



## Design and Fabrication of A Foot Operated Washing Machine

Chetan Rajoria<sup>1</sup>, Deepali Gautam<sup>2</sup>, Harsh Rajput<sup>2</sup>, Abhinav Vats<sup>2</sup>, Amit Singh<sup>2</sup>

<sup>1</sup> Assistant Professor, <sup>2</sup>B.Tech Student

Department of Mechanical Engineering, ABES Engineering College,  
Ghaziabad, Uttar Pradesh, India

### ABSTRACT

The current research project is undertaken to solve the problem of electric supply to people because of which many in rural area are unable to wash clothes. Nowadays there is electric supply which is provided in most parts of the world but we cannot neglect those who don't have access to electricity. In India most of village and hilly areas are suffering from lack of electricity supply. So, to overcome above problem we select the washing machine, which is operated manually. It requires no power supply or diesel supply. It is a machine which use the power generated by human pedalling and with the use of bevel gears and shaft converts the pedalling motion into required rotary motion of the inner drum of washing machine. This is a low cost project and can be transported very easily. It is an eco friendly project which is made to help the society altogether. With this societal project we are providing a method to wash clothes that is both economical and effective. Keywords— Pedal Power, Washing machine, Design, Fabrication, Bevel gears

### INTRODUCTION

Pedal power is the transfer of human energy generated by pedalling to inner drum of machine with the help of two sets of bevel gears. This transmission is used to propel bicycle. An individual can generate four times more power by pedalling than by hand cranking. At this rate i.e 1/4 HP, continuous pedalling can be served for only short periods, approximately 10 to 20 minutes. However, pedalling at half this power (1/8HP) can be sustained for close to 60 minutes but power capability can depend upon age. Pedalling depends on age of person, gender, physical health of a person. Women wash clothes by hand, using cold or lukewarm water that they carry from a river or pull up from a well which is a very difficult task. This process

also pollutes water bodies which is also injurious to health. In developing countries, rural women are among the least privileged. Several attempts have been made to develop a solution for these areas and to solve these problems, but either the project in itself becomes very expensive, or the repair and maintenance of the machines require a lot of money and imported parts to replace. Thus the project has the following objectives:

- Provide a low cost machine.
- High speed machine which uses only bevel gears for proper speed and eliminating factors like slip, friction, etc.
- Low maintenance
- Wash any type of cloth.
- Having all mechanism in a conventional machine: Washing, Rinsing, and Spinning.
- Concept of perforated inside rotating drum

### PROBLEMS IN ALREADY EXISTING WASHING MACHINE(S)

There are various problems that are faced by a rural family as far as washing of clothes is concerned the very first being

- Price Range is too high to afford
- High maintenance of an electrical washing machine
- With added baggage of electricity to run it
- High cost after service of these machines
- Prior knowledge is also required to operate an automatic washing machine

But with human powered washing machine the advantages are many. Our project can be used by any

individual from any level of social class but our main focus is to bring forth an inclusive way of washing for the people who are living below poverty line or those who just can't buy as these washing machine will burn a big hole in their already empty pockets.

### LEVELS OF PEDALLING CYCLE

It is very vital to know that how many rpm we have to take. Person to person the energy generated by them varies because of their built and their endurance. For each individual there is a pedalling rate that falls somewhere between flailing and straining. That specific rpm is the rpm that on which further calculations will be done. When people deliver power or generate power if they were to be working for an hour then the rpm were somewhere between 55 RPM to 70 RPM. This is the rpm considered for an individual who is not ill. For the simplicity of calculation we will take 60 RPM i.e one revolution per second as our reference mark for RPM value.

A conventional washing machine has three cycles with respective spin cycles are as follows:

- Washing 20-30 RPM
- Rinsing 500 RPM
- Drying 1000-1200 RPM

As we have taken the reference only of 60 RPM hence we will be focusing our project to washing cycle only. The graph below entails the power generated when an individual is pedalling at 60 rpm.

The graph below shows the Power vs RPM relation. It is found that at 60 RPM cycle the power generated is 125 watts.

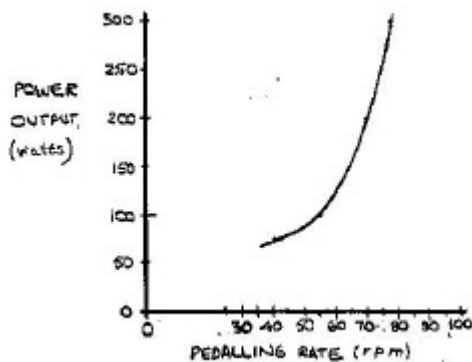


Figure 1: Understanding pedal power

### WORKING MODEL OF FOOT OPERATED WASHING MACHINE



Figure 2: Working Model

Figure 2 shows the working model of the washing machine that is designed and fabricated. The design that we have fabricated contains Bevel Gear. (see Figure 3)



Figure 3: Bevel Gear Assembly

The reason why bevel gear is chosen above other available gear was because they give right angle drive. That is an added advantage to the design. Two sets of bevel gear are used in the design, one below the rolling drum and another is on the axis on which pedals are rotated. Since the driving shaft and driven shaft is  $90^\circ$  apart, hence they are a perfect fit for the transmission of power. To run the drum chain and sprocket or pulley system was not used because they added strain and a lot of energy/power produced was used to overcome the friction that was produced. The inner drum and outer drum system is used for washing purpose (see Figure 4). The outer drum is the stationary drum whereas the inner drum is drilled with holes. The inner drum is attached to the rotating assembly. In between the drums a roller is added so

that the inner drum rotates on its axis with least friction and more speed of rotation.



Figure 4: Perforated inner drum with rollers



**Chetan Rajoria:** He is an Assistant Professor in the department of Mechanical Engineering, ABES Engineering College, Ghaziabad. He is pursuing Ph.D from NIT Kurukshetra. Prior to that, he has done M.Tech. from MD University, Rohtak, and B.Tech. from UPTU, Lucknow. He has a total 8 years of teaching experience.

## CONCLUSION

We have put forward a design that is ergonomical and economical for benefit for the society. Specially designed foot operated washing machine is for rural people who cannot have a luxury of electricity, let alone a washing machine. The project aims at delivering cost effective and eco friendly way of washing clothes with zero maintenance cost.

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