Design and Fabrication of Hand Water Pump with a Pendulum

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ABSTRACT

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. Part of the total oscillation energy of the pendulum-lever system is changed into a work for operating a pump, a press, a rotor of an electric generation system. The creation of free energy was proved by a great number of physical models. The effect of creating the free energy is defined in this study as the difference between the energy which is the machine transfers to the user system by the lever and the energy which is input from the environment in order to maintain the oscillation of the pendulum. Appearance of the free energy is not in accordance with the energy conservation law. The effect of creating the free energy results from the difference between the work of the orbital damping forces of the lever and the work of the radial damping force of the pendulum motion. This effect enables increase of the input energy.

***Index Terms*- Free energy, Pendulum, Oscillation, Pump**

1. INTRODUCTION

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.

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 occasional pushing of 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. The pendulum should be occasionally pushed, to maintain the amplitude i.e. the stream of water. 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 force 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.

II. WORKING PRINCIPLE

The parts of Hand water pump with pendulum are:

1- Load of the pendulum,2- Handle of the pendulum,3- Axis of the pendulum,4- Axis of the two-leg lever,

5- two-leg lever, 6- Water pump, 7- Piston of the pump

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 periodical action of the human arm.

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. 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. Physical model of this type of water pump was shown at a number of exhibitions, in some publications and on the Internet

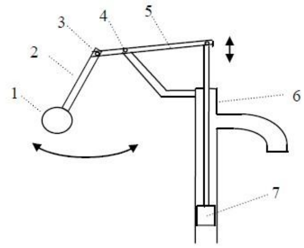

Fig 2.1 Schematic hand water pump with pendulum.

III. FORCE ANALYSIS OF A PENDULUM

The vibrating is acted upon by a restoring force. The restoring force causes the vibrating object to slow down as it moves away from the equilibrium position and to speed up as it approaches the equilibrium position. It is this restoring force that is responsible for the vibration. So what forces act upon a pendulum bob? And what is the restoring force for a pendulum? There are two dominant forces acting upon a pendulum bob at all times during the course of its motion. There is the force of gravity that acts downward upon the bob. It results from the Earth's mass attracting the mass of the bob. And there is a tension force acting upward and towards the pivot point of the pendulum. The tension force results from the string pulling upon the bob of the pendulum. In our discussion, we will ignore the influence of air resistance - a third force that always opposes the motion of the bob as it swings to and fro. The air resistance force is relatively weak compared to the two dominant

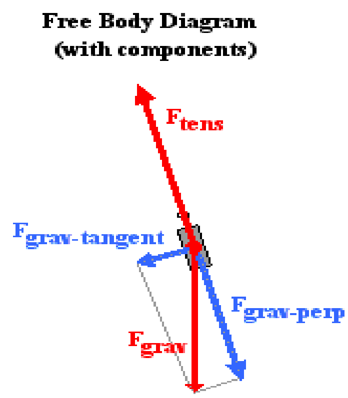

Fig 3.1 free body diagram of the force analysis of pendulum

The gravity force is highly predictable; it is always in the same direction (down) and always of the same magnitude - mass*9.8 m/s^2. The tension force is considerably less predictable. Both its direction and its magnitude change as the bob swings to and fro. The direction of the tension force is always towards the pivot point. So as the bob swings to the left of its equilibrium position, the tension force is at an angle - directed upwards and to the right. And as the bob swings to the right of its equilibrium position, the tension is directed upwards and to the left. The diagram below depicts the direction of these two forces at five different positions over the course of the pendulum's path.

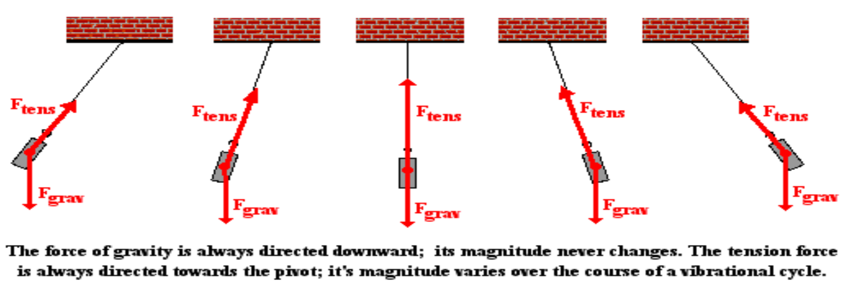

Fig3.2 The direction forces at different positions over the course of the pendulum's path.

In physical situations in which the forces acting on an object are not in the same, opposite or perpendicular directions, it is customary to resolve one or more of the forces into components. This was the practice used in the analysis of sign hanging problems and inclined plane problems. Typically one or more of the forces are resolved into perpendicular components that lie along coordinate axes that are directed in the direction of the acceleration or perpendicular to it. So in the case of a pendulum, it is the gravity force which gets resolved since the tension force is already directed perpendicular to the motion. The diagram at the right shows the pendulum bob at a position to the right of its equilibrium position and midway to the point of maximum displacement. A coordinate axis system is sketched on the diagram and the force of gravity is resolved into two components that lie along these axes. One of the components is directed tangent to the circular arc along which the pendulum bob moves; this component is labelled $F_{grav\text{-}tangent}$. The other component is directed perpendicular to the arc; it is labelled $F_{grav\text{-}perp}$. You will notice that the perpendicular component of gravity is in the opposite direction of the tension force. You might also notice that the tension force is slightly larger than this component of gravity. The fact that the tension force (F_{tens}) is greater than the perpendicular component of gravity ($F_{grav\text{-}perp}$) means there will be a net force which is perpendicular to the arc of the bob's motion. This must be the case since we expect that objects that move along circular paths will experience an inward or centripetal force. The tangential component of gravity ($F_{grav\text{-}tangent}$) is unbalanced by any other force. So there is a net force directed along the other coordinate axes. It is this tangential component of gravity which acts as the restoring force. As the pendulum bob moves to the right of the equilibrium position, this force component is directed opposite its motion back towards the equilibrium position.

The above analysis applies for a single location along the pendulum's arc. At the other locations along the arc, the strength of the tension force will vary. Yet the process of resolving gravity into two components along axes that are perpendicular and tangent to the arc remains the same. The diagram below shows the results of the force analysis for several other positions.

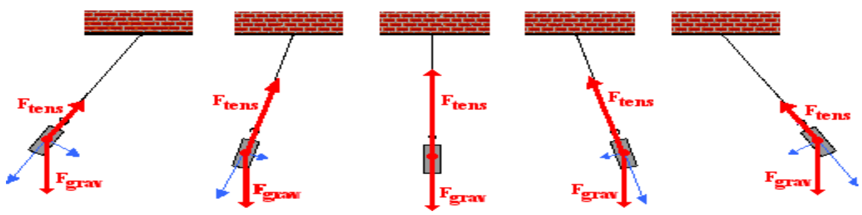

Fig 3.3 the direction of forces along the axis of pendulum at different positions

There are a couple comments to be made. First, observe the diagram for when the bob is displaced to its maximum displacement to the right of the equilibrium position. This is the position in which the pendulum bob momentarily has a velocity of 0 m/s and is changing its direction. The tension force (F_{tens}) and the perpendicular component of gravity (F_{grav}-per6p) balance each other. At this instant in time, there is no net force directed along the axis that is perpendicular to the motion. Since the motion of the object is momentarily paused, there is no need for a centripetal force.

Second, observe the diagram for when the bob is at the equilibrium position (the string is completely vertical). When at this position, there is no component of force along the tangent direction. When moving through the equilibrium position, the restoring force is momentarily absent. Having been restored to the equilibrium position, there is no restoring force. The restoring force is only needed when the pendulum bob has been displaced away from the equilibrium position. You might also notice that the tension force (Ft_{ens}) is greater than the perpendicular component of gravity ($F_{grav\text{-}perp}$) when the bob moves through this equilibrium position. Since the bob is in motion along a circular arc, there must be a net centripetal force at this position.

IV. The Sinusoidal Nature of Pendulum Motion

The sinusoidal nature of the motion of a mass on a spring. We will conduct a similar investigation here for the motion of a pendulum bob. Let's suppose that we could measure the amount that the pendulum bob is displaced to the left or to the right of its equilibrium or rest position over the course of time. A displacement to the right of the equilibrium position would be regarded as a positive displacement; and a displacement to the left would be regarded as a negative displacement. Using this reference frame, the equilibrium position would be regarded as the zero position. And suppose that we constructed a plot showing the variation in position with respect to time. The resulting position vs. time plot is shown below. Similar to what was observed for the mass on a spring, the position of the pendulum bob (measured along the arc relative to its rest position) is a function of the sine of the time.

Now let's try to understand the relationship between the position of the bob along the arc of its motion and the velocity with which it moves. Suppose we identify several locations along the arc and then relate these positions to the velocity of the pendulum bob. The graphic below shows an effort to make such a connection between position and velocity.

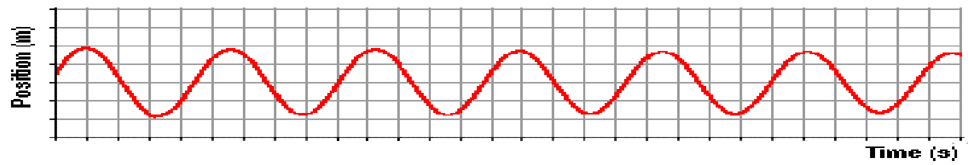

Fig 4.1 Position v/s Time graph of the pendulum

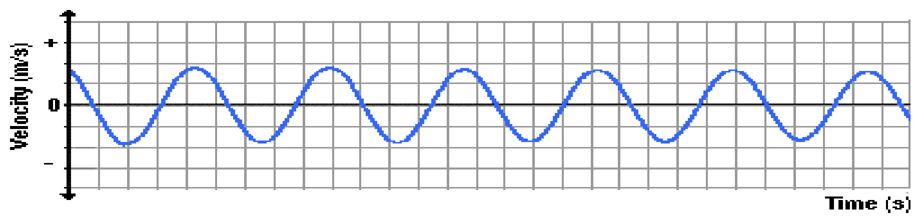

Fig 4.2 Velocity v/s Time graph of the pendulum

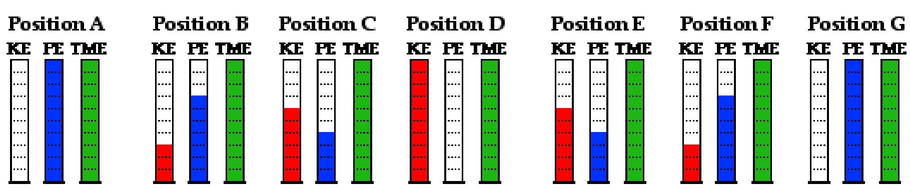

Fig 4.3 Bar graph Kinetic energy, Potential energy and Time of the pendulum at different positions

As is often said, a picture is worth a thousand words. Now here come the words. The plot above is based upon the equilibrium position (D) being designated as the zero position. A displacement to the left of the equilibrium position is regarded as a negative position. A displacement to the right is regarded as a positive position. An analysis of the plots shows that the velocity is least when the displacement is greatest. And the velocity is greatest when the displacement of the bob is least. The further the bob has moved away from the equilibrium position, the slower it moves; and the closer the bob is to the equilibrium position, the faster it moves. This can be explained by the fact that as the bob moves away from the equilibrium position, there is a restoring force that opposes its motion. This force slows the bob down. So as the bob moves leftward from position D to E to F to G, the force and acceleration is directed rightward and the velocity decreases as it moves along the arc from D to G. At G - the maximum displacement to the left - the pendulum bob has a velocity of 0 m/s. You might think of the bob as being momentarily paused and ready to change its direction. Next the bob moves rightward along the arc from G to F to E to D. As it does, the restoring force is directed to the right in the same direction as the bob is moving. This force will accelerate the bob, giving it a maximum speed at position D - the equilibrium position. As the bob moves past position D, it is moving rightward along the arc towards C, then B and then A. As it does, there is a leftward restoring force opposing its motion and causing it to slow down. So as the displacement increases from D to A, the speed decreases due to the opposing force. Once the bob reaches position A - the maximum displacement to the right - it has attained a velocity of 0 m/s. Once again, the bob's velocity is least when the displacement is greatest. The bob completes its cycle, moving leftward from A to B to C to D. Along this arc from A to D, the restoring force is in the direction of the motion, thus speeding the bob up. So it would be logical to conclude that as the position decreases (along the arc from A to D), the velocity increases. Once at position D, the bob will have a zero displacement and a maximum velocity.

The velocity is greatest when the displacement is least. The acceleration vector that is shown combines both the perpendicular and the tangential accelerations into a single vector. You will notice that this vector is entirely tangent to the arc when at maximum displacement; this is consistent with the force analysis discussed above. And the vector is vertical (towards the centre of the arc) when at the equilibrium position. This also is consistent with the force analysis discussed above.

V. ENERGY ANALYSIS

The energy possessed by a pendulum bob was discussed. We will expand on that discussion here as we make an effort to associate the motion characteristics described above with the concepts of kinetic energy, potential energy and total mechanical energy.

The kinetic energy possessed by an object is the energy it possesses due to its motion. It is a quantity that depends upon both mass and speed. The equation that relates kinetic energy (KE) to mass (m) and speed (v) is

$$KE = \frac{1}{2}mv^2$$

The faster an object moves, the more kinetic energy that it will possess. We can combine this concept with the discussion above about how speed changes during the course of motion. This blending of concepts would lead us to conclude that the kinetic energy of the pendulum bob increases as the bob approaches the equilibrium position. And the kinetic energy decreases as the bob moves further away from the equilibrium position.

The potential energy possessed by an object is the stored energy of position. Two types of potential energy are discussed in The Physics Classroom Tutorial - gravitational potential energy and elastic potential energy. Elastic potential energy is only present when a spring (or other elastic medium) is compressed or stretched. A simple pendulum does not consist of a spring. The form of potential energy possessed by a pendulum bob is gravitational potential energy. The amount of gravitational potential energy is dependent upon the mass (m) of the object and the height (h) of the object. The equation for gravitational potential energy (PE) is

$$PE = mgh$$

Where g represents the gravitational field strength (sometimes referred to as the acceleration caused by gravity) and has the value of 9.8 m/s^2

The height of an object is expressed relative to some arbitrarily assigned zero level. In other words, the height must be measured as a vertical distance above some reference position. For a pendulum bob, it is customary to call the lowest position the reference position or the zero level. So when the bob is at the equilibrium position (the lowest position), its height is zero and its potential energy is 0 J. As the pendulum bob does the back and forth, there are times during which the bob is moving away from the equilibrium position. As it does, its height is increasing as it moves further and further away. It reaches a maximum height as it reaches the position of maximum displacement from the equilibrium position. As the bob moves towards its equilibrium position, it decreases its height and decreases its potential energy.

There is an increase in potential energy to accompany this decrease in kinetic energy. Energy is being transformed from kinetic form into potential form. Yet, the total amount of mechanical energy is conserved. This explains principle of energy conservation

VI. ADVANTAGES

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 with is more efficient when compared to normal hand water pump as the water flow is high here

VII. APPLICATIONS

Hand water pump with pendulum can be widely used in rural areas. As the installation cost of hand 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.

VIII. 2D MODEL OF HAND WATER PUMP WITH PENDULUM ALONG WITH DIMENSION

All dimensions are in mm

(SIDE VIEW) (FRONT VIEW)

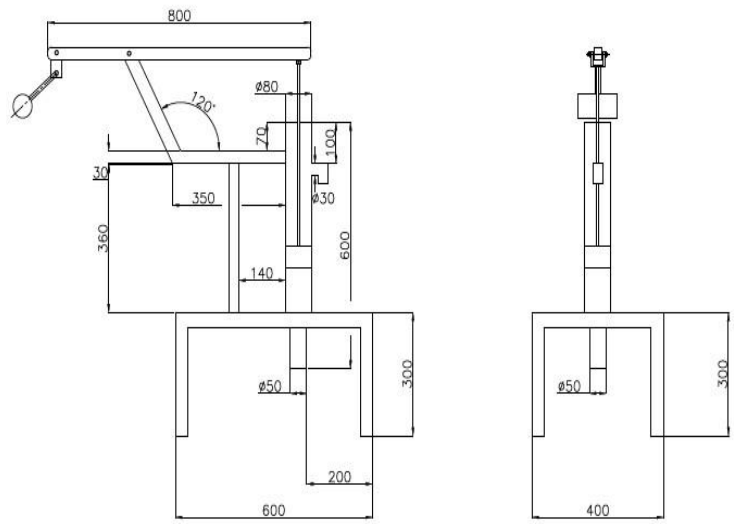

Fig 8.1: 2D Model of Hand Water Pump with Pendulum (front view and side view)

IX. 3D MODEL OF HAND WATER PUMP WITH PENDULUM

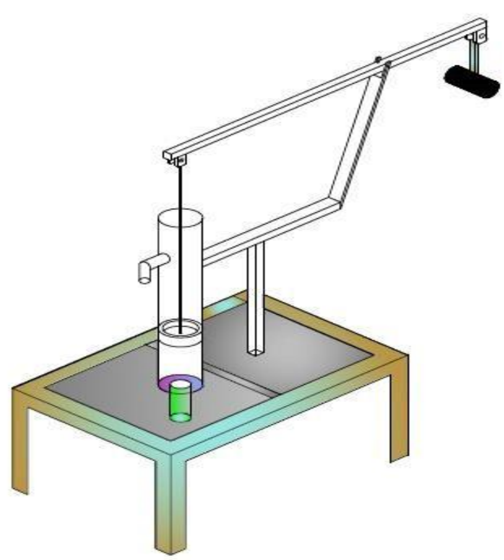

Fig 9.1: 3D Model Of Hand Water Pump With Pendulum

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

REFERENCES

[1] " The secret of free energy of the pendulum v. Milkovic,2010 edition (vrelo, novi sad, serbia, 2001).

[2]*A scientific paper of Prof.B. Berrett*, Energy Abundance Now presented in university of Ohio 2007.

[3] *A scientific paper of Dr. Bratislav Tošic*: ,"Oscillation of the lever caused by the swinging of the pendulum"

(Novi Sad, Serbia, 2000).

[4] *Veljko Milkovic* – website http://www.veljkomilkovic.com

[5] "*ANGULAR MOMENTUM OVER UNITY*"Jovan marjanovic, 2011 edition, VOL 4

[6] A book on "*KEYS OF GRAVITY MACHINES*" by jovan marjanovic, 2008 edition.

[7]A scientific paper of Nejbosa Simin on „*FREE ENERGY OF OSCILLATING PENDULUM LEVER SYSTEM*" (Novi sad Serbia, sept 11 2007)