

Study on see saw pump

D.B. Jani¹, Rathod Rahul², Pawar Aniket³, Prajapati Hemil⁴, Rathava Mehul⁵
^{1,2,3,4,5}GEC, Dahod-389151, Gujarat Technological University, GTU, Gujarat, India

Abstract—The study used the mechanical motion of playground seesaw as a means to produce pumping action. The study aimed to design a low-cost prototype energy contraption using playground seesaw using locally available and recycled materials. Pump is an innovative concept which pumps water from a bore well, a sump or a rain water harvesting tank. It uses playful energy of the children or the operators collectively to pump water. See-Saw pumps use the force lift technology to draw water from a well to an overhead tank above the ground level for storage and distribution. It does not require electric power. See-Saw pumps work on the same technology and use the reciprocating motion to move the valves of a water cylinder. The technology below the ground is same as the hand pump technology, hence making it very easy to maintain at the village level.

Key words—See pump, lifting water, pendulum, reciprocating pump.

I. INTRODUCTION

Hand water pump with a pendulum is a very simple solution for pumping water. It 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. Work is alleviated because easier, long-lasting and effortless use of the hand water pump has been enabled. Once input is provided to pendulum, it keeps on oscillating for some time, thus transferring the oscillatory energy into reciprocating motion. The attraction of the mechanism was the amount of energy input provided to be less than the energy output. The statement was explained by carrying out various kinds of experiments. The hand pumps are manually operated pumps, they use human power and mechanical advantage to move fluids or air from one place to another. There are many different types of hand pump available, mainly operating on a piston, diaphragm or rotary vane principle with a check valve on the entry and exit ports to the chamber operating in opposite directions. Most of the hand pumps have plungers or reciprocating pistons, and are positive displacement. Thus by considering all conventional advantages we decided to use water

operated pump with more efficient working which can be used in various purpose. Earlier pumps which are run on the electricity, that are not used in places where electricity is not available. Also they have high cost and high maintenance cost. Operating cost of such pumps is also high. To solve this problem we want to develop new gravity assisted free energy pump by using two springs and two masses system, which runs without electricity. Gravity assisted free energy pump system is an innovative method that utilizes the concept of Free un-damped vibrations in two mass-two spring system. The gravity assisted free energy pump is operate manually and should have low initial and operating cost. Many methods of alternative energy generation have been invented and devised; one such method is discussed in this document and is direct application of energy to pumping [1-3]. Gravity assisted free energy pump system is an innovative method that utilizes the concept of ‘Free un-damped vibrations in two mass two spring system, i.e. effective use of vibrations to form an industrial application. The following are the objectives which were considered:

- To use new source of energy i.e. Alternative energy, where problem of electricity is occurring.
- To improve the efficiency of pump by using spring and mass system with minimum input gives maximum output.
- To run the reciprocating pump by using vibration of masses.
- To create a device which is runs by man efforts & which is used for small scale farming.
- To develop pump which have low operating and which require minimum space.

The innovation of see saw pumps lies in the fact that it makes the mundane process of pumping water fun. It is suitable for use on 100mm and above diameter bore well, sump or rainwater collector tank and can lift water up to 8m above ground for storage and distribution [4]. Easy to install and safe to use, these pumps have low operation and maintenance cost and can be adopted with below ground assembly of any

deep well hand pump even in remote areas. The see saw pumps have a wide range of applications in the following settings:

- Schools, for drinking, sanitation and personal hygiene.
- Institutions for drinking and sanitation.
- Public garden, drinking, sanitation and watering plants.
- Community centers for drinking and sanitation.
- Small communities for drinking.
- Relief camps for drinking.

II. WORKING OF SEE SAW PUMP

The concepts behind this see saw pump is to lift the water with the help of pendulum, which is attached to the fulcrum. The pump used in this prototype converts the oscillatory motion into the reciprocating motion, and henceforth lifts up the water up to the desired level. The pump is made of pendulum, and cylinder with the piston which pumps the water. Oscillation of the pendulum is maintained by periodical action of the human arm as shown in Fig.1. 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. 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 [5].

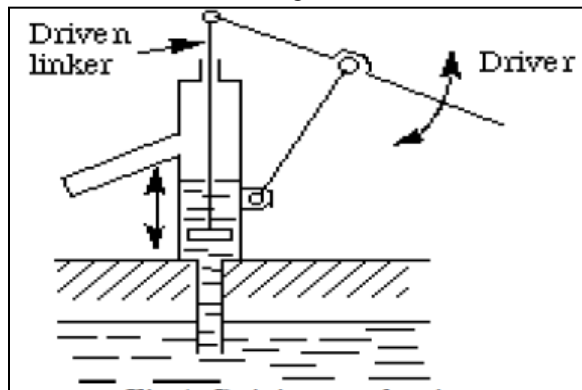


Fig. 1. Driving mechanism.

The gravity effect can be created by using rotation and inertia. In this, the pendulum represents the gravity shield, such that its energy varies from horizontal to vertical axis. The work done by total vertical force acting at pivot point of the pendulum when the pendulum is at vertical axis is passed to the left side of the lever and this work is used to increase potential

energy of mass on the other side of the lever as it goes in upward direction. As the pendulum is attached to the fulcrum perpendicularly, its oscillating motion is converted into the reciprocating motion of fulcrum. Later, this reciprocating motion of fulcrum is damped by springs, which are attached to the base and fulcrum. This damping motion of springs provides reciprocating motion to the pump and hence lifts up the water as shown in Fig. 2 [6].

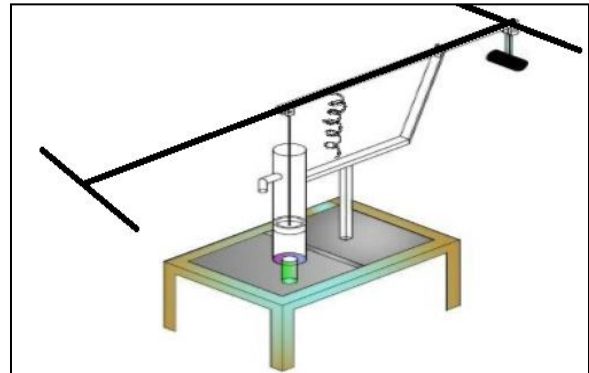


Fig. 2. Working of see saw pump.

The main advantage of hand water pump is to avoid 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 with is more efficient when compared to normal hand water pump as the water flow is high. The main advantage of this pump is that they are one of most economical and simple solution for providing collective supply of drinking water.

The main limitation is the reciprocating pump initially needs priming so it lifts water at desired level. As the design is simple the links are simple and long hence system becomes bulky. A pump requires regular maintenance which must be carried out if pump is to be use on a sustainable basis.

Water pump with pendulum can be widely used in rural areas. As the installation cost of water pump with pendulum is low 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. The technical specifications of see saw pump given below table 1 [7-9].

Table 1. Technical specifications see saw pump.

Sr. No.	Construction details	Specifications
1	Wing span	3 meter

2	Play mechanism	See saw
3	Capacity	8-16 children
4	Ideal speed	40 strokes per minute
5	Output	1500-2000 liters per hour
6	Space requirement	6 m × 1.5 meter minimum
7	Operating depth	Up to 80 meter depth
8	Cylinder	Direct action reciprocating of cylinder of any deep well hand pump
9	Delivery head	8 meter
10	Weight	600 kgs.
11	Construction material	Fabricated mild steel
12	Riser pipes	As per requirements

The see saw pump can be used for the following applications:

1. Schools, for drinking, sanitation and personal hygiene.
2. Institutions for drinking and sanitation.
3. Public garden, drinking, sanitation and watering plants.
4. Community centers for drinking and sanitation.
5. Small communities for drinking.
6. Relief camps for drinking.

The following are the merits of using the see saw pump:

1. Suitable for use on 100 mm and above diameter bore well sump or rainwater collector tank.
2. Can lift water up to 8 meter above ground for storage and distribution.
3. On line water purification devices can be used with either pumping or distribution system.
4. Easy to install and safe to use.
5. Low operation and maintenance cost.
6. Can be adopted with below ground assembly of any deep well hand pump.
7. Convenient for use in remote areas.

III. CONCLUSIONS

In upcoming days the demand of energy resources will be increasing every day's the aim of this project is to develop the world by enriching by utilizing its resources more. Now time has come for using such innovative ideas and it should brought into practice. In

this project the mechanism is used to lift the water from one place to another with reciprocating pump. This project is completely based on "simple pendulum". There are many sources to convert from mechanical energy to various forms. In this system no fuel or electrical energy is used. This project gives the overview for the challenges and opportunities for energy lasting in coming decades, this work can make best use of existing technology to ensure reliability and efficiency under changing condition. It outlines the need for cost effective technology in rural region. It is very useful not only in the hilly area where electricity is not available but also it is best option for farmer which are economically backward and those people who want the pump which is free from electricity. From the trials it was concluded that the water can be lifted with the less effort and human can easily operated.

REFERENCES

- [1] Ganorkar, Atul P., K. S. Zakiuddin, and H. A. Hussain. "Development of pedal operated water pump," International Organization of Scientific Research, pp. 265-267, 2014.
- [2] Kali Charan Rath, Pradip Kumar Samanta, and Deepak Kumar Kanhara, "A brief study on pendulum based pump," Gandhi Institute of Engineering & Technology, Gunupur, Odisha, India, pp. 57-62, 2016.
- [3] Verma, Ambe, "Swing set irrigation system," International Journal of Scientific & Technology Research, 4.05, 2015.
- [4] Pandian S R 2004 A Human Power Conversion System Based on Children's Play, Tulane University, New Orleans, LA.
- [5] Abad J R B, Capucan M D and Legaspi L D C 2012 Energy Contraption Design Using Playground Seesaw Proc. 22nd ASEMEP National Technical Symposium (Pasay City, Philippines) pp1-3.
- [6] Herbert L 1836 Air pressure engines (The engineer's and mechanic's encyclopedia Vol. 1) p31.
- [7] A. M. WAHL, Mechanical Spring 2nd edition, McGraw-Hill 1963.
- [8] S. Telli, O. Kopmaz. Free vibration of mass grounded by linear and nonlinear springs in

series. Journal of sound and vibration. 289, 689-710 (2006).

- [9] Vaibhav M Nimbalkar, Saurabh S. Bhange, Rucha R. Kolhekar, G.H.R.C.E.M. & P.R.M.I.T. & R. Badnera Amravati, India, volume 3, special issue 1, pp. 565-568, 2016.