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Design of Machine that Convert Gravity into Electricity

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Abstract: ***This deals with the design, analysis of a a machine that convert gravity into electricity. The basic principle behind this is combined gravitational and buoyancy force makes this machine convert gravitational energy into electrical energy. The parts of this machine are wall frame, bucket, piston, stopper, rollers, pulley, belt and fluid. The bucket goes to downwards by gravitational force and it moves upwards by buoyancy force of fluid which is filled in the bucket. This to and fro motion of bucket is converted into rotational motion by mechanical setup. This rotational motion is given to pulley; however simultaneous clockwise and anticlockwise rotation of pulley leads to damage to generator. Hence this to and fro rotation is converted into unidirectional rotation by combined crank, freewheel and gear mechanism. This rotational motion is multiplied by gear mechanism which is finally coupled to generator to have electricity.***

Keywords: Gravity, Electricity, Buoyancy, Bucket, Rotational motion

I. INTRODUCTION

In recent times, due to depletion of conventional energy sources, there is a need for generating power from renewable sources. A far as our earth is concerned, the gravitational energy is available all over the earth, abundant, and consistent. Thus, Here, it is designed a methodology wherein gravitational energy is successfully transformed to usable electrical energy.

When a body is at certain height from the ground, it possesses potential energy. At the same time, due to gravitational pull the body tends to fall down. Potential energy which is possessed by body is converted to kinetic energy when it falls, and it can be converted into mechanical energy. Finally, using generator, mechanical energy is converted into electrical energy. Gravity being available everywhere, all the time; because of these, we can find the solution of scarcity of energy into great extend. The other obvious benefits are it is pollution free, noiseless process, huge saving in cost of transmission, we can minimize those ugly high-tension transmission lines, and so on.

II. WORKING OF THIS MACHINE

The objective of this project is to determine the potential energy savings associated with improved utilization of waste heat from
The working of this machine can be explained in 5 stages

A. First Stage

At this stage the left bucket is at the top position, and the right bucket is at the bottom position as shown in figure. Piston flange inside the left bucket is at the bottom side of the bucket, and it touches with the stopper inside the bucket. The top position of the piston touches the main stopper which is welded on the main frame. In the case of the right side bucket the piston flange inside the bucket is at the top most position. The bucket rests on a main stopper which is at bottom portion, and the bucket here is supported by rollers. Both bucket carrying liquid which provides high buoyancy force on the piston which will ultimately result the movement of the piston, and consequently leads the movement of the bucket.

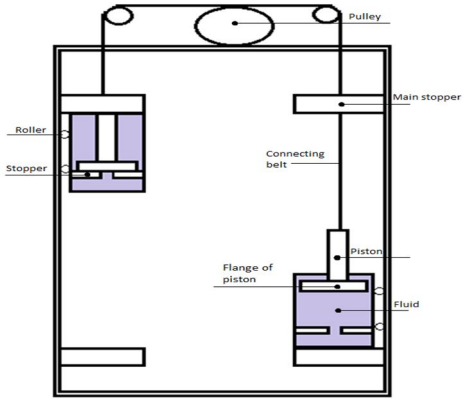

Fig. 1 First stage

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B. Second Stage

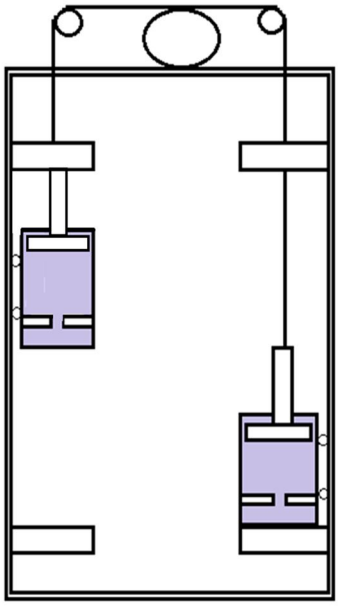

Fig. 2 Second stage

In the second stage, the fluid inside the left side bucket starts to exert a buoyant force on the piston inside it. As a result, the piston has a tendency to move upward. However, piston cannot move upwards. This is because piston do not have any degree of movement as the top side of the piston touches the stopper. Consequently, this arrested motion of piston makes the bucket move downwards. This bucket continues to be in motion due to gravitational and inertia forces, and this will lead to the upward motion of the right side bucket.

C. Third Stage

In this case the left bucket moves downwards which results the lifting of the right bucket. Right bucket goes to upwards through connecting belt which results the two bucket to be in motion; here, gravitational force leads to the motion of downward bucket. When both buckets are in same level, Inertia force acting on bucket tends to turn movement of left bucket downwards.

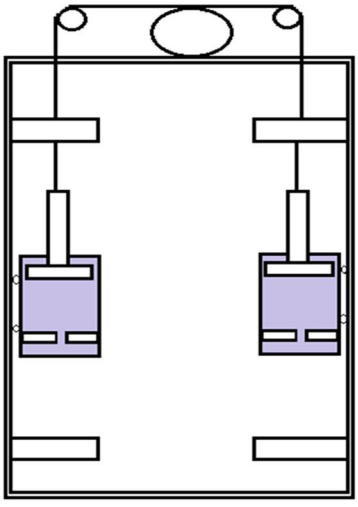

Fig. 3 Third stage

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D. Fourth Stage

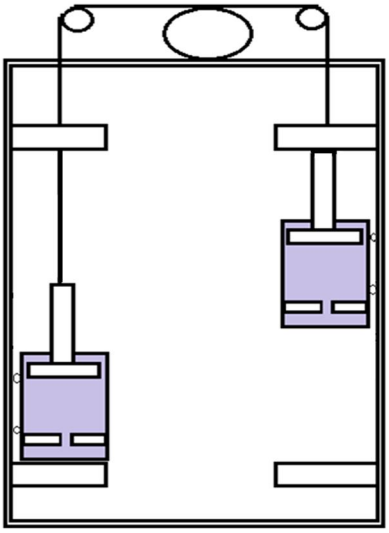

Fig.4 Fourth stage

At this stage the right bucket comes to the top level, and the left bucket is at bottom level. The top of right piston touches the stopper here. The stopper does not move upward again due to presence of stopper

E. Fifth Stage

The buoyant force by the fluid exerts on piston leads to make the piston move upward direction. But piston cannot move upwards due to arrested motion between the piston and main stopper. Thus there is a tendency to move bucket in downward direction, and the process continues as in the left bucket.

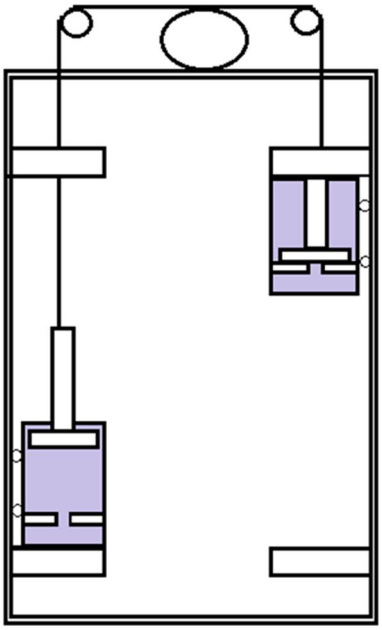

Fig. 5 Fifth stage

F. Power Transmission Mechanism

The upward and downward motion of the both buckets are connected to a V-pulley by means of a V-belt. The longitudinal motion of the buckets are converted into rotational motion by the pulley and this rotational motion is connected to generator then to battery via shaft. Generally power transmission mechanism consists of pulley, gears, chain, sprocket, and shaft. Here we get both clockwise and anticlockwise directional rotation of the pulley. Simultaneous rotational motion of the pulley at the clockwise and anticlockwise direction generally leads to the complaint to the generator. So to avoid this, these rotations have to be converted into unidirectional. This is done by special mechanism that is incorporated here.

G. During Clockwise Rotation

During clockwise rotation of the pulley, freewheel F1 in first chain sprocket system get locked in bearing, and engaged in power transmission. Hence, the crank and the freewheel F1 rotates in the same direction and the load is transmitted from crank to freewheel F1, and this clockwise rotation s provided to the generator. The power produced is simultaneously transmitted to second crank; Here rotation becomes anticlockwise by gear mechanism, both having same diameter and same teeth to get uniform motion and power transmission. Then second freewheel F2 are free from locking system, and rotation and power is not transmitted. The net result here is pure rotational motion. The gear 4 is a smaller diameter than gear to enhance speed. This arrangement will provide a satisfactory rotation even if the buckets move in a slow speed. Thus the rotation here finally is clockwise rotation.

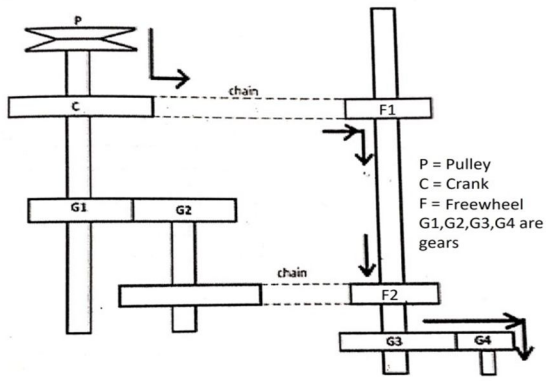

Fig. 6 Power transmission during Clockwise direction

H. During Anticlockwise Rotation

During anti clockwise rotation of the pulley, the shaft carries the rotation through both chain and sprocket system. On the first chain and sprocket system, the freewheel F1 rotates freely on shaft results not to transmit power through that shaft. The gear 1 at the end of the shaft 1 is meshed with gear 2, both is having same diameter and module will inverse the anticlockwise direction to clockwise direction. This clockwise direction is carried to the second chain and sprocket system. Here the freewheel F2 become lock in bearings. Thus the clockwise direction of the crank will transmitted to the en shaft by freewheel F2, and gear combination G3-G4 mechanism. Here the output shaft will rotate in clockwise direction even though the input rotates in anticlockwise direction. So the output is clockwise directional irrespective of input. Thus by incorporating this mechanism, the output motion become unidirectional which reduces the risk to generator.

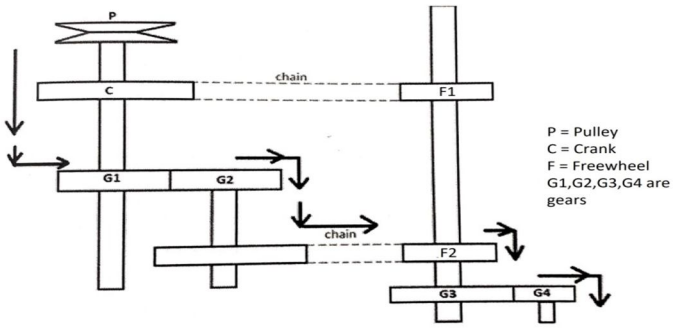

Fig. 7 Power transmission during Anticlockwise direction

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III. FLUIDS USED IN THIS MECHANISM

Fluid used here should have high buoyancy and less viscosity to perform well. Firstly, the fluid which is under consideration was FOG JUICE. It contains 30% glycol, 30% glycerin, 30% mineral oil and 10% salt water. But mixing of these 4 components should be done at 21 bar pressure and at 671 K. Since the attainment of environment of of 21 bar pressure and 671 K are difficult, we reselect fluid as mercury. But mercury have high cost and dangerous. If wound person is touch mercury fluid, it will mix with blood causes death to person. So then we reselect the fluid as salt water having 30% salt content.

A. Design Of Bucket Including Piston

The material of the bucket is chosen as galvanized steel because steel has high strength to weight ratio and have high corrosion resistance, the stopper is made by cast iron,, here S represent stopper

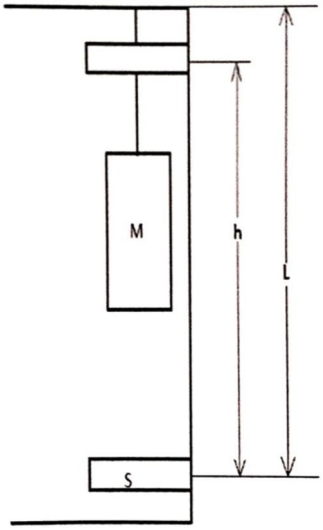

Fig. 8 Drawing of Bucket including piston

M represent mass of bucket which is containing piston
When the mass M impact on stopper S.
Smax=allowable yield strength = Sy/fact of safety=690/1.5=460, D-diameter of bucket = 340 mm, Cross sectional area of bucket, A = 93000 mm, E = modulus of elasticity = 100 GPA, h = height which the bucket move = 1100 mm, L=total length from bucket = 1580 mm, K=32
Substitute these values in equation, Smax=k W/A(1+√(1+2hEA/WL) to get W
W=143 N

1) *Design of Bucket:* The top and bottom and bottom part is made by Galvanized steel, circumferential part is made by steel C40, thickness of top and bottom plate is represented by t1, thickness of circumferential plate represented as t2

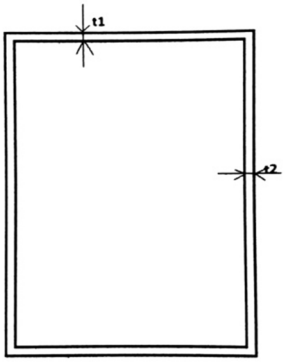

Fig. 9 Bucket

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In case of Longitudinal stress, Minimum wall thickness (t), the top and bottom part is made by Galvanized steel, P = pressure exerted by fluid in the piston = 40 N/mm, Smax = allowable yield strength = 690/1.5 = 460 mpa, D = diameter of bucket = 340 mm t=Pxd/(4xSmax)=7.39 mm=8 mm, Allowance 2 mm for sudden action of piston, Thickness t=8+2=10 mm
In case of circumferential stress, material is steel C40, Minimum wall thickness (t), ultimate strength, Su=667 mpa, Let yield stress sy=su/2=334 mpa, Smax=sy/1.25=267 mpa, p=40 N/mm2,Smax=267 mpa, d=340 mm, thickness t=Pxd/(4xsmax)=12.73 mm=13 mm

B. Design of Pulley

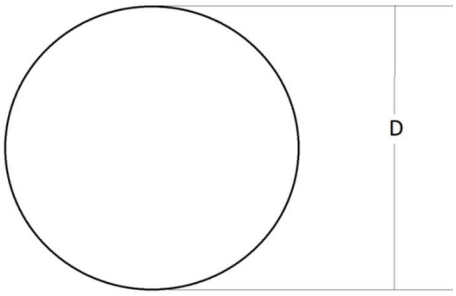

Fig. 10 Front view of Pulley

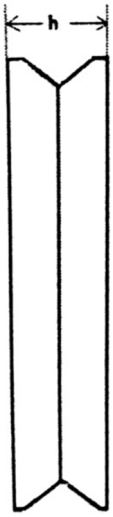

Fig. 11 Side view of Pulley

Let diameter of pulley D = 4 inches = 10.16 cm, Polar moment of inertia Ko = 0.42D =4.267 cm,
D=2 Ko+h, where h is width of pulley, h=1.6256 cm = 0.64 inch, round to 1 inch

C. Design of Belt

width of pulley = h=1.lw+0.8=1 inch, from last equation, width of belt = w =1.6 cm for rubber on cast iron allowance 0.2 mm, μ = coefficient of friction = 0.3, for rubber on cast iron allowance=0.2 mm, L= Length of belt = 207 cm, width of belt = a = 2.54 cm, Thickness of belt t = aμ/(0.02179(gL)^0.5)+allowance = 0.776+0.2 = 0.976 cm = 1 cm

D. Design of Shaft

Shaft is used to transmit power from pulley to gear, material used is Steel 1030, ultimate Tensile Strength=586 MPa, yield Strength = 441 MPa, Shear Strength = 241 MPa, factor of safety = 5, assume n=2 rps=120 rpm, power = VI = 230x1.5=345 w, twisting Moment = T = 60xp/(2x∏xn) = 27454 Nmm, Allowable shear stress Ted =Te/Factor of safety = 48, Diametre of shaft D = 16 x T/(3.14 x Ted) = Diameter of shaft = 15 mm

IV. CONCLUSIONS

When compared to other sources of energy like thermal, tidai, wind, nuclear and so on, gravity is more abundant and available everywhere on the earth continuously. Moreover, it is eco-friendly. So it would be helpful to our mankind in energy deficiency problem by formulating the concept of gravity power generation. This work is an attempt to make machine which convert gravity into electricity. The basic principle behind this is combined gravitational and buoyancy force makes this machine convert gravitational energy into electrical energy. The parts of this machine are wall frame, bucket, piston, stopper, rollers, pulley, belt and fluid. The bucket goes to downwards by gravitational force and it moves upwards by buoyancy force of fluid which is filled in the bucket. This to and fro motion of bucket is converted into rotational motion by mechanical setup.

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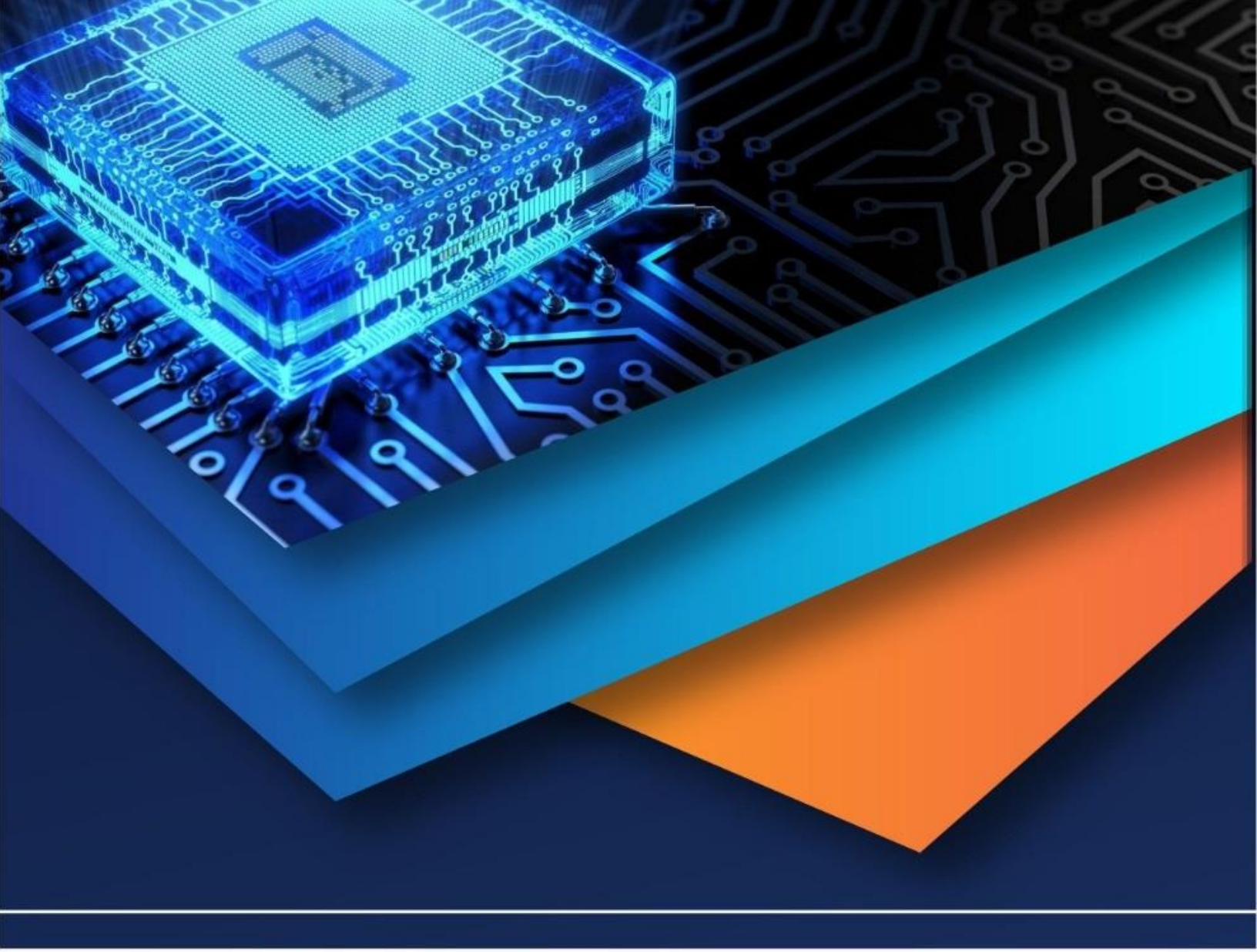

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