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Design and Fabrication of Water Lifting by Cradle

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***Abstract*: This paper work describes about water lifting using cradle for various application in garden, school and irrigation purposes. Irrigation is the main necessity for agriculture. In day to day life there is wastage of electricity for providing water to the garden using centrifugal pump, Similarly, people and children uses cradle for reading newspaper and spend time respectively. This results in loss of energy during swinging of cradle. So, we use this wastage of energy for lifting of water in village area or garden and school by connecting with reciprocating plunger type pump, In these project, we uses plunger type pump for lifting the water from water source through inlet using plunger by suction. Next water is discharged to the garden through outlet. After experimentation, it is observed that actual discharge is less than theoretical discharge. Some reason may be Air leakage. This project is eco-friendly by supplying of water to the plants and trees. This project main focuses on proper utilization of energy and electricity for better use of resource. This will help in conserving resources for future generation.**

***Keywords*: Cradle, Reciprocating plunger type pump, Swinging, Water lifting.**

1. Introduction

India is one of the fast developing country based on agriculture. Irrigation is the most important criteria for agriculture. In India, there are many sources that can be provided for irrigation. Nowadays, many technologies are introduced for development and welfare of people. New technology revolutionized the world; in turn new technology replaces old technology for ex mobile. So consumption of resources will also increase which leads to rapid depletion of resources. Since electricity is using major resources and it is costly too.

We generally use cradle during reading newspaper or children playing on it. During which, energy is generated by swinging of cradle and these energy is wasted. So, in this project we use swinging of cradle for lifting of water. These enable us to proper utilization of energy and saving electricity and resources for future generation. Therefore, low cost water lifting by cradle can be designed and implemented without seriously affecting efficiency.

2. Literature Review

These research paper is the design of the small scale model of a water lifting by cradle.

Atul [1] (2014) found that the water is pumped by the pedal operator for water lifting using pedalling. Pedalling is the most efficient way of utilizing power from human muscles. Water lifting continuously by pedalling is not possible. It is very much tiring and painful to the human muscles that also cannot pedal for an hour.

Kali charan [2] found that using the pendulum, water is pumped through oscillating motion. But this oscillating motion is not continuous motion. a person should lift and drop or either by keeping magnet for lifting and drop it requires human efforts.

Remy Uche (2014) gives us idea of using double pump, results in very good performance and efficiency in lifting of water.

To overcome all the obstacle of above. We use here reciprocating plunger type pump to get better efficiency.

3. Components

Main components of the water lifting by cradle are:

1. Reciprocating Plunger Type Pump.
2. Connecting link.

1) Reciprocating plunger type pump

This is a type of reciprocating pump that use a plunger to move media through a cylindrical chamber. These pump is a type of positive displacement pump where the high-pressure seal is stationary and a smooth cylindrical plunger slides through the seal It is one of the component which helps in delivering water to certain level from well or sump. The piston expels liquid a one-way valve (check valve). The pumping rate is usually adjusted by controlling the distance the piston retract, thus limiting the amount of liquid pushed out by each stroke. Reciprocating pump are generally very efficient and are suitable for very high heads at low flows. The pump delivers reliable discharge flows. Often used for metering duties delivering accurate quantities of fluid

2) Connecting link

A connecting link formed of a pair of identical generally c-shaped elongated element each having an interior pin at a first end an interior pin-receiving aperture at a second end. The interior of first end is contoured to mate with the exterior of the second end of another link.

4. Methodology

A. Material

1) Shaft

A shaft is the bar that connects part of machine so, that power can pass between them. The material used for ordinary shafts is mild steel. When high strength is required, an alloy steel such as nickel, nickel chromium or chromium-vanadium steel is used. The value for young modulus for mild steel is 210Gpa.

2) Cradle frame

Cradle frame are different type and different material available in market. In this model used cost iron material because this is cheap and high strength material. The value for young modulus cost iron 110Gpa.

3) Reciprocating plunger type pump

Reciprocating pump is the positive displacement pump. In this model the pump is use plunger type pump. Its material is of Polypropylene. It is thermo plastic addition polymer made from combination of propylene monomers. It is highly corrosion resistant material.

5. Construction

The swing cradle operated water pump model basically includes fabricated frame parts such as simple parts use in swing cradle for ex as simply grounded support and on horizontal both side extended lever. we can provide two No's of simple constructed reciprocating pump on both side constricted with four No's of non -return valve, out of which two can mounted at inlet and two can mounted at outlet port on each pump.

The model is a manually operated concept model. The operator has to sit on the seat and operate cradle in forward and reverse motion. The connected pump take the suction in one stage during that stage inlet non return valve got open whereas outlet port gets closed. In next stroke when compression start delivery port got open and suction port got closed,

For continues discharge we can provide both pump in our project

Dimension:

Shaft = Length: 1300mm

Cradle frame = Fe CI

Cradle length= 500mm

Outer frame = Height= 2300mm

Reciprocating Plunger type piston pump (PVC) Material

Boar diameter=70mm =0.07m

Stroke length=120mm =0.120m

Calculation:

Area of piston = $\frac{\pi}{4}*d^2*0.07^2 = 3.848*10^{-3}\ m^2$

Volume of pump = Area * Stroke Length

$3.848*10^{-3}*0.12=4.62*10^{-4}\ m^3$

Now the science $1m^3$=1000 lit

The one pump per stroke water are deliver to 0.462 lit.

Now, in these model we use two reciprocating pump,

So, the water delivered by two pump alternately is 0.924 liter per stroke.

Fig. 1. Swing cradle

6. Working

"In this model to and fro motion of the cradle is converted into reciprocating motion which in turn provides water from sump or the pump effect to lift the well".

Cradle links is welded to the shaft at the top. This in turn is mounted between two pedestal bearings. The torque generated by swinging motion of the cradle is transferred from the shaft to the bevel gear which is on one side of the bearing and other side is connected the alternator. This alternator is to charge the battery and operate the electric circuits. Bevel gear is compounded with another bevel gear with reduction ratio of 1:1.6 at each bevel gear thus making it a total reduction of 1:3.2. The purpose of reduction in gear is to have maximum displacement of plunger in the reciprocating pump with minimum angular displacement in the cradle.

The main function of slider is to covert the rotary motion into reciprocating motion. The motion of the bevel gear is transmitted to the crankshaft which is connected to the connecting rod, which in turn is connected to the plunger of the reciprocating pump.

Now with each oscillating motions of cradle the plunger of pump starts reciprocating inside the cylinder. Thus with each upward stroke of plunger the suction valve opens and water gets into the chamber from the well or sump. With each downward movement of the plunger, the suction valve closes and the delivery valve opens and water is forced out of the chamber

through delivery pipe up to certain height.

7. Result

1. The cradle water delivered by 98-meter length.
2. The water delivered by two pumps alternately is 0.821 lit per stroke.
3. The theoretical discharge is less than actual discharge.

8. Application

The most widely useful application of this model is to transfer the water from one reservoir to another without use of electrical energy.

It can be used for watering plants in the garden without any consumption of electricity.

It can also be used for storing water in tank at a particular height.

9. Conclusion

The water delivered by cradle is very economically by using the mechanism of crank and linkages so there is no any electricity or power consumption is used for delivered the water to the desired low head area.

Due to this mechanism we reduce the labor cost and time.

Use human efforts for water lifting through cradle.

To prepare and efficient and cost effective system

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 also observed that in project that cylindrical chamber of reciprocating piston type pump can be longer which can lead to increase in stroke length. This is turn, result more space for suction of water.

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