived to meet the energy needs of those living in rural areas, due to poor access to electricity and also as a model for gym centers and cycle workout studios.*

Keywords*: -Exercises pedal, Sprockets, Energy generation, Battery charging*

I. INTRODUCTION

In this process Bicycle pedal is connected to rear sprockets which drives the wheel. And rear wheel is connected to the rotor of the generator through a belt drive, as we pedal rotor also rotates thus producing DC power. We need to regulate this dc power to suits for conversion purpose. Regulated DC is given to inverter for conversion to AC. And also to the electrical appliances with small energy requirements like motor, light etc.. the setup for an idea of energy generation through the exercise pedals. If this system is introduced in every exercise cycles in gym then mass production of energy can be done.

This type of energy generation is now a days in demand for implementing the project at rural areas in India. Rather than wasting the human energy we can use it in a better useful way to produce electricity which can fulfil many types of energy crises. Rotating of rotor of alternator causes the generation of energy in the coil of alternator, which can then be extracted and used directly or indirectly by charging a battery or a inverter.

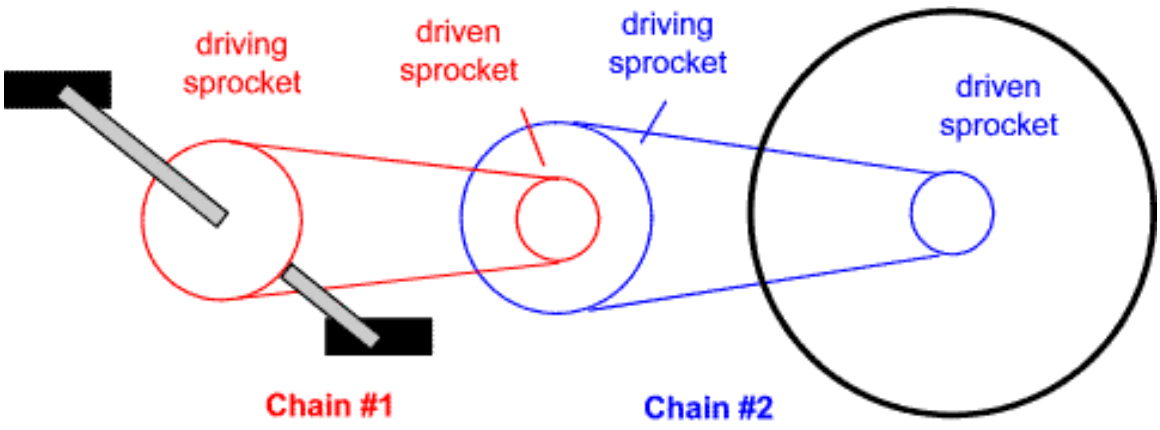


schematic diagram for energy generation

II. New proposed way for increasing output speed in padel power generation system

Need of introducing new idea was to increase the energy generation to fulfil more energy crises. All devises even with high energy requirement can be run as well as large amount of energy that is gained can be used in various other ways. By adding of two extra sprockets in the existing project to increase the speed at the dynamo for increased power generation is our main idea. This invention relates to self-propelled vehicles and more particularly to bicycles incorporating additional gearing and than normal in order to obtain additional efficiency and adaptability to various conditions. More particularly still, this invention relates to the use of a bicycle having multiple apparatus not only on the pedal mechanism and the rear drive Wheels, but also an additional double sprocket assembly gearing arrangement positioned below the seat and toward the backside of the bike, additional gearing being provided With multiple sprocket Wheels.

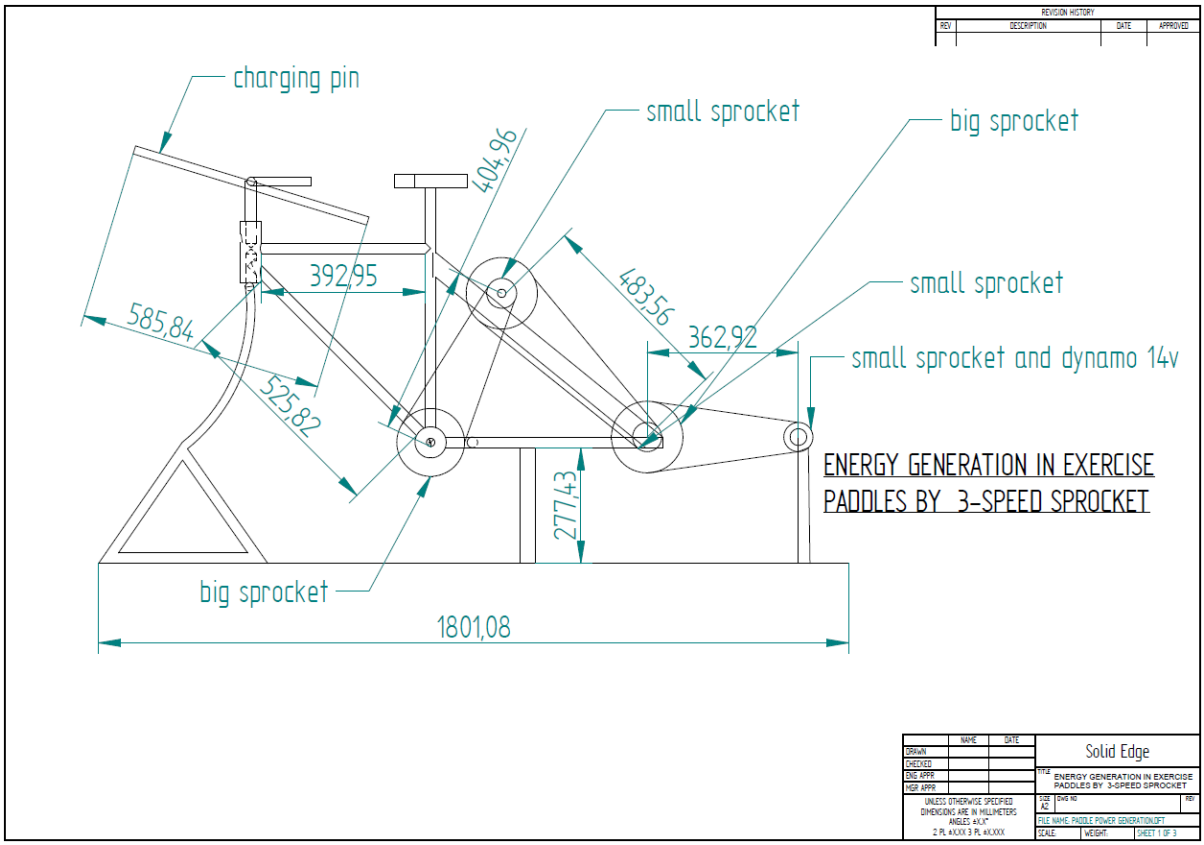
Our main idea is of increasing the output speed and this can be achieved by arranging sprockets as follows:



output increasing arrangement for bicycle energy generation

By applying this concept, we propose new idea in the energy generation through exercise pedals and found the new optimal arrangement for achieving the target.By this we can achieve the speed ratio increment upto almost 1:40, which will actually help a lot in increasing the effiency of power generating capacity in the pedal power generation system.

The new proposed arrangement for the pedal power generation after adding two more sprockets to it, for achieving our main puopose.



New proposed arrangement for energy generation.

Calculations

Standard size sprockets of diameter 5cm and 18cm.
The smaller sprocket rotates four times on one rotation of big sprocket when in a connection through standard size chain set.

According to new standard size sprockets.

Sprocket No.	1	2	3	4	5	6
Rotations	1	4	4	16	16	64

No. of rotations on different sprockets

Thus, on considering whole sprocket train, one rotation of sprocket 1st will lead us to the output of 64 rotations on the 6th sprocket.

We are using 1000 RPM, 14V, 35Amp Alternator for power generation.

Hence, we get 14 V generated at 1000 RPM

i.e. if we paddle 20 times in a minute, we get 64 x 20 = 1280 RPM

Thus, it is possible to gain 14 V power in a minute.

POWER= V x I

= 14 x 35

= 490 Watts per minute.

TIME	POWER GENERATED
1 Minute	490 W
10 Minutes	4900 W
20 Minutes	9.8 kW
40 Minutes	19.6 kW
60 Minutes (1 Hour)	29.4 kW

Power generated in specific time

Appliances which can run with this amount of energy.

APPLIANCE	ENERGY REQUIRED
Table Fan	15 kWh
Coffee Maker	9 kWh
Oven	16 kWh
Toaster	5 kWh
Iron	10 kWh
Digital Clock	0.5 kWh
Table Lamp	1 kWh
Radio	7 kWh
Water sprinkler system	28 kWh
Dryer	5 kWh

Appliances working under 30 kWh power

Also can charge: 1) laptop battery at 12 kWh

2) Mobile phone battery at 2 kWh

3) Car battery at 15 kWh

III. LITERATURE REVIEW

May 24, 2016 a US patent 9346515 stated A pedal assisted bicycle a first and a second wheel; a pedaling assembly mechanically decoupled from the first and second wheels by which an user can supply a pedaling power; an electric motor mechanically coupled to at least one of the wheels capable of taking a motor power; a generator device adapted to generate a generator device electric power from the pedaling power, arranged in an energy exchange relationship with the pedaling assembly and the electric motor; an energy storage device arranged in an energy exchange relationship with the electric motor and with the generator device by **Politecnico di Milano.**

Charging battries using bicycle paddles

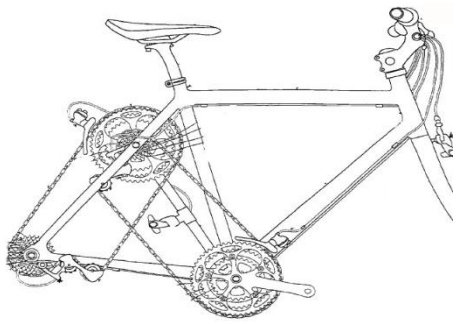
Georgev Alexander Holt III designed a human powered generator using recumbent bicycle technology for using in a sail boat using 6061-T6 aluminum; he built a light weight foldable apparatus. The human power requirement was **120 watt at 75 rpm** (**George, 1988**).

October 17, 2013 a patent number 20130274064 by **Xiwu Liang** stated that A fitness power generation bicycle includes: a bicycle gymnastic device, comprising a main frame and a drive sprocket pin-jointed with the main frame; a generator located on the main frame, comprising a shaft and a driven sprocket fixed on the shaft; a chain connecting the drive sprocket with the driven sprocket; a battery electrically connected with the generator for storing an electric energy from the generator; and an inverter electrically connected with the battery for adjusting an output current of the battery. The above-mentioned fitness power generation bicycle combines the fitness with power generation, which not only makes the user take exercise, but also stores the energy from the exercise, thereby achieving the environmental protection. By this we get two ideas of using exercise or gymnasium cycles in the project. Also the concept of storing energy for future use as well as use it directly at the same time. Using sprocket-chain mechanism for transmission proves to be very feasible idea.

Apr. 6, 2004, US patent US 6,717,280 B1 by **Francis Bienville** stated The front Wheel is held off the ground by a pair of cradles to permit rotation during pedaling, While the intermediate derailleur is held in a stabilizer for better balance. In this the arrangement of bicycle generation project is given, from which the base support or base stand was suitable for our project. The same stand is used in the project.

As early as 2007, fitness facility or gym around the world have begun researching applications for converting human power to electricity. The California Fitness facility in Hong Kong was one of the first gym establishments to incorporate human powered machines. Started by French **inventor Lucien Gambarota and entrepreneur Doug Woodring**, the gym began a program called "Powered by YOU" in which the excess energy generated by members on 13-step cycling and cross training machines is converted to power lighting fixtures in the gym (**Gerard, 2008**).

Mar. 14, 2006, a US patent US 7,011,323 B1 by **Naseer M Saeed** states that A drive for a bicycle includes an auxiliary sprocket Wheel assembly having two sets of at least three sprocket Wheels associated in each assembly attached to a common axle, one of said sets having a larger diameter than the other set. Each set is provided With a derailleur for changing associated sprocket chains from one sprocket of the set to another. Use of the auxiliary sprocket Wheel assembly together With the regular pedal and drive Wheel sprockets enables Very high Speeds to be attained by the average rider'. By this we use the idea of adding extra sprockets of different sizes to get the maximum speed. The best possible arrangement of sprockets can also be known which we are probably using in the paper.

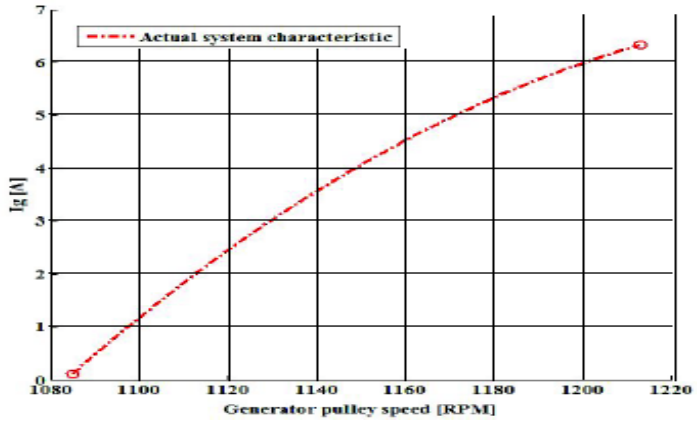


Sprocket arrangement for max output speed

April 2015 patent number ISSN: 2321-9653 by **Nidhi V Bhavsar, Vishal A Shah** states that This paper emphasis the idea to use kinetic energy of vehicle when it is passing over the speed breaker. This kinetic energy can be utilized to produce power by using a special arrangement called "POWER HUMP" [1]. This generated power can be utilized for the general application like street lights, highway lights; traffic signals etc. more over that electricity can be stored in a battery for any other general purpose of use. By this, we get the calculations for the final output speed and power calculations. Also other areas of project usage can be known.

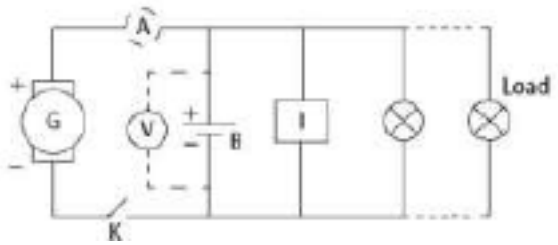
February 10, *2015* *a* paper *by* **ŞTEFAN MOCANU1, ADRIAN UNGUREANU** stated a prototype scavenging system (dedicated to fitness/stationary bikes) to collect and (re)use this energy is presented. Specifically, we depict the design of a low-budget system that uses existing, discrete components and is able to scavenge some of the energy spent by the biker. The experimental results show that the system is functional, but its efficiency is

limited by (mechanical) losses before the collection. By this paper we come to know various calculations of power and energy management.



Relationship between Current and Rotations

October 2015 paper number ISSN (Online): 2278 – 8875 by **B.Sneha, Dr.M.Damodar Reddy** stated that Dynamo attached to the cycle pedal can serves as a mechanism for converting mechanical energy from pedal to electrical energy .For running of appliances we need to convert this dc power to ac power by using inverter.Output of the dynamo or generator depends on the pedaling speed. A hardware prototype of this model is developed and tested for various loads. By this we came to know how the power generated can be used directly as AC current. Also battery charging circuit is mentioned.



Electric block diagram

IV. CONCLUSIONS

After referring to various research papers, review papers, we can yield the conclusion that our expectations for Use of a more powerful (high watt) DC motor for power generation, Designing a three-sprocket mechanism to attain higher RPM, Storing generated energy in battery, Reduction of load for human to work on pedals, Achieving torque required to run high watt DC Dynamo and Chain and Sprocket materials.

V. ACKNOWLEDGEMENT

The completion of this project phase would not have taken place without the contribution of many key people. The progress of the project was supervised by **Prof. MRS SWEETY**

PATEL from Mechanical Department of Institute Of Technology And Management Universe, Vadodara. A special thanks to our Head Of Department **Prof. Minesh Patel.** Their guidance, advice and wisdom throughout this work are also greatly appreciated.

Finally, special thanks to family and colleagues who provided constant support and encouragement during this work.

VI. REFERENCES

1) Electricity Generation by Speed Breaker Using Spur Gear Mechanism
By Nidhi V Bhavsar1, Vishal A Shah2
Department of Mechanical Engineering, C.U.Shah University

2) Gear Theory for Bicyclists
By Sheldon "Gearhead" Brown revisions and addition by John Allen

3) Human Power Using Bicycle Mechanism as an Alternative Energy Source: A Critical Review
By M. P. Mohurle1,D.S. Deshmukh2,P. D. Patil3
1Student of Master of Engineering, SSBT`s COET, Bambhori, Jalgaon, M.S
2Prof. & HOD of Mechanical Engineering Dept., SSBT`s COET, Bambhori, Jalgaon, M S., India
3Professor of Mechanical Engineering, SSBT`s COET, Bambhori, Jalgaon

4) Generation of Electrical Power using Bicycle Pedal
By Rajneesh Suhalka1, Mahesh Chand Khandelwal2,Krishna Kant Sharma3, Abhishek Sanghi4
1,2M.Tech Scholar, Jagan Nath University, Jaipur
3Assistant Professor, YIT, Jaipur
4Assistant Professor, Jagan Nath University, Jaipur

5) Bike-Powered Electricity Generator
By ŞTEFAN MOCANU1, ADRIAN UNGUREANU2, RADU VARBANESCU
1Faculty of Automatic Control and Computer Science, Department of Automatic Control and Industrial Informatics, University „Politehnica" of Bucharest, Romania

6) Human Power Using Bicycle Mechanism as an Alternative
Energy Source: A Critical Review
By M. P. Mohurle1,D.S. Deshmukh2,P. D. Patil3
1Student of Master of Engineering, SSBT`s COET, Bambhori, Jalgaon, M.S., India.
2Prof. & HOD of Mechanical Engineering Dept., SSBT`s COET, Bambhori
3Professor of Mechanical Engineering, SSBT`s COET, Bambhori, Jalgaon, M.S

7) Analysis of Bicycle Ergometer: A Review
By Pramar P. Bakane 1, Dr. K. S.Zakiuddin2
1Student (Mtech MED), Priyadarshini College Of engineering, Nagpur. Maharashtra, India
2 Professor, Department Of Mechanical Engineering, Priyadarshini College Of Engineering, Nagpur.

8) A Review of Experimental study of home automation by bicycle pedal power
By Ram Singh ME IVth sem student Jabalpur Engg. College Jabalpur (M P)
Prof. Mrs. D.C. Sharma Assistant professor ,Jabalpur Engg. College Jabalpur (M P)

9) Generation of Power from Bicycle Pedal
By B.Sneha1, Dr.M.Damodar Reddy2
1PG student [PSOC], Dept. of EEE, SV University, Tirupati, A.P, India
2Professor, Dept. of EEE, SV University, Tirupati, A.P, India

10) Electricity Generation by Speed Breaker Using Spur Gear Mechanism
By Nidhi V Bhavsar1, Vishal A Shah2
Department of Mechanical Engineering, C.U.Shah University

11) Generation of Electricity Using Road Transport Pressure
By Md.Saiful Islam1,Syed Khalid Rahman2,Jakeya sultana Jyoti3
Lecturer, EEE department, World University of Bangladesh, Dhanmondi

12) Bike-Powered Electricity Generator
By ŞTEFAN MOCANU1, ADRIAN UNGUREANU2, RADU VARBANESCU
Faculty of Automatic Control and Computer Science, Department of Automatic Control and Industrial Informatics, University „Politehnica" of Bucharest, Romania

13) Generating Electricity Through Pedal Power
Designed by: Jamie Young, Aaron Oro, Jeff Sarsona, Chuck Allen

14) Portable Pedal Power
By CASL and the EDC

15) Platform drive calculations

16) United States Patent Application Publication

17) Motor drives

18) l. J. RlGA ET Als HIGH-SPEED DRIVE FOR BICYCLES