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Design And Fabrication Of Pedal Operated Washing Machine

K.S.Raghuram [a], D.V.V.Yashwanth Kumar,[b] B.Charan Reddy,[c] A.Pavan Kumar,[d] G.Satyanarayana Reddy [e]

[a.] Associate Professor, Department of Mechanical Engineering, Vignan's Institute of Information Technology (A), Visakhapatnam, A.P, India, 530049

[b,c,d,e] .Student, Department of Mechanical Engineering, Vignan's Institute of Information Technology (A), Visakhapatnam

Abstract: The main objective of this is to design and for the fabrication of pedal operated washing machine. It is a machine which is used to wash clothes without consuming electrical energy. The main need of pedal operated washing machine is to provide a product with an alternative way to wash clothes where there is no proper electricity facility. The components which are used for pedal powered washing machine is readily available in market with low cost and requires less maintenance. The components used in pedal powered washing machine are outer drum (made up of GI sheet), inner drum (made up of SS sheet with small equally spaced holes throughout the surface), shaft (SS rod), frame (made up of MS angular bar), bearings, pedal arrangement, chain and sprocket setup, seat. Intinally Designed a pedal operated washing machine in CAD and carried by fabrication and the assembly of components by performing various mechanical operation I.e., rolling ,shearing, drilling ,cutting, grinding, welding operation and finally inspected the working of the product. Rolling operation is performed on sheets for fabricating outer drum and inner drum. Cutting operation is performed for removing excess material. Welding operation is performed for joining various components together for obtaining final product. Whenever a load is applied on the pedal the energy will be transmitted towards the drum shaft and inner drum (where washing clothes are placed) then it will rotate. The product which is pedal driven machine will satisfy the need of rural people. The pedal powered washing machine satisfies the rural people needs by providing alternative way of washing clothes.

Keywords: Pedal operated cycle, human pedaling, energy saving, low maintenance and repair costs.

1. INTRODUCTION

The main objective of this research is to reduce the burden of the people who are living in rural area, where there is no proper electricity facility. By implementing Pedal Operated Washing Machine in rural areas & tribal areas the people need to apply less effort for washing cloths as compared to manual washing of clothes [1-4]. In case of Developed countries like America etc people who are migrated from one place to another place (i.e., Developed countries) then the people use to give their cloths for laundry for washing, at the same time they will also go for Gym for maintaining fitness .With the help of Pedal Operated Washing Machine at a same time both Washing of clothes & maintaining of fitness can be achieved .The main concept of this mechanism is the Pedaling is converted into Rotary motion. Whenever a load is applied on the Pedal by Human effort [5-8].Then, the applied energy will be transmitted to the shaft which is placed inside the drum through chain spockets. By varying the speed of the shaft we can also performs the various operations like Drying, Soaking, Rinsing. The Pedal Operated Washing Machine can used effectively without electricity , it is cost effective Washing Machine made up of scrap materials available in our daily life and easy to build , it also required less maintenance.

The objectives of this project is as follows.
-Perform various operations like RINSING, WASHING, SPINING
-Low maintenance
-Low machine cost
-Reduces human efforts while washing clothes
-Suitable for washing any type of clothes
-easy to use
-washing of clothes can be done without electrical energy

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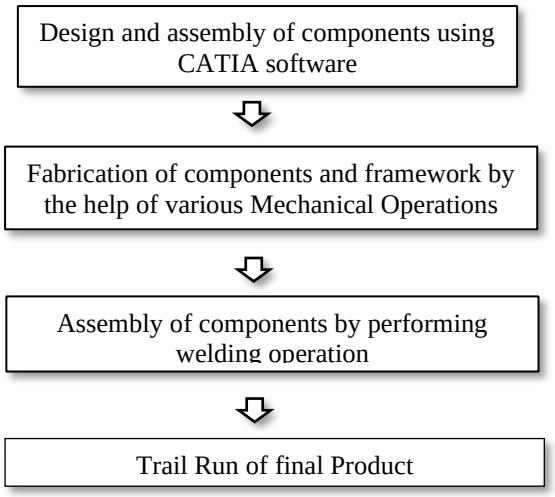
2. LITERATURE REVIEW

AUTHORS	TITLE	OBSERVATION
Hakizimana E (2020)	Design and Analysis of a Pedal Operated Washing and Drying Machine	To solve the issue of washing clothes and design a new generation for everyone in washing and drying clothes
Rahul Shrivastava (2021)	Design and Fabrication of Pedal Operated Washing Machine	To solve the problems faced by so many persons in their day-to-day life, while washing clothes
S. RAMANA BABU (2021)	Fabrication of Pedal Powered Washing Machine	To reduce the human effort for provides the easy washing in the rural and dark areas which are very far from the electricity and development
Adarsh Ranjan (2014)	Pedal Powered Washing Machine	To develop a new design for easy effort in washing, rinsing and drying clothes

3. METHODOLOGY



Flow Diagram 3.1: showing the block diagram of the methodology adopted for the present work

4. HARDWARE COMPONENTS

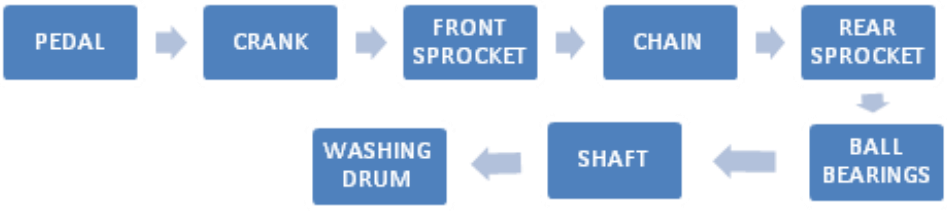
i. Pedal with Crank

ii. Chain Sprocket

iii. Ball Bearings

iv. Shaft

v. Washing Drum



Flow Diagram 4.1: showing the component fixing in a series manner

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5. MODELLING

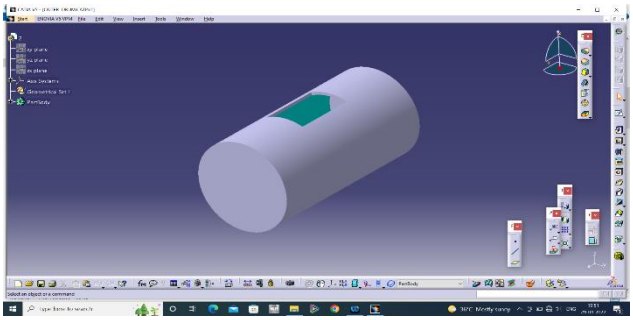

Fig. 5.1: Outer Drum Design in Catia

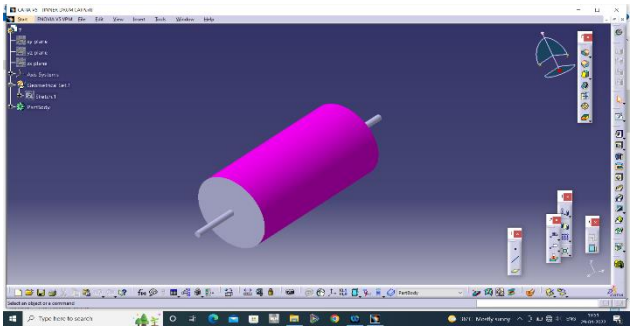

Fig. 5.2: Inner Drum with shaft Design in Catia

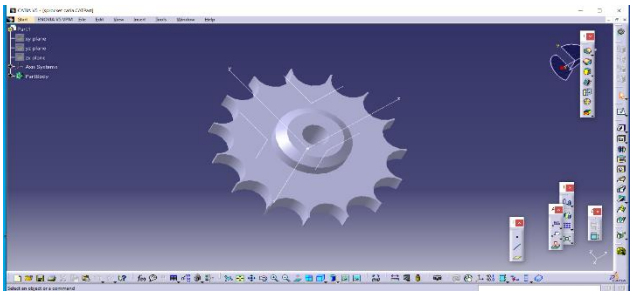

Fig. 5.3: Sprocket Design in Catia

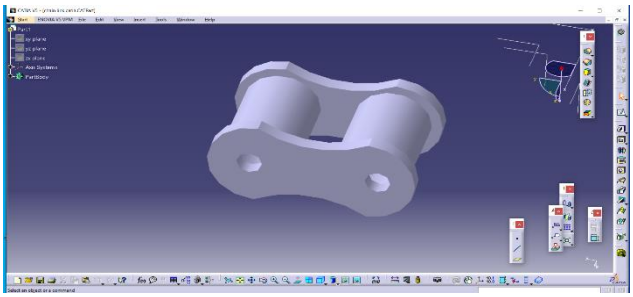

Fig.5.4: Chain Link Design in Catia

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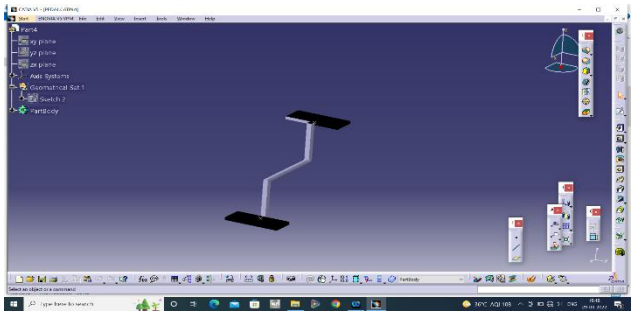

Fig. 5.5: Pedal Design in Catia

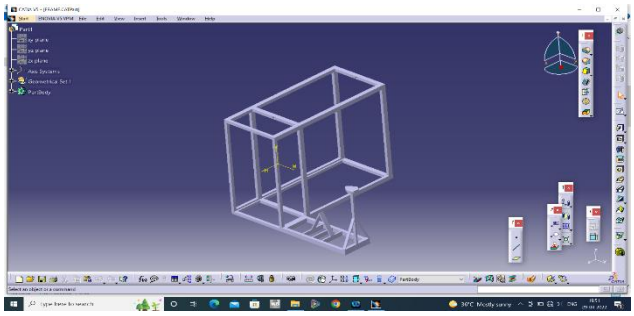

Fig. 5.6: Frame Design in Catia

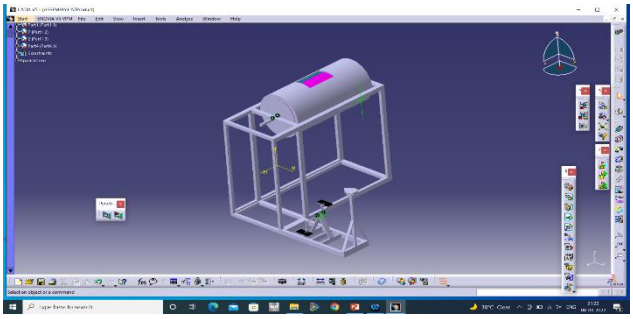

Fig. 5.7: Design of Pedal Operated Washing Machine in Catia

6. FABRICATION DETAILS

OUTER DRUM:

By the help of GI sheet, the outer drum has been fabricated. The GI sheet which is taken for fabricating outer drum as the given dimensions of 800mm x 600mm x 1.5mm. The diameter of the outer drum is 600mm, the length of the drum is 800mm and the thickness of the GI sheet is 1.5mm.

Fig. 6.1: Outer Drum

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FRAME:

The frame of the product has been fabricated using MS bar i.e., Angular (bend). The dimensions of the MS bar of thickness = 6mm and width of the bar = 40mm. By performing mechanical operation i.e., cutting, rolling, welding, grinding, the final frame of the equipment has been fabricated.

Fig. 6.2: Frame

INNER DRUM:

The stainless-steel sheet having small holes through the surface of the sheet is used for the fabrication of inner drum as dimensions of 600mm x 400mm x 1mm. The diameter of the inner drum is 400mm and the length of the inner drum is 600mm and the thickness of the stainless-steel is 1mm. By performing mechanical operation i.e., cutting, rolling, welding, grinding, the inner drum has been fabricated.

Fig. 6.3: Inner Drum

SHAFT:

Stainless-steel shaft of diameter 20mm and length 1000 mm is used for the rotation of inner drum. The shaft is exactly placed at the center of the outer drum and inner drum by using plummer block.

PLUMMER BLOCK:

For the smooth and steady rotation of inner drum. Two ball bearings are placed at either side of the drum. The shaft which is filled at the center of the inner drum will get support by the help of the bearings.

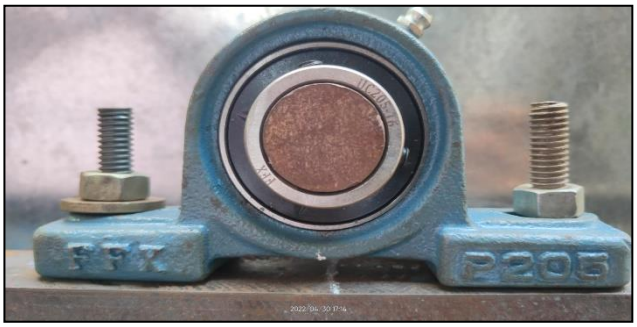

Fig.6.4: Plummer Block

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PEDAL ARRANGMENT:

The pedal arrangement is used for transmitting motion from foot lever to the shaft. Whenever a load is applied on the foot lever by the cyclist, the pedal gets rotated and the rotatory motion of the pedal is transmitted to the inner drum shaft which will tends to rotate the inner drum.

CHAIN:

Chain plays an important role for transmitting motion from pedal to shaft. The chain is placed between two sprockets. Larger sprocket is placed near the pedal and the smaller sprocket is placed near the drum.

Fig.6.5: Chain

7. WORKING PRINCIPLE

Whenever the operator applied a load on the pedal, the rotatory motion will be developed on front sprocket and the chain which is commonly connected between the front and rear sprocket. It will transmit the mechanical power from front sprocket to rear sprocket [8-12]. Then, shaft which is attached to the rear sprocket by the help of ball bearing will tends to rotate if the pedaling is done in clockwise direction then the shaft will tends to rotate in clockwise direction. Similarly, if the pedaling is done in anti-clockwise direction then the shaft will tends to rotate in anti-clockwise direction. A filter (inner drum) which is placed on the shaft will tends to rotate along the shaft which helps us to clean the clothes. Initially, open the door of the outer drum and inner drum. Put up the clothes in the inner drum. After that pour required amount of surf detergent, water and close the doors. Now sit on the seat and start pedaling the equipment [13-14]. After pedaling for 20-25 minutes, stop pedaling. Then remove the clothes from the washing drum and by the help of the drain valve, the water used for washing clothes which will be allowed to slow outside from the drum.

Fig 7.1 .PEDAL OPERATED WASHING MACHINE

8. EXPERIMENTATION AND TABULATION

To obtain the result of the performed experiment, we need to tabulate the values and plot the graph. Steps to be followed while performing the experiment are,

1. Half of the outer drum should be filled with water.
2. Only required amount of detergent should be added.
3. The required clothes for washing are added in the inner drum.
4. Due to load/force applied on the pedal, the pedal tends to rotate and it will transmit the motion towards the shaft of drum which helps in performing the operation of washing machine.

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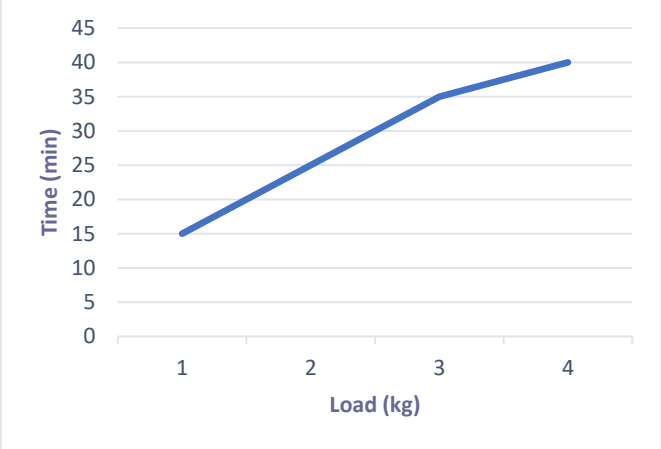
5. At the same time, we need to note the readings of varying loads with respect to time.

For Washing Operation values are:

SI. No	Speed (rpm)	Load (kg)	Time (min)
1	70	1	15
2	70	2	25
3	70	3	35
4	70	4	40

Table.8.1: Table of Washing

Graph:



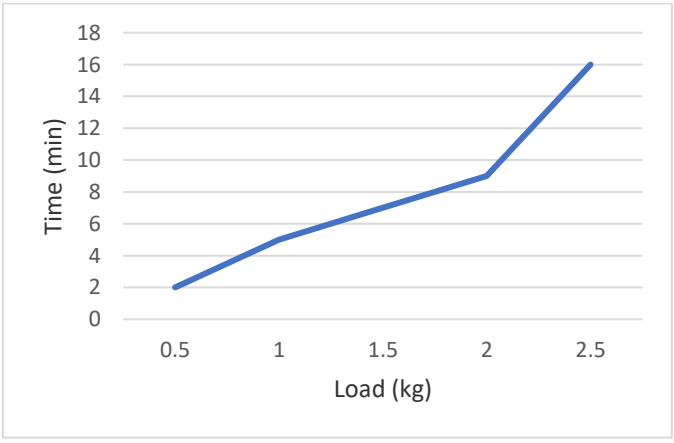
Graph.8.1: Graph of washing operation

For Spinning Operation values are:

SI. No	Speed (rpm)	Load (kg)	Time (min)
1	100	0.5	2
2	100	1.0	5
3	100	1.5	7
4	100	2.0	9
5	100	2.5	16

Table.8.2 : Table of Spinning

Graph:



Graph.8.2: Graph of spinning operation

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9.RESULT AND DISCUSSION

From the above experimentation, we can say that by varying the parameter i.e., load and time with respect to constant speed will alter from washing operation and spinning operation.

In the case of washing operation, at constant speed and different loads the time required for washing clothes will vary. As we increase the load of the pedal operated washing machine the time taken for washing clothes will gradually increase. Similarly, as the load on the pedal operated washing machine decreases then the time taken for washing clothes will also reduce gradually.

In case of spinning operation, for performing spinning operation the speed required for rotating the drum must be high. By maintaining a constant speed of the drum and at different loads, the time taken for spinning clothes will vary. As we increase the load of the pedal operated washing machine, the time taken for spinning clothes will gradually increases. Similarly, as the load on the pedal operated washing machine decreases, then the time taken for spinning will also reduce gradually.

10.SCOPE FOR FUTURE WORK

1.STORAGE OF ENERGY:

The excess of energy generated during washing operation can be stored in fly wheel and the stored energy can be utilized during spinning operation. Therefore, the cyclist need not to apply more force for performing spinning operation.

2.INCREASE THE WASHING MACHINE CAPACITY:

If the washing machine capacity increases, then more amount of clothes can be placed in the machine. The time required for performing washing operation can be reduced. At the same time, there will be some drawbacks i.e., it is difficult to perform spinning and drying operations of clothes when there is more load in the drum. So, we need to perform spinning and drying in different turns of operation. So, we cannot complete the whole washing cycle in single turn.

3.DEVELOP A MACHINE WITH MULTIPLE FUNCTIONS:

The excess energy generated during washing operation, can be stored in battery instead of washing it. Pedal operation is also used for developing various types of machines which is helpful for rural area people i.e., pedal operated wood cutting machine, pedal operated circular saw, pedal operated winnowing and pedal operated corn shelling machine.

11. CONCLUSION:

The main objective of the author is to fabricate an equipment for washing clothes which operates without consuming electrical energy. As the pedal operated washing machine is more useful for people who are living in rural areas and tribal areas. So, the components which are used for the fabrication of pedal powered washing machine are easily available in market at low cost. As our main focus is on cost-effective. The product has been fabricated using bicycle and other materials from scrap. The cost of the developed pedal powered washing machine is around Rs. 7000/- (Rupees of Indian currency) which was less than a low model washing machine currently available in market. The product which is fabricated has low maintenance cost, easy to operate, required minimal effort for washing clothes, low operational cost. It is also used in urban area for washing clothes at the same time they can also maintain their body fit instead of going for gym for maintaining body fitness.

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