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Pedal Operated Low Head Water Pump

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Abstract: ***The primary goal of this project was to design, construct, and conduct an experimental investigation into the operation of a Pedal Powered Water Pump (POWP), which is used for irrigation of gardens and local drinking water supplies. POWP is made up of a pedal-powered pump. The single-acting pump is set up on its stand such that the driven shaft of the pump is directly in line with the wheel of the bicycle. By moving the connecting rod forward and backward while pedaling, the bicycle rotates the pump, which releases water from the sump. POWP offers irrigation and drinking water in rural areas without electricity. POWP offers clean air, no pollution, and wholesome activity. POWP lowers the rising cost of energy. POWP is intended to be a portable irrigation system that may be utilized in a variety of locations. The experimental inquiry was carried out, and the POWP's performance was tested at various rpms. The findings show that the POWP had discharged a significant amount. The POWP uses solely manual power, which significantly lowers the utility expense. According to experimental findings,mechanical energy is employed to elevate water up toa height of 2 to 5 feet.***
Keywords: Pedal, pump, head, power.

I. INTRODUCTION

Pumping water is a concept that has existed since the evolution of civilization. As a result of the crucial part that pumping plays in human life on a daily basis, various techniques for moving waterhave emerged over time. The availability of water has been a very serious problem, primarily affectingrural regions. One of the most significant blessings from nature to humanity is water. Since it is one of the most crucial components of excellent health, it ought to be easily accessible to everyone.

Over the years, various approaches and techniques have been used to handle this issue, from manually operated pumps to more effective but more expensive electrical and internal combustion engine powered pumps. This endeavor aims to create a novel product that is totally devoid of any electrical or mechanical power sources. Rural residents will easily be able to buy and access this, and all children and women included will find it simple to use. This will be simple to move from one location to another and put up without difficulty. manufacturing is simple with the resources at hand. Cost-effective, readily maintained, and adaptable for use as irrigation or as a pump for other liquids.

II. OPERATION OF THE PUMP

A pump is a device that raises or moves liquids by requiring power. It is either a device that converts mechanical energy into liquid potential and kinematic energy or a machine built to elevate, transport, and move different kinds of liquids.

Positive displacement pumps known as pistonpumps use oscillation mechanism as opposed to reciprocating motion to move fluid. They can be made to move gases, liquids, or mixtures of the these. Their capacity is regardless of piston speed, just like pumps used in engines. the upstroke of thepiston draws water, through a valve, into the lower part of the cylinder. On the downstroke, water passes through valves set in the piston into the upper part of the cylinder. On the next upstroke, water is discharged from the upper part of the cylinder via a spout. This type of pump is limited by the height of water that can be supported by air pressure against a vacuum.

III. MACHINE DESCRIPTION

The bicycle transmission unit, pump unit, and piping unit are the three main parts of the machine. The bicycle transmission unit includes the chain drive, sprocket, pedal, gear, bicycle frame, and wheel. The pump unit includes the pump cylinder, piston, connecting rod, rotating disc, bolt, and nut. The piping system includes the inlet and outlet valves. Bicycle pedals are used to operate the pump.

A. Bicycle

It is the project's primary driving force. The used frame is a typical bicycle frame with a rear wheel, frame, and additional components as needed.

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Figure 1: Bicycle Frame

B. Chain Drive

Power is sent from one end of a chain drive to theother. A chain drive is characterized as a network oflinks joined together at pin joints. In order to jointhe ends of sprockets, the roller chain is necessary. Chain drive attaches the pedal to the bicycle's drive wheel, which is coupled to the sprocket.

C. Pump

The pump set and includes a housing in which a foot pedal and drive shaft rotate an eccentric pin rotating with the drive shaft moves a connecting rodwhich in turn causes push rod to move linearly. Thepushrod extends into a pressure tight chamber formed above the rising main. A pump rod connected to the push-rod extends to the conventional plunger through verified motion.



Figure 2: Pump

IV. DESIGN COMPUTATIONS

The designing of Pedal operated centrifugal water pump requires complex analysis in order to lift the water at particular height, at which the water has to be lift.

And according to that the pump has to be chosen and after that the size of the cycle that can lift up to that height and should be quite cheap and easily fulfil our requirement.

The project's construction is made up of a few key components, with the bicycle serving as the major one because it supplies the mechanism for operatingthe pump that is attached to it. The rear wheel of thebicycle has a 500mm wheel base, making it a general-purpose bike. The piston of the pump isconnected to the disc of which the pump by the sprocket of the wheel that is attached to the disc. The various parts are firmly fastened together using nuts and bolts.

V. SPECIFICATION

The materials and components for fabrication of thepedal operated water pump are here after the evaluation and various factors also to choose ideal material for the project. The material specifications are presented in Table 1.

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Table 1: Material specifications

S/N	Materials	Specification
1	Disc	40 cm
2	Pump	40 cm
3	Pump Stand	100 cm
4	Water Tank	16.5 lire
5	Connecting Rod	40 cm
6	Water Inlet Pipe	½ inch
7	Water Outlet Pipe	1.5 inch

VI. FABRICATION

This research's manufacturing process took place in Department of Mechanical Engineering at Swami Keshvanand Institute of Engineering Technology, Management & Gramothan, Jaipur. Figure (whatever) depicts the machine in an isometric perspective. The first step of making power operated water pump is the preparation of the stand.Scarp mild steel pipes are made into sufficient pieces and are welded together to get the stand.From the market, the cylinder and piston were carried, and they were mounted on the stand. The stand rod of diameter 4 cm and length 600cm which was machined to 100cm and another two pieces of 65cm on the lathe. A mild steel shaft measuring 30mm (again) and 50mm in length was used tomake the connecting rod. The connecting rod was then machined on a grinder to a length of 40cm. A rotating disc was made from 80mmx80mm mildwooden ply sheet and was 40mm in circumference. The suction and delivery pipes are then connected to the suction and delivery ports respectively



Figure 3: Fabrication Process

VII. Testing

During testing time, we faced lots of problem related to slip between piston and connecting rod. But finally we obtained this data. Through this project we want to reduce human efforts.

A. Tables

The testing our according to man weight, wheel speed (rpm) and the time (sec) taken by pump to filled water in water tank up to the mark (15 liter). Table 2 shows the Reading of Inlet Pipe Distance (0.5 m). Table 3 shows the reading of inlet pipe of distance(2m).

Table 2: Reading of Inlet Pipe Distance (0.5m)

S/N	Conditions	RPM	Time
1	Low	115	45 sec
2	Normal	178	39 sec
3	Fast	232	30 sec

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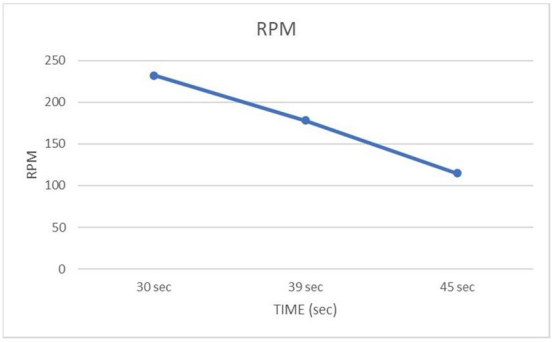


Figure 4: Testing data- RPM vs Time

Table 3: Reading of Inlet Pipe Distance (2m)

S/N	Conditions	RPM	Time
1	Low	117	75 sec
2	Medium	171	60 sec
3	Fast	226	55 sec

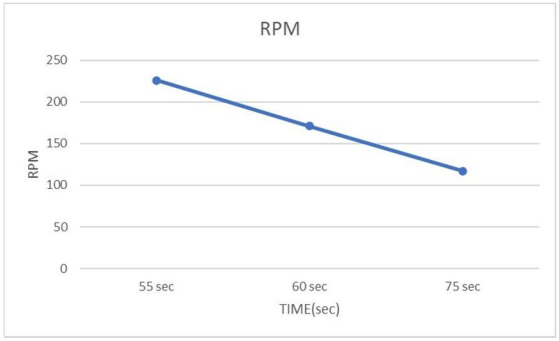


Figure 5: Testing data- RPM vs Time

VIII. ACKNOWLEDGEMENT

Whenever a person pedals, mechanical energy is transmitted to a flywheel, where it is transformed into rotational energy. The connecting rod that is attached to the single acting piston of the cylindricalpump is made to travel forward and backward whilethe bicycle is being pedaled. This causes the cylinder pump to oscillate back and forth. The pump produces a vacuum inside the cylinder as it moves backward, sucking water out of the sump or tank. As a result, mechanical energy rather thanelectrical energy is used to move the water.

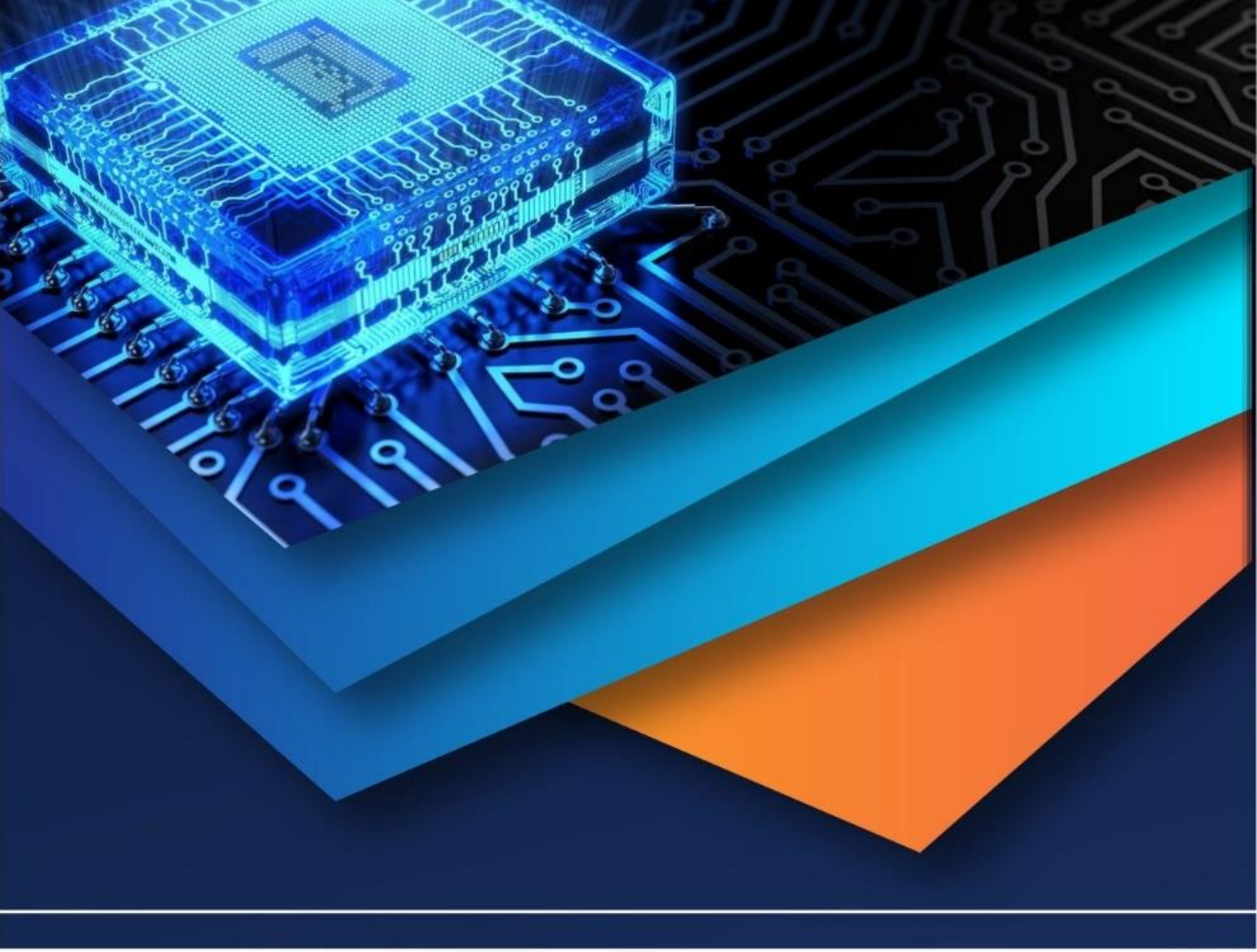
IX. CONCLUSION

The whole research on the subject concluded that bicycle-powered water pumps with wheels were particularly useful in rural areas. In India, there is a severe energy crisis, and many rural areas have powered water pumps. By using this project, we can save electricity, obtain a specific water head, and deliver water for irrigation. As part of the project, we will use a bicycle mechanism to drive a water pump so that we can fill the water tanks of homes and perform building work. The wheel of a bicycle rotates when it is being driven, therefore we can provide a disc over the wheel that is mounted with the sprocket, which is further connected to the connecting rod, and lastly the connecting rod to the pump. Therefore, this project is installed everywhere there is water, and the pump is operatedto supply the water at a specific head.

For populations without access to or with little use for electricity, develop a straightforward and effective method of pumping water using a human-powered bicycle. A remote settlement that eitherhas or does not have electricity needs effective water pumping. It can also be placed in a garden, permitting simultaneous cycling and gardening. In comparison to a modern water pumping machine, manufacturing costs are lower. The power savedand the beneficial workout for everyone. Since it is powered manually, fuel is not needed. The cost of operation and maintenance are both low. The activity is not too noisy.

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