

DESIGN AND FABRICATION OF PEDAL POWERED WATER PURIFICATION SYSTEM

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Abstract: This paper analyzes the design of a pedal powered purified water supply device to be used by local dwellers. It consists of reciprocating pump with pedal power. It works on the principle of compression and sudden release of a tube by creating negative pressure in the tube and this vacuum created draws water from the sump into the pump while roller push the water through to the filter where adsorption takes place to purify the water. This paper proposes to take on challenges associated with the accessibility and purity of water in developing countries by designing and building a filtration and that are portable, durable, and cost-effective. Pure water is very much essential to survive, but now a days the water is getting contaminated due to Industrialisation which leads to many water-related diseases. A reciprocating pump will be used to pull salt water out of one holding tank, pass through a filtration system (membrane), and onward into a clean tank while the rider pedals the bicycle. Both the holding tanks and the filtration system will be incorporated into the design of the entire system that is portable and can be easily retrofitted to most standard bicycles. Water is the most basic necessity for life and many of the people in the world lack access to it. In many developing countries, people walk many miles to reach a source of water that is not portable. The functionality of the pump and filter system needs to require as little maintenance as possible. The design must also be user-friendly as the assumption will be made that users will have no experience with any vehicle of this type. Once the design is optimized, materials within the build will be considered to find the most cost-effective method of manufacturing. This design will reduce the labor, cost and weariness caused by transporting and sanitizing drinking water for use in the homes of villages. In operation by pedalling the cycle, man power is converted into mechanical energy which is further converted into hydraulic energy in reciprocating pump.

Keywords: Bicycle pedal crank, Reciprocating pump, Pure water, Eco friendly, Power consumption, Cost Saving.

1. INTRODUCTION:

Developing countries around the world face challenges accessing safe and clean drinking water. Alarming statistics led us to the idea that that we could use a simple mechanism of transportation that is common in these areas, such as the bicycle, to help aid their water and struggles. Our goal is to design a bicycle attachment to purify and transport water from contaminated sources that is active while the rider is pedalling. This attachment, though not a permanent solution, would be a contribution to the improvement of their quality of life. Our motivation from the idea of quickly aiding those less fortunate areas, as well as providing a backup should those regions run into contamination problems within their local wells. Pedal Powered Water Purification is simplest form of water purification and it is an eco friendly system. It works on the basis of mechanical energy without electricity. It is a portable thing and can be transferred to the various irrigation places. Pedal powered water purification consists of reciprocating pump operated by pedal power. The reciprocating pump is mounted on the stand in such a way that the connecting rod of the piston (reciprocating pump). By pedalling the crank, the crank rotates, thereby rotating the reciprocating pump which in turns discharges water from the container and transmitted to pre filters which purify the water simultaneously. It can be also used as automatically with help of vehicle machines.

The project has the following objective

- Provide a low cost machine.
- Replacement of the filter membrane is easier
- The mechanism is Pedalling, Processing and filtering

2. LITERATURE RIVEW:

Literature view is carried out for what has been studied and what is being modified regarding the project and what the earlier work has done on the project.

- Ademola Samuel Akinwonmi et. al (2012)has prepared pedal power water purification and design was focused on process of conception, invention, visualization, calculation etc. he also made a force analysis to check performance criteria. The physical parameter of design was determined by the appropriate calculation and the practical consideration with some reasonable assumption. It is discovered that the design is simple, cheap, efficient and affordable as could be seen from the readily available materials used. It also use the Bernoulli's principle for the flow calculation with the help of peristaltic pump.
- Betzabe Gonzalez et. al (2014) has studied on the design and he used peristaltic pump with silicone tubing. This tubing was visually better suited for our project having no kinds to reduce flow, easy to clean and flexible enough to create suction between rollers. Sidecar is added to the bicycle for the two tanks setup one of dirty water & other of clean water tank for utilization around the home. Filtered water we get through this design.
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3. MATERIALS:

NAME OF THE MATERIAL	TYPE OF MATERIAL	QUANTITY	COST OF MATERIAL
1. BI-CYCLE(setup)	CAST IRON	1	300/-
2. CONNECTING ROD	TUBE ROD	1	50
3. PISTON & CYLINDER	CAST IRON	1	450/-
4. CONTAINER	PLASTICS OR GLASS OR MICA	2	200/-
5. FILTER	ULTRATHIN POLYAMIDE, POLYSULFONE & POLYESTER	1	1750

4. METHOD:

A pedal powered water purification system is simplest form to purify water. The main platform of the project is to convert salt water into fresh water. The basic principle applied in the water purification is Bernoulli's principle and it states that an increase in the speed of a fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy. During pedaling the mechanical energy is converted into potential energy, where the pedal crank is fitted with the connecting rod so that it connects the piston & cylinder, the flow of water in the pipe and piston rod forces the water to through the membrane and pure water be collected on the container. Flow rate of this membrane is 10 LPH (below 1000 ppm) minimum which depend upon pressure and input water quality. It can purify water 8 to 15 Litres per hour. **After completing 1 rotation 0.15 calories will burn. 600 rotation=90calories.**

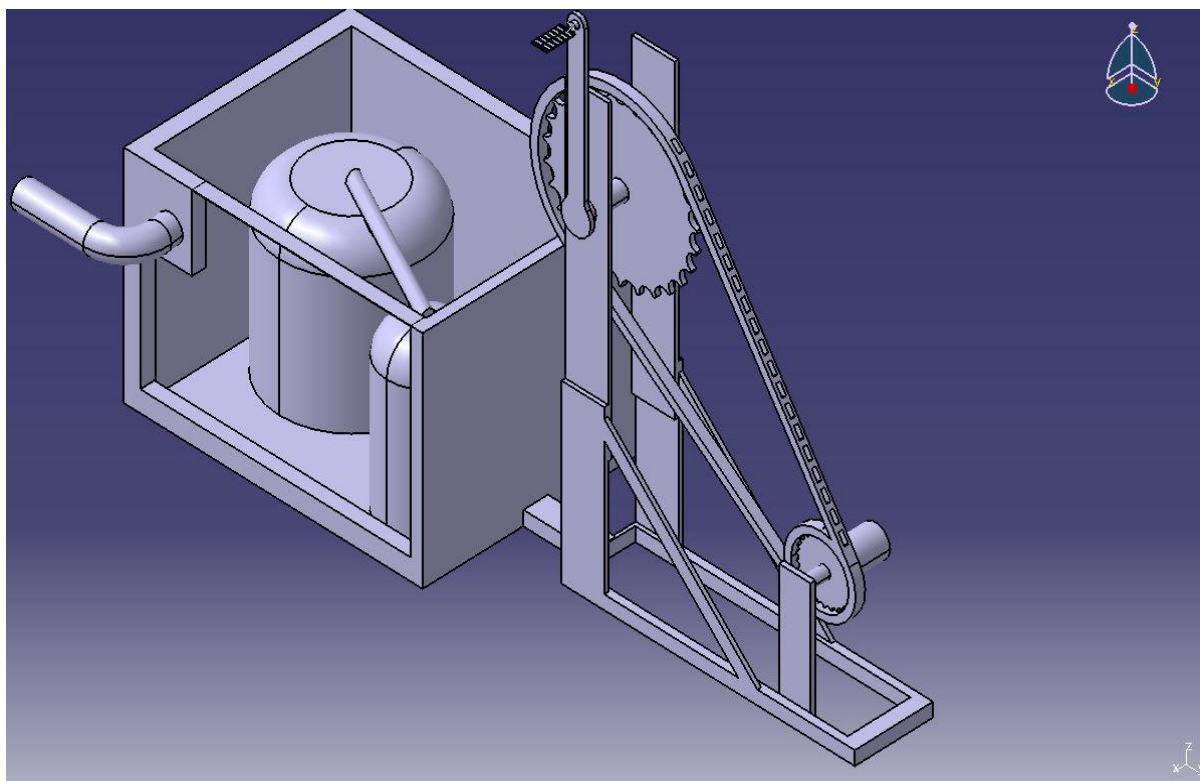


FIGURE 1.1

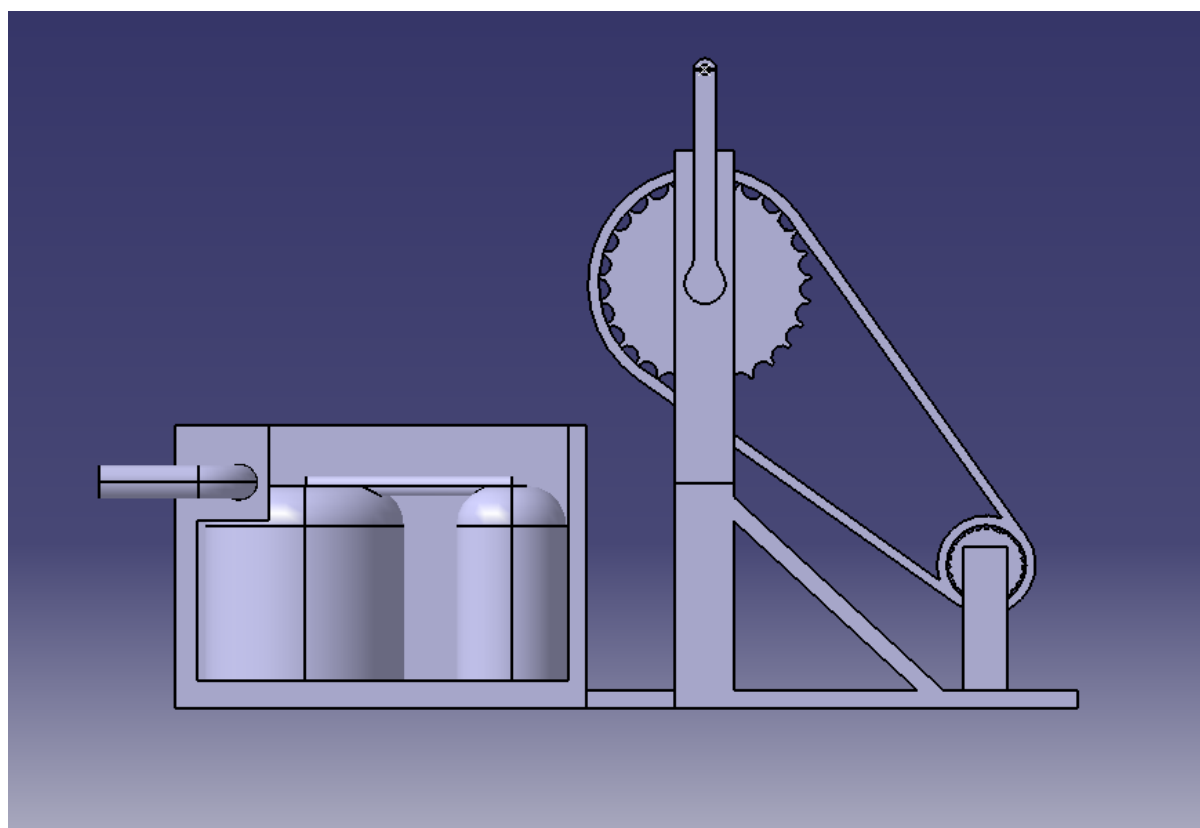


FIGURE 1.2

5. DISCUSSION:

- It is Low cost and helpful in rural areas.
- It will not need any types of electricity.
- Comfortable to use.

6. ANALYSIS:

- **Capacity to purify:** Minimum 75 Gallons per Day
- **Water usage:** Maximum need of capacity
- **Peddalling time:** Maximum 15 minutes each for purifying water
- **Total operation time:** Maximum 20 minutes, which depend upon pressure and input water quality
- **Lifetime of structure:** membrane should be changed thrice a month
- **Capital cost:** Rs.2770/- (welder, membrane, tds machine)

7. RESULT:

- It is very useful in rural areas.
- It is very much useful in summer seasons.
- Usage of electricity is not needed.
- Fresh water can be obtained.

8. FLOWCHART:

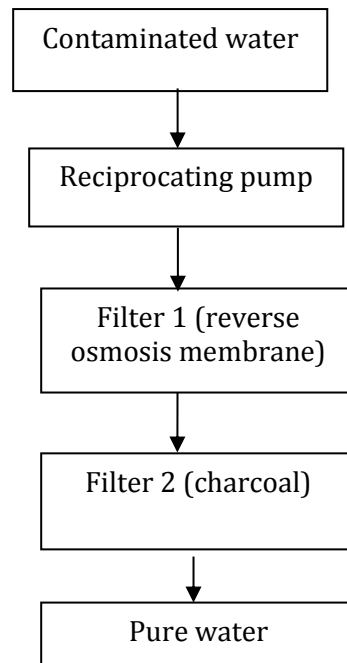


FIGURE 1.3

9. CONCLUSION:

Pedal powered water pumping and purification meet these problems as this system only works on pedal powered there is no need of electricity neither to pump nor to purify the dirty water. The benefits associated with access to safe drinking water provide a increased source of allocation to intervention for improving current drinking water situation. Pedal powered water purification reduces the rising energy costs. Pedal powered water purification is design as a portable one which can be use for irrigation in various places. The experiment was executed and performance of the pedal powered water purification had carried out. So in this paper we have proposed that the pedal powered water purification will give a considerable amount of discharge and head of the purified water.

The pedal powered purified water supply system is an invention that utilizes simple technique and puts them all together to help villages in developing countries to have daily access to safe drinking water all by harnessing the energy of pedal power.

The project has mainly aimed that all the people would get safe drinking water by means of simplest process, without electricity and every people of the developing country will deserve it for the cause of drinking.

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