



RESEARCH ARTICLE

PERFORMANCE OF A PEDDLING WASHING MACHINE

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ABSTRACT

Peddling washing machine is a very great innovation in its own. Peddling washing machine is specially made for the purpose of its utilization to wash the cloth by means of applying pedal. Today due to non renewable energy cries its basic need to utilize the energy from other way or save the energy. This project includes the construction and utilization of the peddling washing machine which can with any amount of requirement. The following pages in the report includes about the constructions of peddling washing machine, its raw material, it's working, benefits of the peddling washing machine with respect to actual electronics washing machine save the time, water, electricity and not very expensive. Its main expect is exercises with applying the pedal to wash the cloth.

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INTRODUCTION

Pedal power washing machine means applying the pedal rotate the drum attached with the shaft by means of chain drive and create the resistance (Turbulence) between inside drum water, cloth, powder to wash the cloth. "To support the basic family economy, through the design and distribution of bicycle machines, providing an efficient alternative for the rural development of India." Women in GUJARAT (also in India) wash clothes manually, but the detergents are chemically harmful to their hands, and the motion of scrubbing is Straining to the muscles. Our goal is to design an inexpensive and durable pedal-powered washing machine for use in rural areas to gently wash clothes. Due to cost constraints, the washing machine is to be shared among several families or canbe. Used by a local entrepreneur to run a laundering service. The washing machine must be easy to build and maintain locally with local materials, easy to operate (minimal required steps), and easy to power by women or children. It must also be more comfortable to use than manual methods and culturally acceptable in GUJARAT.



Peddling Washing Machine

Peddling washing machine

Mission

To support the basic family economy, through the design and distribution of bicycle machines, providing an efficient alternative for the rural development of India.

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It all started around 3 months ago, we are going around scrap yards, local dumps, and could not believe how much was being wasted. So we thought about trying to make something out of waste washing machines. A washing machine that was ecofriendly also helps get you fit so we built the pedal powered washing machine. It took about twenty weeks tinkering in the evening and many failed attempts to start with. But after a few attempts we noticed that the machine wanted to build itself so we worked with it, and after each hurdle we faced we just sat down and looked, and out of the blue the problem was solved this carried on for quite a while so you could say the machine built itself. The workings of the washing machine are so simple. All you need is an old washing machine to strip down, just the drum and shocks, we made a frame for the machine to sit on. We made a frame for the bike to sit on using the brazons on the bike connected the whole machine together and it worked!. This could help many people in developing nations, eco villages, conserve water, and of course get you fit.

Problem Statements

Women in India (Gujarat) wash clothes manually, but the detergents are chemically harmful to their Hands and the motion of scrubbing is straining to the muscles. Our goal is to design an inexpensive. Anddurable pedal-powered washing machine for use in rural areas to gently wash clothes. Due to Cost constraints, the washing machine is to be shared among several families or can be used by a Local entrepreneur to run a laundering service. The washing machine must be easy to build and Maintain locally with local materials, easy to operate (minimal required steps), and easy to power by women or children. It must also be more comfortable to use than manual methods and culturally Acceptable in India.

Design Specifications

The most important aspect in the design of the machine is its ability to perform as a device that eases the task of washing clothes. In order to be a viable solution in rural areas, the machine should be able to deliver the same quality of washing without adding excessive overheads (in terms Of water use, clothing wear, effort required to operate, etc.). Thus the design and operation of the Machine should be firmly grounded in the physics of clothes washing, with a special emphasis on the mechanical aspects (since water temperature and detergent composition are likely to vary). The group also identified a number of secondary goals with varying degrees of importance that could help make the machine more useful and thus more

successful. The ability to spin-dry clothes would increase water economy by requiring fewer wash cycles, and could relieve the strenuous task of manually wringing the clothes before they are hung to dry. If the layout of the machine allowed the user to perform manual work (hand-craft, food preparation, etc.) while pedaling, we could further reduce the amount of time consumed by washing. A number of safety features should also to be included in order to mitigate the inherent safety issues involved in a chain-driven machine. If the machine was to be used in a home, insuring its portability of would allow it to be shared among families, transported close to a water source for operation, or used in households where space is limited. Another set of specifications for load sizing, water usage and pricing, depend on the targeted Community. Since we are expecting the amount of laundry to vary between families, an initial size was selected based on existing washing machines, and designs allowing for easy re-sizing were preferred.

Analysis

Cleaning: Machine-washed clothes must be as clean as those hand-washed for 5 minutes [color]

Gentleness: Must wear clothes at slower rate than hand-washing [hole/tear growth]

Capacity: Minimum 3kg of clothes/load – should be easy to re-size.

Water: Effective washing must occur in soft and hard water at temperatures from 70-120_F

Water usage: Maximum 5L water / 1kg clothes

Active pedaling time for effective washing: Maximum 20 minutes each for wash and rinse cycles

Total operation time: Maximum 1 hour, including fetching water, filling, washing, draining, and cleaning machine

Power: Maximum 100W (comfortable level of human-power output)

Lifetime of structure: 10 years, assuming daily use

Manufacturing capital cost: 5000 Rs. (welder, metal cutter, shop tools)

Manufacturing location: Icit, Bhandu

Materials: local (shaft, bearing, weld able metals, galvanized drum, cycle parts, etc.)

Dimensions: Less than combined size of a cycle and commercial washing machine.

Weight: Maximum 30kg or 45kg if it has wheels (1 woman can move it indoors so it can'tBe stolen or damaged).

Culturally acceptable: Suitable appearance, user position and motion such that most Women are willing to use the machine.

Drum maximum rotation: 400 rpm without cloth and water, with 250 rpm.

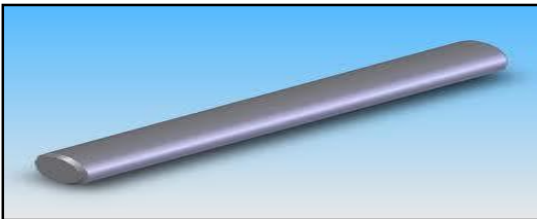
Final Design choices

Our final design resembles a commercially available horizontal axis washer. The inner drum which holds the clothes is currently constructed by modifying a plastic utility tub. Tubs like these are widely available in anywhere, but could easily be substituted for other types of buckets, perforated sheet metal or mesh, depending on availability. The inner drum is perforated, so that spinning the drum will extract water from the garments. There are also three triangular fins inside the inner drum that agitate the clothes during the wash cycle. The main structure of the machine consists of a simple tube frame. The frame can be built by modifying an existing bicycle frame. The inner drum is mounted on one side of a pedal shaft. Rotational force turns the drum via a drive gear attached to the opposite side of the pedal shaft. A bicycle chain connects the gear at the drum to a set of pedals mounted on their's frame.

The pedals are mounted close to the ground so that the operator can pedal the machine while seated. In a regular chair. There is an outer barrel that surrounds the inner drum and contains all the water. In our current design, the outer barrel is constructed using a common plastic oil drum. The operator loads and unloads clothing from the inner drum through a cutout on the side of the outer barrel. The operator drains the soapy water and rinse water by opening a drain valve at the bottom of the barrel. A convenient feature of the peddling washing machine is the optional table mounted above the structure. The operator can use her hands to do manual work like weaving while pedaling the machine. Women are expressed interest in this particular feature.

Part of the washing machine

Shafting



Here we are using a iron-hollow shafting. It is a main base for the mounting the flywheel, fins and both the drums. It is shown in figure .first of all when we applying the pedal this shafting is rotated by means of chain drives.

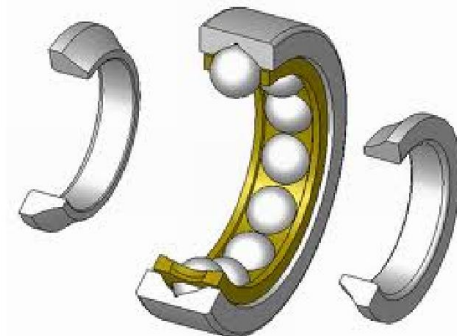
Gearing



The machine uses a regular mountain bicycle transmission which can provide gear ratios between 1:1 and 3.5:1.

The user is expected to turn the pedals of the machine at about 60 rpm for the wash Cycle and a higher 80 rpm during the dry cycle, where the lack of resistance from water makes Pedaling easier (continuous pedaling is not necessary in this case). With a inner drum diameter of 19in, at a 1:1 gear ratio, pedaling at 60rpm results in a centripetal acceleration on the clothing of about 0.87 g, which results in efficient clothing tumbling. For the spin cycle, the user would switch to the highest available gear, and a pedal speed of 80 rpm results in an acceleration of 18.5 g. This has been shown to extract 50% of the water from wet cotton clothing (remaining water weight in clothing is approximately 90% of the dry fabric weight - comparable to commercial vertical axis washing machines).

Bearing



Sliding Bearing and Rolling Bearing

Bearing are used as a mechanical component to transfer the power and to move a certain part, and is done by utilizing the small frictional forces of the bearing, which makes rotates easily withstanding the force and weight load acting against them. Bearing house be classified into two major groups, namely, sliding bearings and rolling bearings, depending on their friction type. Three types of bearing are shown in fig. and ball bearing has balls between inner ring and outer ring and roller bearing has rollers instead of balls. Either balls or rollers of rolling bearings serve the same purpose as the lubricating oil in the sliding bearings.

Rolling bearing have some advantages as listed below, compared with the sliding bearing.

- Because bearing specifications are standardized internationally, most rolling bearing are interchangeable, and could be replaced easily with the made by different manufacturers.

- Surrounding structures of a bearing could be simplified.
- Easy to diagnose and maintain.
- Comparatively easy to be used even under the high or low temperatures.
- The rigidity of bearing could be increased by applying preload.

Flywheel



Here we are using a 20 teeth back wheel of the cycle flywheel. It is attached with the shafting and another end with the cycle big flywheel by means of chain drive. It is shown in figure.

Fins



We are using an opposite shaped fins to creates the turbulence inside the drum water and cloth. We are using second hand fins of the A.C. It is attached with the shafting by means of gas welding. When we applying the pedal shafting are attached by means of flywheel there for fins also rotated with the shaft in the drums.

Drum

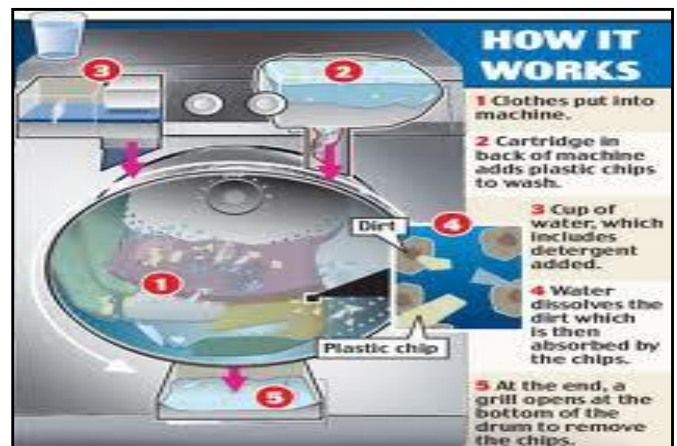


Here we are using a galvanized drum. First of all we are thinking about the plating drum, but after practice we are failed. Then we decided the used heavy structure drum of the galvanized drum both inner and outer. Drum is shown in figure. It is a main important part of the peddling washing machine because of all load of water; cloth is rotated by with drums. So it's required heavy structure.

Water Usage

The diameter of the outer tub is 23 inches, and depth 22 inches. Our machine is not optimally efficient in terms of water use, since the plastic construction of the inner drum required larger clearance between the two tubs in order to prevent contact during the spin cycle. The front of the Outer drum also extends considerably past the front of the inner drum to provide easy access for Clothes. With approximately 1/3 of the capacity of the outer drum filled with water, the machine requires about 10 gallons of water. Total water usage for one load of laundry ads up to approximately 20 gallons, half of which is used for the wash cycle, while the other half is used for the first rinse cycle. The water from the second rinse cycle, containing just soap, can be reused for washing the next laundry load. We expect that clever design would allow for sizeable reduction in the water Requirement in the next prototype.

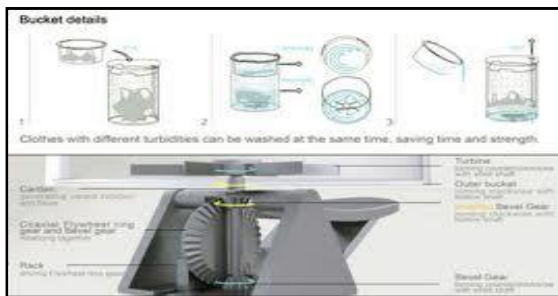
Working of peddling washing machine



The main important thing is how the pedal powered washing machine works?

Here after manufacture we are starting a working of the peddling washing machine. First of all open the both the door of the inside and outside drums. Then put up the cloth in the drum. After put up the cloth according to requirement put the 5 to 10 liters water and the washing powder. Now close the both the door. And sit on the cycle and starting up to applying a pedal with slowly.

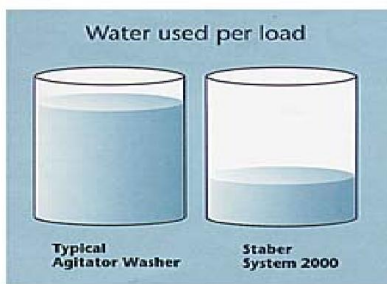
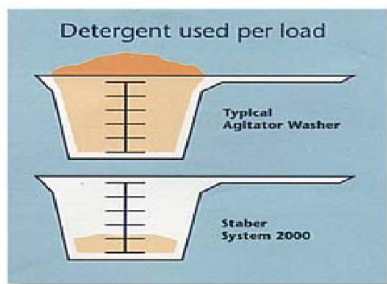
After 15 to 20 minutes applying the pedal stop the applying the pedal and see what's happens. Then removes the inside water with the help of below pipes in the one doll or other objects. After removing the water apply the some pedal its gain the heat inside the drums and its help into the drying the cloth. Then remove the cloth from the drum.



This way working of the peddling washing machine is done also working is easily understand showing the above figures.

Savings (or advantages)

Loads per Week	Gallons of Water Saved per Year	Gallons of Detergent Saved per Year	kWh of Electricity Saved per Year	Total Savings in Rs./- per Month	Total savings in Rs./- per Year
6	8,856	8	839	1020	12838
8	10,824	10	1,025	1372	16464
10	13,777	12	1,305	1666	19992
12	16,729	15	1,585	2009	24108
14	19,681	17	1,864	2303	27636
16	22,633	20	2,144	2597	31164



Value and service

- Uses 66% less water than a top load agitator washer
- Uses 50% less energy than a top load agitator washer
- Uses 75% less laundry additives than a top load agitator washer

Ease of use

It is easy to use by younger and older women. After loading the machine, Washing requires three cycles. Between each cycle, the drum spins quickly to draw the water out Of the clothing, as it drains out of the drum. In the first cycle, water and detergent are added to the drum. The operator pedals the

machine for roughly 25 minutes, spins, and drains the water. The next two cycles are rinse cycles. In each rinse cycle, the operator pours clean water into the Machine, pedals for 10 minutes, spins, drains the drum. After the last rinse cycle, the operator Spins the clothes dry and saves the slightly soapy water for the next wash cycle. Our research into existing washers and our earlier prototypes indicate that the power required for washing and spinning is relatively low. We demonstrated that it is not difficult to spin a perforated Plastic drum up to extraction speeds with clothes inside. For these experiments, we used a Geared transmission from a bicycle. Both younger and older women can generate enough power for the wash and spin cycles. We Estimate this power to be 50-75 watts. While familiarity with pedaling in general and the machine In particular will reduce the effort expended by the user, no prior experience will be necessary forIts operation. The ability to change gearing ratios will allow some level of tuning to individualUsers and also allow for shorter wash times with more power input or conversely less strenuousOperation if the user can pedal for a longer amount of time.

Critique of prototype

Inner barrel instability



The inner barrel was cantilevered from a rotating shaft supported in a bicycle bottom bracket. Since the plastic was so flexible, the inner barrel distorts quite a bit during rotation and needs a large clearance within the outer barrel to avoid collisions. Frequent use would probably lead to fatigue failure of the bucket, shaft, or bearing.

Next generation prototype

Double supported inner barrel

The inner barrel will be supported at both ends fixed to a rotating shaft. Since the first prototype had one open end to allow for side-loading, alternative loading mechanisms must be designed. One option is to have a trap door in both the inner and outer barrels. Another is to make one of the supports for the inner barrel movable so that the inner barrel can still be opened and accessed from the side.

Different materials for outer barrel

We are considering using a steel oil drum so it can be welded directly to the structure. Welded attachment points would not require any bolt holes that need to be sealed. The oil drum may also be shortened by cutting off the end, and welding on a steel lid. Steel would also be more rigid than the plastic drum we used for the initial prototype, so it would be easier to align the

barrels and avoid collisions during rotation. We are also considering using a cement basin that has the structure incorporated into it. This would make the machine much easier to manufacture because most of the machine would be a single intact piece.

Advantage

Having a washing machine will make you forget about Laundromats. If you buy one, you will have enough freedom to wash clothes when you need to with comfort. The greatest washing machine's advantage is time. Just think about all the things you could be doing while clothes are being washed. Although prices are high, your time is precious. Specially, if you are with your family or performing activities you like. If you have your own washing machine, you can determine what kinds of washing procedures you need for each piece of cloth and you do not need other people to do it for you.

- Uses less water, power, and soap
- Cleans as well as commercial washer with similar capacity
- Spin dries so no wringing needed
- Comfortable to use
- Enables women to do more rewarding things
- Technology for women
- Community investment that also benefits the poor
- Sustainable with local production and maintenance
- Replicable anywhere with bicycles
- Save the water.
- It is a non-polluting, as well as not using any types of electricity.
- Also we get the advantage of exercises with washing the cloth by means of applying the pedal.

Disadvantages

The washing machine needs detergent, and water. This means an increase of consumption and expenses in your house. If you are about to buy a washing machine, you should bear these items in mind as future expenses and analyze your economic possibilities. The washing machine occupies too much space. If you generally change spaces or live in small apartments, having a washing machine will be a disadvantage for you to move around and for the machine too.

Application

- It is very useful into the local rural areas.
- Saving in detergent and the water
- Scale free tub
- Reduced traces of detergent on clothes
- Better wash quality
- Softer clothes
- Easy to operate and the less effect of chemical on the women hand.
- Exercise is also done with the applying the pedal.

Conclusion

From the above project, it can be concluded that the "peddling washing machine" is a very simple yet very powerful design of washing cloth which if brought into application in the rural areas of the developing countries can aid a lot of plight and the suffering of the poor peoples who find it very difficult to wash cloth by means of hand. Thus it is used as a application keeping in mind the social welfare of the peoples of the rural areas. Also It is safe in working condition and hence it does not require any safety guards during operation. The cost of maintenance is a low and it has a long life.

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