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Design and Development of Pendulum Operated Water Pump

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Abstract - *The traditional hand water pump may take more efforts, the man who operates traditional hand water pump has to apply his force continuously on the lever of pump, due to which man who are using this pump get tired immediately. One important think of a pump with a pendulum is that the work is alleviated or in simple terms it makes work rather easier when is compared with a traditional hand water pump. It is due to this underlined feature which enables the pendulum pump to be used as an efficient mode in the irrigation of smaller lots, water-wells. By the use of pendulum based water pumping system we can increase the efficiency of the plant and reduce the effort, cost of production, production time, and manpower requirement.*

The research done fill today is concentrated on the working and effectiveness of the mechanism only. Considering all of the advantages of the mechanism it was decided to use it for lifting water with the help of reciprocating pump such that the input to the mechanism is given by humans which is comparatively less than the effort applied by humans to lift water using hand pumps directly.

Key Words: **Oscillating Pendulum, Energy conservation, Reciprocating Pump, Lever, spring, Pendulum bracket, Bearing.**

1. INTRODUCTION

The main importance of a pendulum pump is that the initiation energy for starting the process of pumping, swinging of the pendulum, is considerably less when compared with the work required to operate hand pumps. Typical hand pumps require sufficiently large effort and an average person can use the pump continuously only for a short time, but the pendulum pump requires only minimum of the effort, because it is only required to oscillate the pendulum and can maintain these oscillation for several hours, without any fatigue. The advantage of this invention compared to present hand pump solutions are: less force to start the pump, less water consumption, and both arms can be used to fetch the water.

New and technically original idea - hand water pump with a pendulum - provides alleviation of work, because it is enough to move the pendulum occasionally with a little finger 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.

1.1 Working Principle

The oscillation of pendulum has dynamic action of forces. When pendulum is at the extreme ends, the component of force acting on the lever due to pendulum is minimum level and lever is at extreme high position on pendulum side due to action of counter weights. While, when the pendulum is in motion & is at middle position, the force due to pendulum is maximum level & lever is at extreme low position as forces exceed that of the counter weights. Repetition of this phenomenon is the principle of working of the project.

Oscillation of the pendulum is the input to the model. These oscillations will cause the lever to oscillate about its pivot point. The other end of lever as connected to the rod of the pump; causes it to reciprocate thus giving the pumping action.

1.2 Working

The working of pendulum pump is depends on the main parts like pendulum with suitable counter weight, main lever, oscillating mechanisms, reciprocating pump, spring.

The motion of pendulum is depends on the effort applied by human being. The pendulum is connected to one end of lever .when we apply the force on the pendulum then pendulum starts oscillates this oscillates motion of pendulum transferred to the main lever.

The main lever starts oscillates due to movement of pendulum, the liver is mounted on the top of the frame. The liver is supported by two pedestal bearing we can say that the oscillating mechanism. The liver oscillates in which oscillating mechanism.

The connecting rod of the piston is connected to the liver the oscillating motion of liver is transferred to piston rod and then the oscillating motion of liver is converting in to reciprocating motion of piston.

When the cylinder is fully filled by water then water is goes out through outlet port. Where we get the output result of the pump in the form of discharged water.

The downward movement of piston is achieved by the spring. The spring is located at the end of lever at pump side. When the lever takes upward position then spring will expand and piston completes the suction stroke .at the next movement of spring is compression this movement is used to retract the liver. The spring also balances the weight of the pendulum.

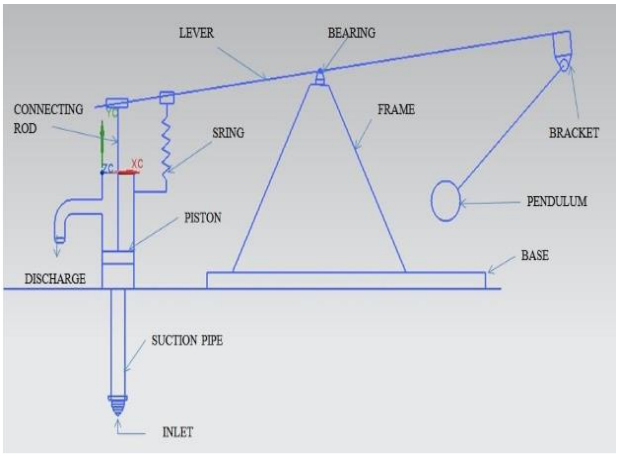


Fig- 1: Schematic Diagram

2. LITERATURE REVIEW

A research has been done in the past to solve the problems. This thesis is the design of a small-scale working model of a Pendulum Operated Pump which providing fully pendulum pump functions along with all the features. Lin et al. [2013] [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 analyzed 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 and Vijay Kumar [2014] [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 check on the angle of the pendulum rod. Finally, MATLAB SIMULATION results reflect the performance of the RIP system with the stated control actions.

3. DESIGN AND FABRICATION

Following parts are Design and Fabricated

3.1 Frame

It is the main part of the pump system and it is made up of steel. The cycle frame consists of seven rigid links which convert the pendulum movement to the piston movement.

3.2 Reciprocating Pump

This is a positive displacement pump. This is closely fitted with cylinder by the principle of actual displacement or a plunger.

3.3 Spring

Spring is an elastic object which store mechanical energy. Here, in this system both tension and compression springs are used. The function of tension and compression springs to stretch and compress according to load applied.

3.4 Oscillating Pendulum

A pendulum is a weight suspended from a Pivot so that it can swing freely. In our case, it is the main input given to the lever which further gives desired output. Pendulum comprises of two parts. We have used Weights as bob and two bolts welded together makes our rod. It is connected to the lever using a bracket housing in which pedestal bearing is fitted.

3.5 Lever

The motion of pendulum is transferred to lever then lever move like see –saw .the spring &piston rod is connected to the remaining side of lever due to this the oscillating motion convert in to reciprocating motion of piston in cylinder.

3.6 Pendulum Bracket

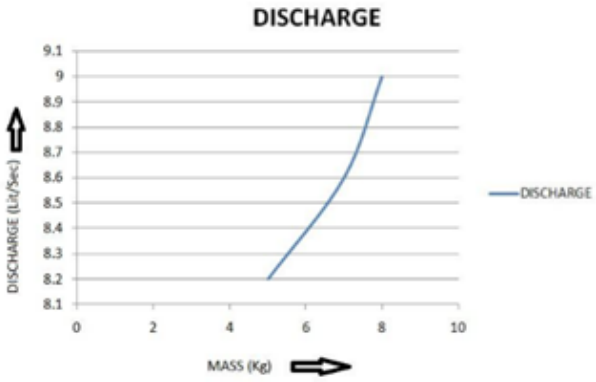
The main function of pendulum bracket is to hold the pendulum lever with counter weight. In pendulum bracket the bearing is fitted .this bearing support to bracket shaft which oscillate due to pendulum.

3.7 Bearing

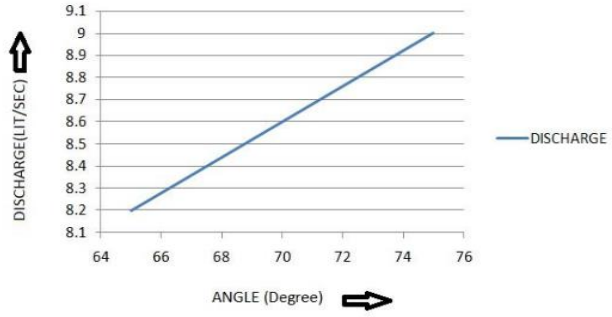
The rod is supported by two Pedestals bearing one on either side of lever forming the fulcrum of lever. The assembly of lever mounted on bearing Lever rotate with the help of beating. Another Pedestal bearing used at the pendulum bracket for motion of a pendulum.

4. RESULT

The various parameters that determine the output discharge of the pendulum pump are analyzed and the results are plotted. Analysis parameters include mass of pendulum, swing angle, length of pendulum.



Graph -1: Mass of pendulum, (m) vs Discharge of pendulum



Graph -2: Swing angle (α) vs Discharge

5. CONCLUSION

This pendulum pump can replace hand pump works on with the help of oscillating motion of pendulum which converted into reciprocating motion of piston for pumping action it is easy to operate & less effort is required for pumping Due to pumps portability and lesser weight even handicapped person and children can operate it. It can be used as a replacement for conventional hand pump.

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