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Lifting of Water by using Simple Pendulum with Solar Energy

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Abstract: Water pump with a pendulum is a very simple solution for pumping water. It provides reduction of work; it was enough to move the pendulum by just switching on the motor to pump with large swings. Work is reduced because easier,effortless and long-lasting use of the hand pump has been enabled. Input energy for starting the process of pumping, in form of power supplied by solar panel connected to battery then to the motor of the pendulum, is much less than with typical hand pumps. Whereas typical hand pumps require significant effort and an average person can use the pump continuously only for several minutes, the pendulum pump needs the minimum of the effort, because it is only necessary to switch the motor that is connected to the pendulum and maintain the oscillation for several hours, without any fatigue. Here, under this work, pendulum operated pump is fabricated. The study explains the effect of creating the free energy in the device made of a) Oscillating pendulum lever system, b)system for initiating and maintaining the oscillation of the pendulum, c)system which uses the energy of the device by damping the oscillations of the lever. The operation of the machine is based on forced oscillation of the pendulum, since the axis of the pendulum affects one of the arms of the two armed lever by a force which varies periodically.

Keywords: Hand Pump, Solar Panel, Motor, Battery, Frame and Pendulum.

I. INTRODUCTION

New and technically original idea hand water pump with a pendulum - provides alleviation of work, because it is enough to move the pendulum by just providing power supply to the motor to pump the water, instead of large swings. Using the minimum of human strength in comparison to present classic hand water pumps enables efficient application in irrigation of smaller lots, for water wells and extinguishing fires even by old people and children, which was proved by a large number of interested future consumers during the presentations. Hand water pump with a pendulum is a realization of a new, original, and even unbelievable, by very simple solution for pumping water. Work is alleviated because easier, long-lasting and effortless use of the hand water pump has been enabled. Input energy for starting the process of pumping, in form of electricity to the pendulum, is much less than with typical hand pumps.

Hand water pump with a pendulum for pumping water out from wells or reservoirs consists of a cylinder with a piston, lever system, a seesaw, a pendulum, a reservoir and output water pipe. To get the water running out of the pump, the pendulum needs to be out of balance. After that, based on gravitational potential, the piston starts oscillating and the continuous stream of water is coming out of the output pipe in the old type of pendulum water pumping method. The pendulum should be occasionally pushed, to maintain the amplitude i.e. the stream of water but now the this pushing is made as automatic using a motor connected with the pendulum. The pump works well with all sizes of the pendulum, but mainly with the amplitude of 90°. The advantage of this invention compared to present hand pump solutions are: less power is required to start the pump, less water consumption, both arms can be used to fetch the water. The invention is applicable on other devices that use lever mechanisms, such as a hand press etc.

Energy has been universally recognized as one of the most important inputs for economic growth and human development. There is a strong two-way relationship between economic development and energy consumption. On one hand, growth of an economy, with its global competitiveness, hinges on the availability of cost-effective and environmentally benign energy sources, and on the other hand, the level of economic development has been observed to be reliant on the energy demand. In the recent years, India's energy consumption has been increasing at one of the fastest rates in the world due to population growth and economic development.

II. LITERATURE SURVEY

Lin et al. [1], from The State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University, China were acquired experimental data from the semi-physical test rig and analysed validate the

energy transmission strategy of dual-medium and Communication Indian Institute of Technology, Roorkee, India presented an approach for the swing up and stabilization of a rotary inverted pendulum (RIP). RIP system is an unstable, multivariable, under actuated and highly nonlinear in nature. RIP consists of a pivot arm; the pivot arm rotates in a horizontal plane by means of a servo motor. The opposite end of the arm is attached to the pendulum rod whose axis is along the radial direction of the motor. The task is to design a controller that swings up the pendulum, and keeps it in upright position. Swing up action is based on the energy principle whereas stabilization pressurize. An onshore pendulum WEC test rig is built to validate the above proposals. A hydraulic cylinder is substituted for the wave that exerts force on the pendulum. Although the force and the output power in the simulation are somewhat different from those in the test results, the overall tendency is the same, and the dual power stroke in one period is clearly shown.

Rahul Singh et al. [2], from Dept. of Electronics uses Takagi Surgeon Fuzzy controller. A mode controller is used to decide which control action is to be implemented. Mode controller is the third approximation. In contrast, the traditional linearization procedure is not always faithful. Alternative characterizations of stability are also presented. They are based on degree theory and on the algebraic structure of the sympletic group. Basically a condition checks on the angle of the pendulum rod. Finally, MATLAB SIMULATION results reflect the performance of the RIP system with the stated control actions.

VeljkoMilković [3], has invented, patented and developed series of such machines based on two-stage oscillator for producing energy. The operation of the machine is based on forced oscillation of the pendulum, since the axis of the pendulum affects one of the arms of the two-armed lever by a force which varies periodically. Part of the total oscillation energy of the pendulum-lever system is changed into work for operating a pump, a press, rotor of an electric generator or some other user system. The creation of free energy was proved by a great number of physical models.

V. P. Mitrofanov1 et al. [4], a trifilar all-fused silica pendulum with a *Q* factor exceeding 107107 is described. This pendulum has been used to study the damping caused by an electric field applied between the suspended mass and a nearby electrode. Among the different loss mechanisms the most interesting one is associated with the surfaces of the electrodes. Application of a field 106V/m added an excess loss Q^-1e of at least 10^-7. These results are for more laser interferometer gravitational wave detectors since electrostatic actuators are suppose tobe used in order to precisely align the cavity mirrors.

NebojsaSimin et al. [5], Free Energy of the Oscillating Pendulum-lever System This study explains the effect of creating the free energy in the device made of: a) Oscillating pendulum-lever system, b) System for initiating and maintaining the oscillation of the pendulum, and c) System which uses the energy of the device by damping the oscillation of the lever.

Crawford, Mike [6], "Self-Cleaning Solar Panels Maximize Efficiency". The American Society of Mechanical Engineers. Solar panel conversion efficiency, typically in the 20 percent range, is reduced by dust, grime, pollen, and other particulates that accumulate on the solar panel. "A dirty solar panel can reduce its power capabilities by up to 30 percent in high dust/pollen or desert areas," says Seamus Curran, associate professor of physics at the University of Houston and director of the Institute for NanoEnergy, which specializes in the design, engineering, and assembly of nanostructures. Cleaning dirty panels with commercial detergents can be time-consuming, costly, hazardous to the environment, or even corrode the solar panel frame. Ideally solar panels should be cleaned every few weeks to maintain peak efficiency, which is especially hard to do for large solar-panel arrays. "Cleaning can cost up to five dollars per panel," says Curran. "That might not sound like a lot of money, but if you have 52,000 panels it adds up quickly".

III. OBJECTIVES AND METHODOLOGY

3.1 Objectives

The main objectives behind this project are listed below:

- To modernise the traditional water pumping system.
- Automating the pumping system to reduce human efforts.
- To use non-renewable resource as source of energy.
- To analyse the amount and rate of flow of water.

3.2 Methodology

The assembly of all the components from nothing to complete model, first the wooden piece acts as a base for the project above which all the components are arranged or assembled. Over the base the frame structure is assembled or fixed with screws and nuts. Then the pendulum is fixed to the frame making sure that the swing motion or oscillation of the pendulum is free without any restrictions. Solar panels are arranged in such a way that the sun rays or light falls directly on it and then through wire it is connected to a battery where

the charges from the solar panel are stored. Then there is a motor which helps in the initiation and oscillation of the pendulum this motor is connected to the pendulum end. Then a connecting rod whose one end is fixed to the pendulum and the other end is fixed to the hand pump, where the pendulum oscillation is converted to linear motion of the pumps piston. The connecting rod is supported by a bearing which is placed above the frame. At last when the motor is switched on then the shaft of the motor starts rotating and this makes the pendulum to oscillate. Due to this oscillation the lifting of water is done in further process. The Flowchart of Methodology as shown in Fig. 1.

- The system works on the basis of solar energy. Solar panel helps in absorbing the solar energy and is stored in a battery.
- The battery is in turn connected to the shaft of the motor. The power supply from the battery helps to rotate the shaft of the motor.
- Due to this rotation, a link connecting the shaft of the motor to the pendulum helps the pendulum to oscillate.
- The pendulum is connected to one end of the lever, when we apply the force on the pendulum then pendulum starts oscillates this oscillating motion of pendulum is transferred to the main lever.
- The connecting rod of the piston is connected to the lever. The oscillating motion of the lever is transferred to piston rod and then the oscillating motion of the lever is converted into reciprocating motion of the piston.
- When the cylinder is fully filled with water then water goes out through outlet port i.e. it gets discharged, where we get the output result of the pump in the form of discharged water.

IV. WORKING PRINCIPLE

The pump is made of pendulum, two-leg lever and cylinder with the piston which pumps the water. Oscillation of the pendulum is maintained by action of the DC motor. Oscillation period of the pendulum is twice bigger than the period of the lever oscillation. Piston of the pump has reverse effect on the lever and damps its oscillation. Damping of the lever motion causes damping of the pendulum, but the work of the force damping the pendulum is less than the work of the forces which damp the lever. The 3D Model of project as shown in Fig. 2.

Equilibrium position of the lever is horizontal, and the equilibrium position of the pendulum is vertical. Oscillation of the lever and the pendulum takes place in the same plane, vertical in reference to the ground. Fig. 3 shows the experimental setup. The vibrating is acted upon by a rod that is connected with the motor. The restoring power is because of the solar panels that are connected to the battery to maintain the requirement of power. It is the restoring force that is responsible for the vibration. Solar panel is connected to the of 12volt and 7amphere battery which supplies the power to the motor. Pendulum is connected to the shaft of the motor. When the motor is switched ON, the pendulum oscillates. The piston moves up and down with the help of the lever that is connected with the pendulum. This helps the piston to lift the water from ground level and sends the water through outlet of the pump. The Fig. 4 shows the schematic diagram.

4.1 Features

- Less man power.
- Without an external aid it can be operated.
- It can be used in various pumping applications.
- It protects from harming while operated.
- It is very cheap to fabricate.
- It can be installed rapidly at any place.
- It provides continuous flow of water by oscillating pendulum.
- It is exclusive for rural areas where the water scarcity is very high.

4.2 Applications

- Domestic: It is used in cities for drinking water.
- Drainage: Used to control the level of water in a protected area.
- Irrigation: Used to make dry lands agriculturally productive.
- Chemical Industry: Used to transport fluids to and from various sites in the chemical plant.
- Petroleum Industry: Used in every phase of processing of petroleum, its transportation, and separation of the impurities.
- Medical Field: Used to pump fluids in and out of the body.
- Steel Mills: Cooling water in steel mills can be transported using a pendulum pump.

V. DESIGN AND CALCULATIONS

Total Force Acting Downwards

Total force acting downward

= (mg – T) (1)

Where, W = mg= 98.1 N

The tension (T) on the string will be equal to 20N

Total load = 80 N

Friction Force Calculation

F = μN (2)

Where, μ = 0.045 for PVC materials.

N = RA / μ (RA = 10N)

F = 10 N

Total Force During Suction

P = F/A (3)

Where, F = (Total load) – (friction)

F = 70 N

$A = \pi \times D^2 / 4$

$A = 7850\ mm^2$.

P = 8.91 KPa.

Actual Discharge

$Q = C_d \times$Area of orifice$\times(2gh)\times 0.5$ (4)

Where, D = 20 mm

$C_d = 0.3$

g = 9.81

h = 0.6

$Q = 1 \times 10\text{-}3\ m^3/s$

VI. FIGURES

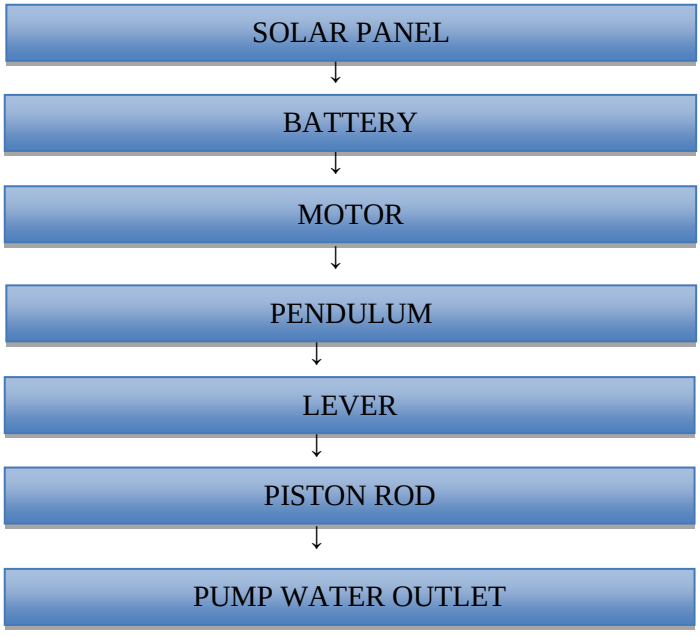

Fig. 1 Flowchart of Methodology

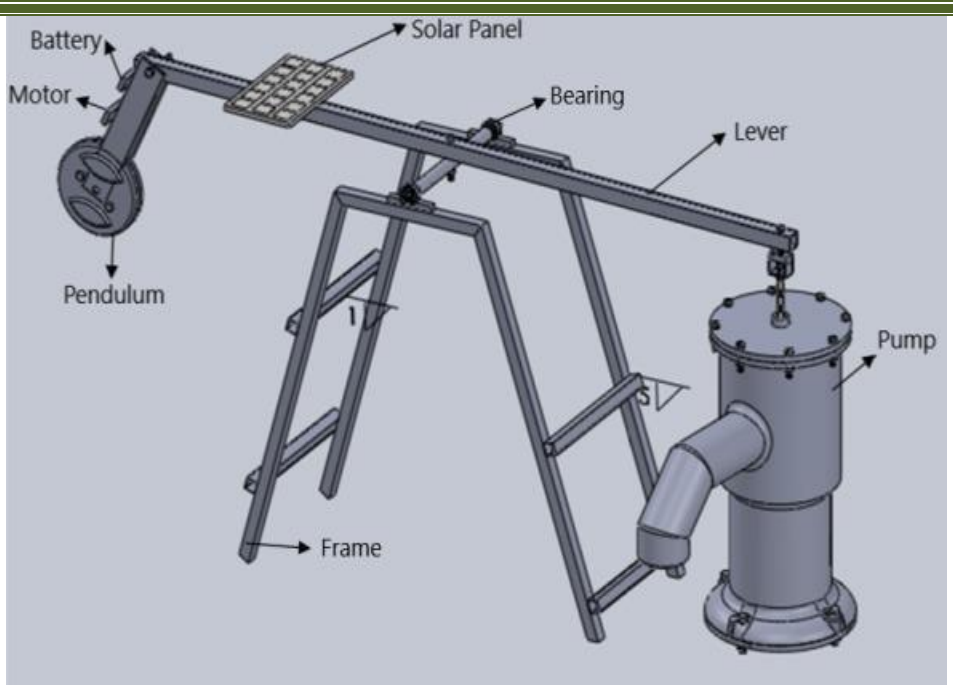

Fig. 2 CAED Model of the Project

Fig. 3 Experimental Setup

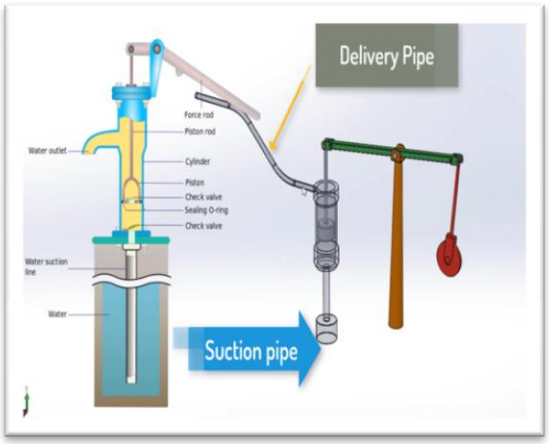

Fig. 4 Schematic Diagram

VII. CONCLUSION

The free energy of the machine based on oscillation pendulum-lever system, is defined in this study, as a difference between the resulting energy of the machine and the energy input from the environment in the same time interval. Existence of the free energy defined in this way is not in accordance with the energy conservation law, but it has been verified experimentally and it can be explained.

Machines based on the operation of the two-stage oscillators can have efficiency coefficients significantly higher than one. This conclusion is verified by a series of experiments done so far with two-stage oscillator systems of different dimensions and different user systems. The main advantage of hand water pump is to Avoiding human strain. It also helps us for the easy way for pumping water. The cost required to implement this is comparatively low. Hand water pump is more efficient when compared to normal hand water pump as the water flow is high here. Hand water pump with pendulum can be widely used in rural areas. As the installation cost of hand water pump with pendulum is low and it is useful for poor people. It can be installed in all the public places. It can be operated by children or old people as the force required by the pump is low.

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