iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4013

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Design and Fabrication of Portable Bicycle Washing Machine

N. V. Dhandapani[1] Suriyapracash C V[2], Jegan Mari P[3], Nishanth Kumar B M[4] , Kumar M[5], Arjun A[6]
[1]*Professor, Department of Mechanical Engineering, Karpagam College of Engineering, Coimbatore, Tamilnadu, India*
[2,3,4,5,6] *UG Students, Department of Mechanical Engineering, Karpagam College of Engineering, Coimbatore, Tamilnadu, India*

Abstract: ***Washing Dresses is one of the most important parts of life. We all wash our dresses either by manually or by machine. A washing machine is a device invented to wash dresses. Nowadays there are a different variant of Washing machines in the market and there is competition among the manufacturers. These washing machines cost around 10,000 to 50,000 depending upon its specification. All of the washing machines are operated by electricity and by developing a turbulent flow of the wash around the dirty dresses. The transfer of human energy through the use of a foot pedal and crank mechanism is known as Pedal power. This mechanism has been used in bicycles.***
Key Words Bicycle, Crank Mechanism, Foot pedal Mechanism, Manual washing Machine, Washing Dresses.

I. INTRODUCTION

The washing machine is designed to wash dresses. The washing machine is mostly applied only to machines that use water as the cleaning solution, as opposed to dry. All washing machines operate by using mechanical energy, and chemical action. The spin speed in these machines can vary from 500 to 1600 rpm. The" **PORTABLE BICYCLE WASHING MACHINE** "is innovative to develop and it requires skill to manufacture. The components can be manufacture in our institution. This project gives us knowledge, experience skill and new ideas of manufacturing.

II. PROBLEM STATEMENT

The major working concept of an electrical washing machine is achieving both clockwise and anti-clockwise rotation of pulse rator inside washing machine the drum. Since no of them have achieved the both clockwise and anti-clockwise rotation of the pulse rator using bicycle. Our target is to achieve both the clockwise and anti-clockwise rotation of the pulse rator using bicycle.

III. LITERATURE SURVEY

A washing machine is a design that is used to wash dresses. Usually this is applied to machines that use water as cleaning solutions. Washing dresses manually is strenuous, laborious and time consuming. Washing machines were invented to address these obstacles. The former washing machines were constructed by hand and made from wood, while later machines were made of metal and keeping the water warm throughout the washing process which helps supply the required thermal power.

IV. OBJECTIVES

The main objective of this project is to achieve the major concept of the electric washing machine without electric power i.e. to achieve both the clockwise and anti-clockwise rotation of the pulse rotor by the use of manual power obtaining by cycling the bicycle.

V. MECHANISM

The scotch yoke mechanism is a mechanism that has reciprocating motion mechanism, converting the translation motion to rotational motion and vice versa. This mechanism is considered to be more efficient means of producing the rotational motion as it delivers more duration at the high point of its rotation than a piston.

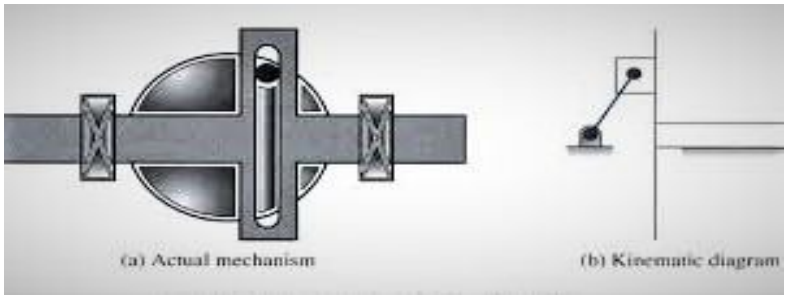


Fig. Mechanism diagram

VI. DESIGN CALCULATION

This calculation part is used to determine the final speed and final power obtained by the washing machine.

A. Assumptions

Standard bicycle which has 42 teeth in front sprocket and 32 teeth in rear sprocket.
Initial RPM of the front sprocket is 20 RPM [considering least care] (i.e.) the normal pedalling power.

B. Calculation of Initial power

Assuming module, m=1 (Standard module)
As per PSG data book pg.no: - 8.9
Reference diameter of Bicycle sprockets
Front sprocket = 42mm
Rear sprocket = 32mm
Formula for Power is (2*pi*T*N)/60
To calculate the power, we need the value of Torque, So
Torque = Force applied * Perpendicular distance
Force applied = mass * gravitation force = (50 * 9.81) ~ 500 N

Now,

Torque, T1= (F*d) = (500*0.3) = 150Nm

P1 = (2*pi * T1 * N1) / 60 Here the speed of front sprocket is assumed as 20rpm as for human effort,

P1 = (2*3.14 * 150 * 20) / 60*1000
∴ Power, P1 = 0.314 kW
Since P2 = P1 (assume losses are negligible)
P2 = 0.314 kW

C. Calculations of Initial Speed

By using the formula, N1/N2=D2/D1 20/N2=32/42
Speed of rear sprocket, N2 = 36 RPM

D. Scotch Yoke Calculation values

Flywheel diameter = 130mm
Location of pin from origin of flywheel, r = 55mm
By using circumference formula, 2*pi*r
Stroke length = (2*3.14*55)
Stroke length = 350mm

E. Calculations of Final Speed

For Rack**: -** Assuming the module as 1 and selecting the length as 350 mm or 35 cm
For Pinion Gear: - Reference diameter of pinion gear = 18mm
Number of teeth on pinion gear = 18 Assume module = 1
Comparing the stroke length and revolution of flywheel, we get 7 revolutions in pinion gear
As the flywheel rotates at 36 RPM Therefore RPM of pinion gear = 36 * 7 = 252 RPM
As the pinion gear connected to the right side of bevel gear
Pinion gear and bevel pinion & gear transmit same power and RPM on empty loading
Speed of pinion gear = 252 RPM

F. Calculations of Final Power

Formula for Power is (2*pi*T*N)/60
To calculate the power, we need the value of Torque, So
Torque = Force applied * Perpendicular distance
Force applied = mass * gravitation force = (50 * 9.81) ~ 500 N

Now,

Torque, T1= (F*0.05) = (500*0.05) = 25Nm
Final Power = (2 * 3.14 * 25 *252)/ 60 * 1000

Power of pinion and bevel gear = 0.659 kW / 0.895 hp
Output power = 0.659 kW / 0.895hp
Final speed = 252 RPM

VII. D CAD Modelling

A. AUTOCAD 2D Drawing

Approximate dimensions of Standard cycle were sketched for the proposal dimensions of washing machine. Dimensions and sketches are only assumption.

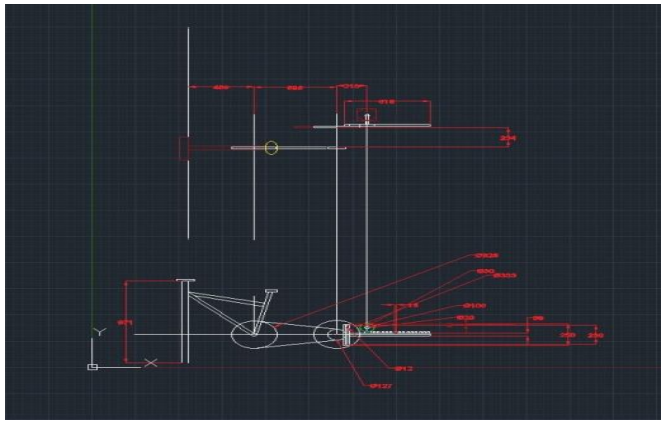


Fig.2D CAD Drawing for Assembly of Portable Washing Machine

B. Solidworks 3D Diagram

In Solid works, we have designed the 3D CAD model of portable washing machine from 2D cad sketch. We have designed two main assembled parts that are following:
Bicycle with standard dimensions.
Scotch-yoke mechanism embedded with rack and pinion mechanism.
This conceptual mechanism and bicycle was assembled with certain mating operations such as gear mating, collinear mating, parallel mating, etc., which are available in Solid works software. We have added some balancing structures to being stable while operating portable washing machine by loads acting on it and forces which are produced by pedalling the bicycle.
Finally, after completing assemblage of portable washing machine parts we have animated the operation of pedal powered washing machine by using animator in software which was successfully worked by our assumptions.

C. View of Bicycle Washing Machine

Fig.Trimetric View of Washing Machine

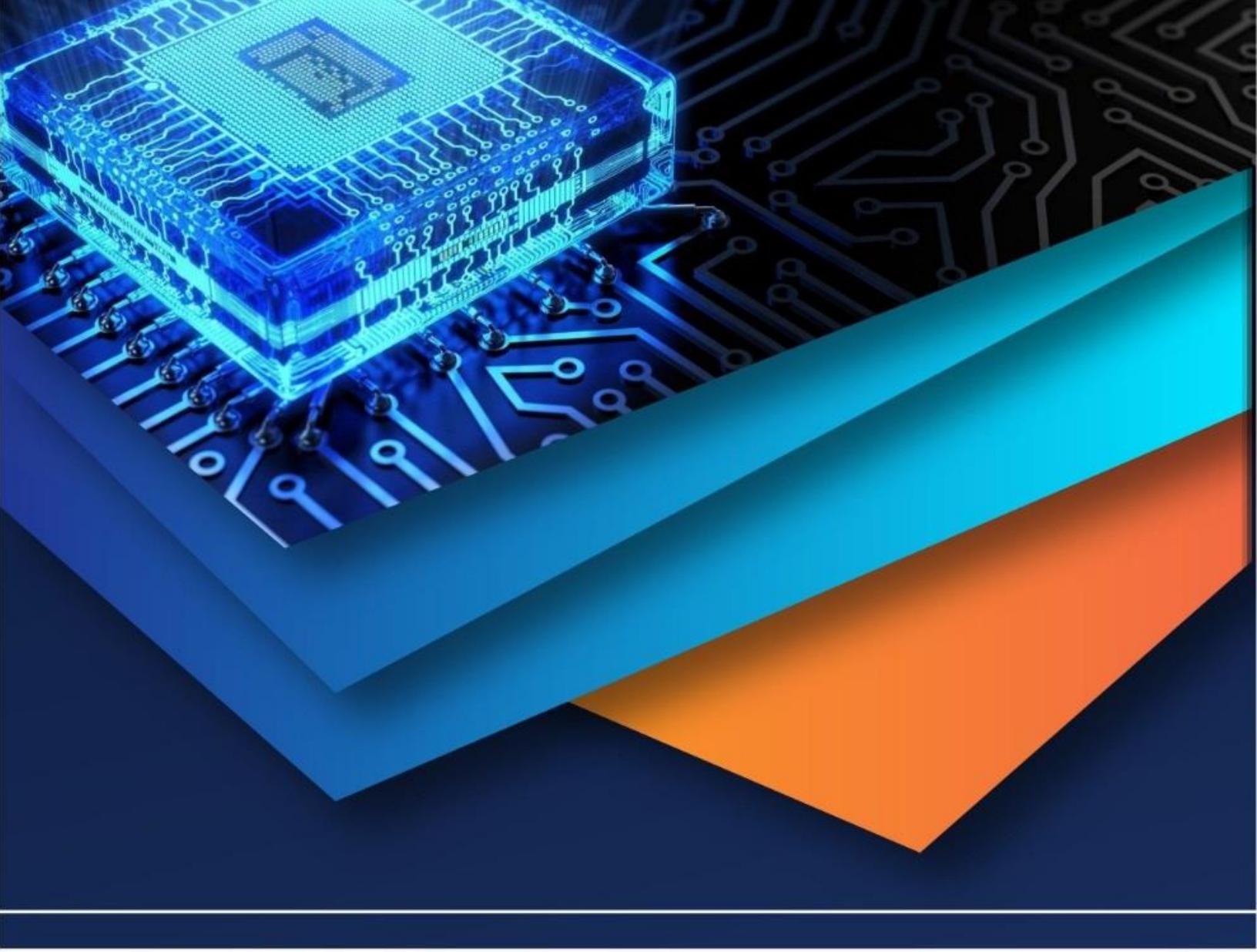
VIII. CONCLUSION

For the acceptance in the community, the machine must be cost efficient and easy to buy. We identified this need and invented the machine from the begin with low cost in mind. The Washing machine cost around 2300 of Indian rupees which was less than we had expected. The machine was built using components which are easily available in rural areas. Therefore, there is no need to import components should they wear out. We made that the washing machine project was “successful”. A functional prototype of a human-powered washing machine was constructed.

REFERENCES

[1] "Design and Development of Turmeric Polishing Machine Energized by Human Power Flywheel Motor."- S.M.Moghe & K.S.Zakiuddin A past review, Proceedings of the 1st International and 16th National Conference on Machines and Mechanisms IIT Roorkee, India, Dec (18-20 2013).
[2] IDEAS 2005 Proposal Bicilavadora: The Pedal-Powered Washing Machine.
[3] "A Reflecting on an Intercultural Design-Build Project in the Kathmandu Valley" Bruzzone, M. & Wieler Final Draft, Feb' 5, 2010.
[4] "Design and Fabrication of Pedal PoweredWashing Machine" GaurangBhatawadekar, Budye Salman, NileshChiplunkar, SwapnilDevrukhakar, Singh Akashdeep,, International Journal of Engineering Research and General Science Vol 3, Issue 1, pp. 1307-1311, 2015.
[5] "Bicycling Science" Whitt, Frank Rowland, Wilson, David Gordon,, 2nd ed. Cambridge, Massachusetts: The MIT Press, 1983.
[6] "Energy: Pedal Power," Darrow, Ken, Pam, Rick, from Appropriate Technology Sourcebook, Stanford, California: Volunteers in Asia, Inc.pp.189-196, 1977.
[7] http://home.howstuffworks.com/washer1.htm Bicilavadora: The Pedal-Powered Washing Machine - IDEAS 2005 Proposal.
[8] "Design of transmission elements" JayachandraPrabhu, T, pp. 2.1-2.15, 2008.
[9] "Hand book of gear design" Gitin M Maitra, second edition, pp. 3.1-3.44, 2002.
[10] "Design and Development of Turmeric Polishing Machine Energized by Human Power Flywheel Motor.‖"-A past review S.M.Moghe & K.S.Zakiuddin, Proceedings of the 1st International and 16th NationalConference on Machines and Mechanisms IIT Roorkee, India, Dec 18-20 2013
[11] "Reflecting on an Intercultural Design-Build" Bruzzone, M. & Wieler, A. Project in the Kathmandu (2010).

75



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY