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8 Methods to generate Electricity efficiently (Pollution free)

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***Abstract*— In this paper I discuss 8 methods with different mechanical models to generate electricity from gravitation, buoyancy force, spring force with less input power i.e. efficient and pollution free.**

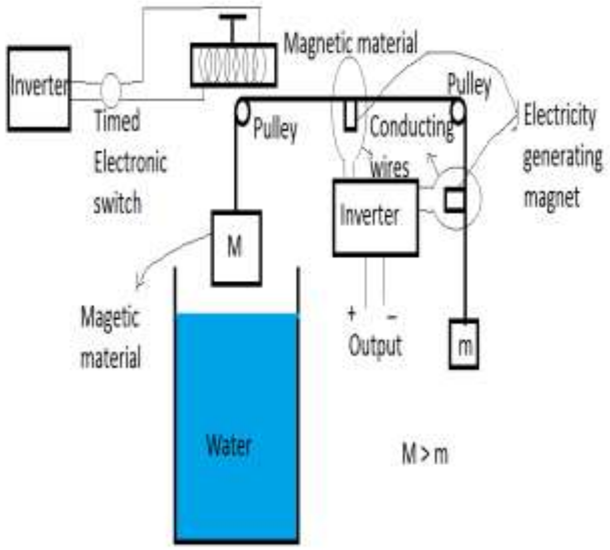
***Index Terms*—Electricity, Efficiently, Pollution, Generate Electricity.**

I. Introduction

Method 1 :

System description :

For system description please see the below image.



Everything is pointed out in the figure. We will now discuss working principle of the system under the heading "working principle".

Working principle :

The mass M is more than mass m. So, when we will release the system when the mass m is at lowermost position with velocity zero then due to gravity the mass M will go down and as a result mass m will go up with acceleration. Now, when mass M will start submerging into water buoyancy force will come into picture. Mass M is such that it floats on water. Now, due to buoyancy force it will decelerate and stop somewhere inside the tank and this point we call the lowermost point. Now the mass m is at highest point. Now, it will start accelerating upward due to buoyancy force and mass M will go up and as a result mass m will move down. When mass M will just above the water level then buoyancy force is absent and it will face deceleration due to gravity and due to inertia it will move upward for some distance and stop. But the mass m will now reach highest point from where it was released because some energy have lost due to air friction, water friction and collision with water surface and pulleys friction etc. Now, to overcome this distance we need to pull up mass M. So, we have fastened a magnetic material which becomes magnet when electricity is on. So, we have assembled it with an inverter and a timed electronic switch. So, when the mass M will come to stop then switch will be ON and the hanging magnetic material becomes magnet and it pulls the magnetic material due to magnetic force and when enough acceleration is gathered by the mass M to reach the previous point from where it was released then switch will be closed. In that way we can make input energy less. Now, the system is again released from previous position and it will again continue moving in the same way. So, the electricity generating magnets are fastened to the rope and they are surrounded by conducting wires and as they are moving they are cutting the flux and as per Faraday's law of induction they will induce emf into the closed circuit which will charge an inerter and the inverter output terminal is useful for any purpose with electricity. Note that the masses will reach same lowermost position irrespective of losses because they are released from same height every time.

Governing equations :

Let the masses are moving through H distance.

Let the mass M goes up to depth h in the water then stops and go upward.

When the mass M is released from upper most position with zero velocity then from Newton's laws of motion we get,

$Mg - T = Ma$ where T is the tension in the rope and a is the acceleration downward.

And, $T - mg = ma$

⇨ $Mg - mg = Ma + ma$ (Adding the equations)

⇨ $a = (M-m)g/(M+m)$

We have, $(H-h) = 0*t_1 + (1/2)at_1^2$ where t_1 is the time required to reach water surface from upper most point for mass M.

⇨ $t_1 = \sqrt{2(H-h)/a}$

We can calculate t_1 as a is known from above Newton's law equations.

Let volume of mass M is V.

Let density of water is p.

Now, the buoyancy force on the mass M is Vpg.

As per Newton's laws of motion,

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$Vpg + T_1 – Mg = Ma_1$ where T_1 is tension in the rope and a_1 is downward deceleration.

And, $mg – T_1 = ma_1$

⇨ $Vpg – Mg + mg = ma_1 + Ma_1$

⇨ $a_1 = (Vp + m – M)g/(M+m)$

Now, if t_2 is the time required to reach lowermost point from water surface for the mass M then,
We have, $0 = v - a_1t_2$ where v is velocity after collision with water.

⇨ $v = a_1t_2$

We have, $h = vt_2- (1/2)a_1t_2^2$

⇨ $h = a_1t_2^2- (1/2)a_1t_2^2$

⇨ $h = (1/2)a_1t_2^2$

⇨ $t_2 = \sqrt{2h/a_1}$

So, we can calculate t_2 from here as a_1 is known from above Newton's laws equations.
So, the frequency of getting in ON state for the electronic switch is $2(t_1+t_2)$
Now, let, v_1 be the velocity when it touches the water surface.
So, energy lost = $(1/2)M(v_1^2 – v^2)$
Now, let it moves (H-h-x) distance due to its inertia.
So, energy lost = Mgx

⇨ $(1/2)M(v_1^2 – v^2) = Mgx$

Now, this x distance needs to be pulled by the hanging magnet.

Let, it stays on for x_1 distance.
So, as per Newton's law, we have, $F/2 + T_2 –Mg = Ma_2$ where F/2 is the average magnetic force during the distance x_1.
And $mg – T_2 = ma_2$

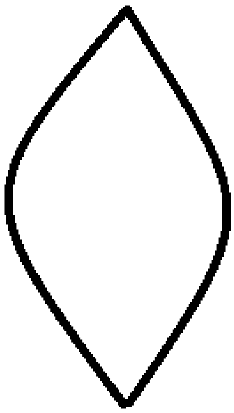
⇨ $F/2 + mg – Mg = (M+m)a_2$

Now, if t_3 be the time to go x_1 distance then we have, $x_1 = 0*t_3 + (1/2)a_2t_3^2$

⇨ $t_3 = \sqrt{(2x_1/a_2)}$

This is the time for which the electronic switch should stay ON.
Now, magnetic force is off and it is decelerating upward means accelerating downward (Mass M).
So, as per above Newton's law, we have, a = (M-m)g/(M+m).

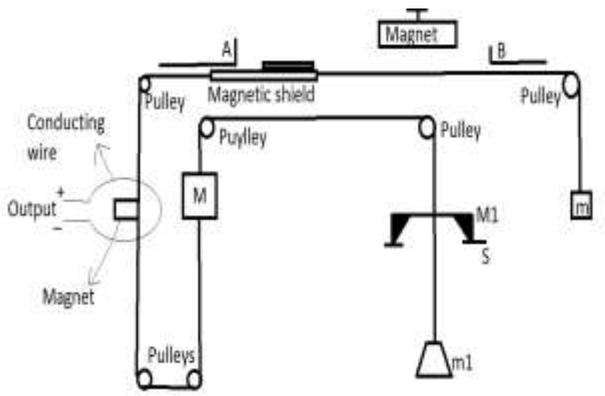
Conclusion :
So, we have calculated the time for which the electronic switch should stay ON and the time for which it should stay OFF i.e. the frequency of getting in ON state. Clearly $2(t_1+t_2) > t_3$. So, the switch will stay OFF for more time and for whole time $2(t_1+t_2) + t_3$ the inverter from where output will be used are being charged while the input inverter is discharging for only t_3 time. We need to hang the electric magnet in such a way that it is closer to the mass M and less input is required. To decrease the collision energy between mass M and water surface we need to make it like a vertical eye shaped as shown in the below figure.



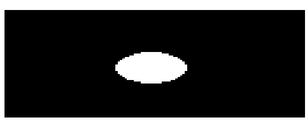
Instead of water other liquid may be used to enhance system efficiency. We have considered here magnetic force to be constant independent of distance but it needs to be taken care of when implemented.

Method 2 :

System description :
For system description please see the images below.



Top view of magnetic shield



Top view of M1

Everything is marked in the figure. A and B are fixed. The magnetic shield made of two layers. The below layer has a hole as shown in the second figure and the above layer can move through the lower layer. When it reaches rightmost position then A gives force on the upper layer to close the hole and when it reaches leftmost position then B gives force on the upper most position to open the hole. A and B's position is so adjusted. Distance between A and B is the distance through which the masses move. The masses m_1, M_1, m, M are such that $2m_1 < M+m < 2(m_1+M_1)$.

Working principle :

When the mass m_1 is release from the lower most position with zero velocity then as $2m_1 < m+M$ so it will go up with acceleration till it touches M_1. Now, when m_1 will meet M_1 then they will become unit mass and as $m_1+M_1 > m+M$ so now the unit mass will go upward with a deceleration and at some point it will stop to go up. If there were no energy loss due to air resistance or collision between m_1 and M_1 or friction between pulleys and rope then the system will continue go up and down with same vertical distance forever. But for the losses of energy it will not go the upper most position where it should go. So, we have provided a hanging magnet and M_1 is made up of magnetic material. Now the magnetic shield is so set that when the unit mass will stop going upward due to inertia then the hole will come between M_1 and the hanging magnet and as a result there will be magnetic force between the unit mass and hanging magnet. So, the unit mass will face an acceleration due to magnetic force and when it will have enough acceleration then the hole will move rightward and cut the magnetic force. Now it will go to the top most position where it needs to go so that when it is released from zero velocity the mass m_1 reaches it's lowermost position from where it started the journey. Now one thing to note that when the unit mass will start going downward then the hole will again come into picture and it will produce a magnetic pull again on the unit mass. To prevent this happening we have used double layer magnetic shield. When the shield will move to it's right most position then B will block the hole by pushing the upper level of the magnetic shield and so the magnetic force will not come into picture. Now, it needs to be opened for next operation. So, A is fixed in such position that it will open the shield hole by pushing the upper level rightward and the system will go up and down forever. Now, there is a magnet fixed in the rope surrounded by conducting wires. This magnet is moving up and down and it will cut the magnetic flux and as a result of Faraday's law of magnetic induction it will induce emf in the closed circuit and electricity will be generated.

Governing equations :

Let the system is moving H distance.

Let, the distance between surface S where M_1 rests and lowermost position of m_1 is h.
Now, the system is released with zero velocity when m_1 is at lowermost position.

From Newton's laws of motion we get,
$T - m_1g = m_1a$ where T is tension in the rope and a is acceleration upward.
And, $Mg - T = Ma$ and $mg - T = ma$

⇨ $Mg + mg - 2m_1g = (M+m+2m_1)a$

⇨ $a = (M+m - 2m_1)g/(M+m+2m_1)$

When mass m_1 meets M_1 then they become an unit mass and faces deceleration.
Let the deceleration is a_1.
Now, as per Newton's laws of motion,
$(M_1+m_1)g - T_1 = (M_1+m_1)a_1$ where T_1 is tension in the rope.
And $T_1 - Mg = Ma_1$ and $T_1 - mg = ma_1$

⇨ $2(M_1+m_1)g - (M+m)g = \{2(M_1+m_1)+M+m\}a_1$

⇨ $a_1 = [\{2(M_1+m_1) - (M+m)\}g]/\{2(M_1+m_1) + (M+m)\}$

Now, let (H-h-x) distance is moved by the unit mass due to gravity only.
Now, x distance needs to be pulled by the hanging magnet.
Let for x_1 distance the magnetic force acts and the unit mass gets enough acceleration upward to move rest $(x-x_1)$ distance due to it's inertia against gravity.
Now, we will consider that for x_1 distance the magnetic force remains constant and it is average of maximum and minimum magnetic force.
So it is $(F+0)/2 = F/2$.
Now, as per Newton's laws of motion we get,
$F/2 + T_2 - (M_1+m_1)g = (M_1+m_1)a_2$ where T_2 is tension in rope and a_2 is the upward acceleration.
And $Mg - T_2 = Ma_2$ and $mg - T_2 = ma_2$

⇨ $F + \{(M+m) - 2(M_1+m_1)\}g = \{2(M_1+m_1) + (m+M)\}a_2$

⇨ $a_2 = [F + \{(M+m) - 2(M_1+m_1)\}g]/ \{2(M_1+m_1) + (m+M)\}$

The it will again decelerate with deceleration a and it come to stop at H distance from the lower most position from where mass m_1 was released. So, mass m_1 will again reach the same position automatically and the system will continue running forever to generate electricity.
Let, v be the velocity when magnetic force stops acting.
We have, $v^2 = 0^2 + 2a_2x_1$

⇨ $v^2 = 2a_2x_1$

We also have, $0^2 = v^2 - 2a(x-x_1)$

⇨ $v^2 = 2a(x-x_1)$

⇨ $a_2x = a(x-x_1)$

If x is calculated practically then we can calculate x_1 from the above equation. x_1 should be the length of the hole in the magnetic shield.

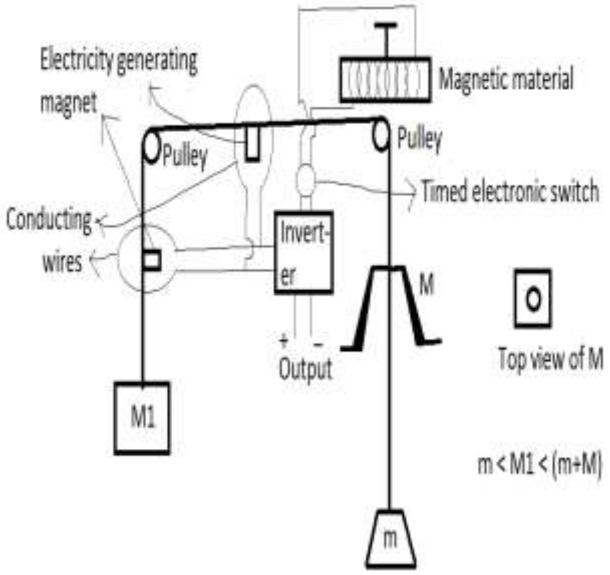
Conclusion :

Here, the forces on the upper part of the shield due to A and B is neglected, mass of the magnetic shield is neglected. Mass M_1 should be greater than m_1 otherwise when it will come down due to air resistance M_1 and m_1 will fail to stay connected as unit mass. The distance x needs to be calculated practically. The maintenance cost includes the replacement of the hanging magnet and magnetic shield when they will be expired.

Method 3 :

System description :

For system description please see the image below.



Here, mass M is made of magnetic material. Mass m is such that it can go inside mass M when it is going upward and become a unit mass of (m+M) and when it is going down then the mass M rests on the surface and mass m goes down alone. There is a hole in the upper ceiling of mass M such that the rope can move freely. We need to charge the inverter with less input energy via a motor. We will study the working principle of the system under the heading working principle.

Working principle :

Now, when the system is released from rest when the mass m is at lower position and M_1 is at upper position then as $M_1>m$ so due to gravity M_1 will go down with acceleration and as a result mass m will go up with acceleration till it meets mass M. Now, when the mass M and m meets it becomes a unit mass of (m+M) and starts decelerating and due to inertia it goes up some distance. Now, the electronic switch is made ON and the magnetic material that is hanging becomes electric magnet and pulls the magnetic material M and the system goes up to it's destination and then the switch is made OFF and the electric magnet loses it's magnetic property and as $(m+M) > M_1$ then the unit mass (m+M) starts going downward with acceleration due to gravity and as a result the mass M_1 goes up with acceleration till the resting surface of M is reached. When M meets the it's resting surface then m becomes alone and as $M_1 > m$ so it starts decelerating and goes down with deceleration due to inertia and then comes to rest and goes up with acceleration as $m < M_1$ and M_1 goes down again and when met with mass M then again decelerates and the system continues to move forever up and down in the same way. One thing to note that the mass m always reaches same lowermost position because every time it starts going downward with same acceleration and then same deceleration. So the system will work forever. Now the electricity generating magnets are surrounded by conducting wires and as the masses move so the rope and so the electricity generating magnets and according to Faraday's law of induction they will induce emf in the conducting wires an the inverter will be charged. Some portion of energy will be required to magnetise the hanging magnetic material and the rest will be output. We need some external energy to charge the inverter also but it is of less amount.

Governing equations :

Let, the mass M_1 roams around distance H i.e. the system moves through h distance. Let, from the uppermost point the resting surface of mass M is h.

Now, when the system is released from rest when the mass m is at lowermost position then for (H-h) distance the mass will accelerate with acceleration say a.

As per Newton's law,

$M_1g – T = M_1a$ where T is the tension in the rope.

And, $T – mg = ma$

⇨ $M_1g – mg = (M_1+m)a$

⇨ $a = (M_1 – m)g/(M+m)$

Now, when the mass m meets the mass M then it starts decelerating say with deceleration a_1.

From Newton's law,

$(M+m)g – T_1 = (M+m)a_1$ where T_1 is tension in rope.

And, $T_1 – M_1g = M_1a_1$

⇨ $(M+m – M_1)g = (M+m+M_1)a_1$

⇨ $a_1 = (M+m-M_1)g/(M+m+M_1)$

Let the velocity with which the mass m meets the mass M is v.

Now, we have, $v^2 = 0^2 + 2a(H-h)$

⇨ $v^2 =2a(H-h)$

Now, we have, $v = 0 + at_1$ where t_1 is time required to reach the mass M_1 from lowermost point.

⇨ $t_1 = \sqrt{2(H-h)/a}$

We know a from above Newton's law equation. So we can calculate t_1.

Let the velocity with which the unit mass (m+M) starts decelerating upward be v_1.

So, $(1/2)(m+M)(v_1^2 – v^2)$ energy is lost due to collision of the masses. We need to minimize it. So, accordingly material of mass m needs to be chosen.

Let it reaches up to distance (h – x).

⇨ x distance to be pulled by the hanging electric magnet.

Now, $0^2 = v_1^2 – 2a_1(h-x)$

⇨ $v_1^2 = 2a_1(h-x)$

Now, $0 = v_1 – a_1t_2$ where t_2 is the time to go h-x distance.

⇨ $t_2 = \sqrt{2(h-x)/a_1}$.

We know a_1 from above Newton's law equations and we need to calculate x experimentally. So, we can calculate t_2.

So, the frequency of the electronic switch to come in ON state is $2(t_1+t_2)$.

Now, let F is the magnetic force when the unit mass at uppermost point and 0 is the magnetic force when it is at x distance from uppermost point. Let, the magnetic force is constant during this distance and it is the average of minimum and maximum force i.e. $(F+0)/2 = F/2$.

Now, one thing need to see that during the whole x distance we don't need to have the electronic switch ON because if x_1 distance is reached by acceleration due to magnetic pull then it will move $(x-x_1)$ distance due to inertia.

So, let t_3 be the time required to reach distance x_1 upward.

From Newton's laws we have,

$F/2 + T_2 – (M+m)g = (M+m)a_2$ where T_2 is tension in rope and a_2 is upward acceleration.

And, $M_1g – T_2 = M_1a_2$

⇨ $F/2 – (M+m – M_1)g = (M+m+M_1)a_2$

From here we can calculate a_2.
Now, we have, $x_1 = 0*t_3 + (1/2)a_2t_3^2$
⇨ $t_3 = \sqrt{\{2x_1/a_2\}}$

Let, v_2 is the velocity when the electronic switch goes to OFF state from ON state.
We have, $v_2^2 = 0^2 + 2a_2x_1$
⇨ $v_2^2 = 2a_2x_1$

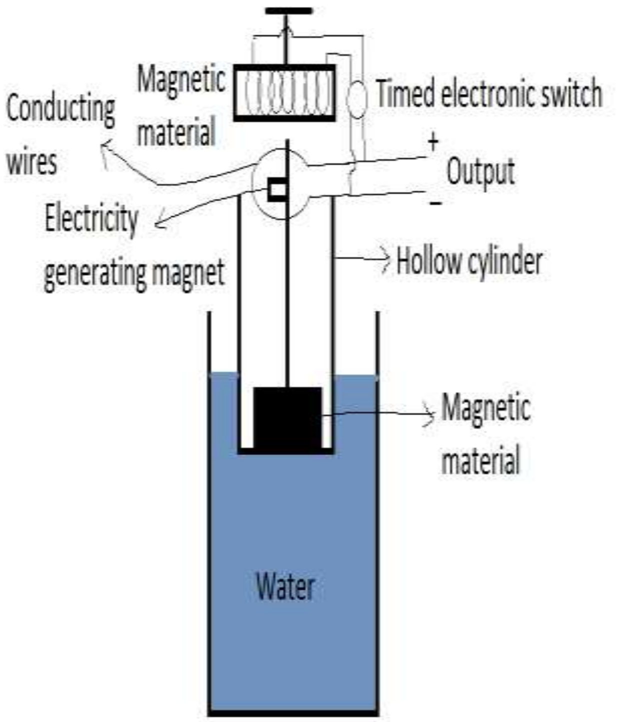
Now, we have, from Newton's law,
$a_1 = (M+m-M_1)g/(M+m+M_1)$ when magnetic force is absent.
So, $0^2 = v_2^2 – 2a_1(x-x_1)$
⇨ $v_2^2 = 2a_1(x-x_1)$
⇨ $2a_2x_1 = 2a_1(x-x_1)$
⇨ $x_1 = a_1x/(a_1+a_2)$

So, we can calculate x_1 from here and put the value in above equation to calculate t_3.
So, the electronic switch needs to be in ON state for t_3 time.

Conclusion :
So, we have calculated the electronic switch ON state period and also the frequency to come in On state. We have considered magnetic force constant here but it needs to be calculated fairly when applied. We need to minimize the energy lost due to collision of mass m and M by choosing appropriate material. We can also fix an electricity generating magnet in the right side of the rope surrounding by conducting wires to generate more electricity. The inverter needs to be charged via a motor which is not shown in the system description picture. The system is efficient because we are using gravitation force as much as we can and for the energy lost due to air friction and collision we are using external energy. Now, energy lost due to above reasons is less compared to energy generated.

Method 4 :

System description :



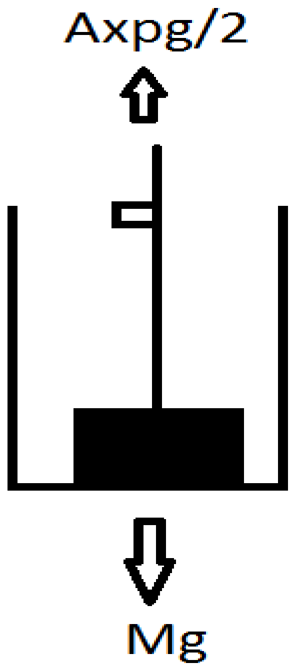
In the above figure everything is pointed out. The solid magnetic material is fastened with the hollow cylinder at its bottom. We will study the working principle in the next chapter.

Working principle :
The hollow cylinder is such that it floats on water. Now a solid magnetic material is put in the hollow cylinder. Now it will go down due to gravity. Now, when it is going down the dispersed water by the hollow cylinder is increasing and hence buoyancy force is increasing. As a result when it will go down then at some point of time the buoyancy force will be greater than gravitational pull and the hollow cylinder and the magnetic material will go up and there is a magnet attached to the magnetic material. The magnet is surrounded by conducting wires. So, when the system will move the magnet will move and hence the magnetic flux lines will be cut and as per Faraday's law of induction it will generate electricity in the conducting wire. Now, if there is no friction then the system will go on moving up and down forever. But there is friction and so we have fixed a magnetic material at the top. It should be fixed in much smaller gap with the solid magnetic material that is inside the hollow cylinder. Now, when it will go up the switch is there to connect the circuit after a fixed interval. Then the magnetic material will turn into a electric magnet and it will pull the magnetic material which is resting inside the hollow cylinder. Now, when the upper point is reached then the circuit will be disconnected by the switch and the magnetism of the electric magnet will be gone and again the system will go down due to gravity. Now, one thing to note that the system will go down every time a constant distance because it will start with same velocity from upper point every time. Now, a fraction of the electricity generated will be used to run the system, rest are useful to use. Now, we will study the governing equations for the system to run forever.

Mathematical discussion :
Let the system is released with zero velocity with the hollow cylinder just touching the upper surface of water.
Let, mass of the hollow cylinder and magnetic material is M (including mass of the electricity generating magnet).
Let mass of the magnetic material which is fastened upper to pull the system is m.

Now, let up to x distance the cylinder and the magnetic material system faces acceleration due to gravity.
Then for y distance it decelerates due to buoyancy force and due to inertia it moves i.e. after (x+y) distance it comes to rest and then starts moving upward with acceleration due to buoyancy force and after moving y distance up it decelerates due to gravity.

Now, if there is no friction of water then the system will continue moving forever but let us say it goes upward z distance by itself.
Now, (x-z) distance is pulled by the hanging electric magnet. The switch must stay on for the time it gets an acceleration to go up (x-z) distance and then the switch must be off.
Free body diagram when it starts going down.



Let, the area of the cylinder is A.
We have considered the buoyancy force to be constant during it's journey through x distance and it is average of the minimum and maximum force.
So, we per Newton's laws of motion,
Mg – Axpg/2 = Ma where p is density of water and g is gravitational acceleration and a is the system's acceleration.
For y distance the equation will be,
A(x+h)pg/2 – Mg = Ma$_1$ where h is the height of the cylinder i.e. x+y = h and a$_1$ is the deceleration.
Now, let us say, v is the velocity at distance x.
Now, $v^2 = 0^2 + 2ax$
⇨ $v^2 = 2ax$.

Again, $0^2 = v^2 – 2a_1y$
⇨ $v^2 = 2a_1y$
⇨ $ax = a_1y$

Now, let time required to go x distance is t_1 and time required to go y distance is t_2.
We have, $x = 0*t_1 + (1/2)at_1^2$
⇨ $t_1 = \sqrt{}(2x/a)$

And, $0 = v – a_1t_2$
⇨ $0 = \sqrt{}2a_1y – a_1t_2$
⇨ $t_2 = \sqrt{}(2y/a_1)$

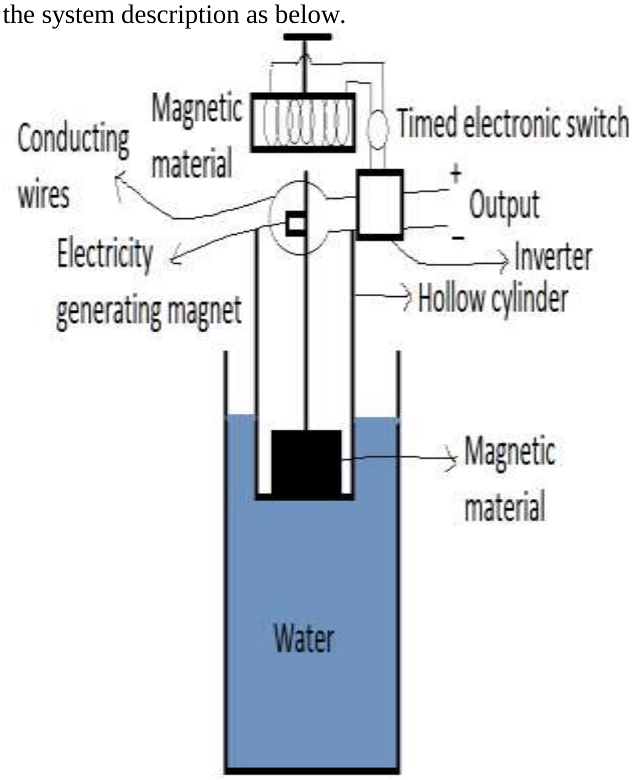
So, total time to reach h distance is $t_1+ t_2 = \sqrt{}(2x/a) + \sqrt{}\{2y/a_1\}$
Now, we know a, a_1 from Newton's laws equations at first.
We have, $ax = a_1y$ and $x+y = h$
From this 2 equations we can calculate 2 variables x, y and we can get t_1 and t_2.
Now, when it is going up then (x-z) distance to be accelerated by the electric magnet.
Let the magnetic force is constant during (x-z) distance and it is average of minimum and maximum force i.e. (F+0)/2 = F/2.
Now, we don't need to switch it on for the whole distance i.e. (x-z) distance so, we will consider here (x-z-x_1) distance.
From Newton's law, $F/2 – Mg = Ma_2$ and $Mg = -Ma_3$ i.e. $a_3 =-g$
Now, let v_1 be the velocity at (x-z-x_1) distance.

We have, $v_1^2 = 0^2 + 2a_2(x-z-x_1)$
⇨ $v_1^2 = 2a_2(x-z-x_1)$

And, $0^2 = v_1^2 – 2gx_1$
⇨ $v_1^2 = 2gx_1$
⇨ $a_2(x-z-x_1) = gx_1$

Now, x-z to be calculated practically. So, we can calculate x_1 from the above equation.
So, let t_3 be the time required to go z-x-x_1 distance.
$v_1 = 0 + a_2t_3$
⇨ $t_3 = \sqrt{}(2(x-z-x_1)/a_2 = \sqrt{}(2gx_1/a_2)$

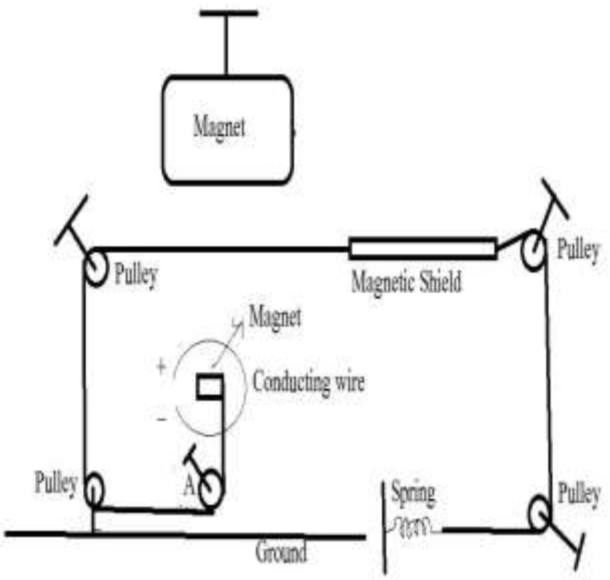
So, the switch needs to remain on for t_3 time and the interval of switch on is $2(t_1+t_2)$
Now, at the time when the system is at rest after going z distance upward it cannot generate electricity. So, we need to add an inverter to charge it during the time $2(t_1+t_2)$ and take the electricity from the inverter to magnetise the hanging magnetic material when it is at just rest. So, we need to modify the system description as below.



Conclusion :
So, we see that we can generate electricity from gravitation and buoyancy force and no other input energy is needed. It may require some input energy to charge the inverter but it will be very less. We have calculated the time for which the electronic switch will stay on i.e. t_3 and the frequency of it's coming to ON state i.e. $2(t_1+t_2)$. Instead of water other liquid may also be used according to advantages. F i.e. magnetic force is not constant during the whole period so it needs to be calculated fairly and so goes to buoyancy force too when it will be implemented.

Method 5 :

System description :
For system description please see the below image.



In the diagram above Pulley A's function is to maintain the magnet in one vertical line. Rest others are as shown in the diagram.

Method :

Now, we will discuss how the electricity will be generated from the above system. The big magnet that is hanging from the ceiling it has that magnetic power such that when the magnet touches ground then it can pull it the magnet that is generating electricity against gravity and spring force. And when the electricity generating magnet will go up then magnetic shield will move left and at a point it will cut the magnetic force between two magnets with its shielding power. Then spring will pull the magnetic shield again at the previous point and the electricity generating magnet will fall under gravity and spring force. When the magnetic shield will be totally out then the magnet will again go up due to magnetic force. And this process will continue without any external energy. So, here we are converting gravitation, magnet and spring force into electricity. The energy conversion is based on the principle of dynamically (or motionally) induced e.m.f. Whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produced in it according to Faraday's laws of electromagnetic induction. This e.m.f. causes a current to flow if the conductor circuit is closed.

Advantages :

1. There will not be any running cost of the plant to generate electricity. If there then it will be very less.
2. No fuel or flowing water are needed to generate electricity.
3. Pollution free.

Disadvantages :

1. The installation cost may be a bit high.
2. If the big magnet loses its magnetic property then it will have to be replaced with another magnet or adding another magnet to it which will require some cost.

Calculation :

Let the spring constant is k.

For easier calculation we will take the spring force as constant throughout the distance h. So we take the average value $(kh + 0)/2 = kh/2$

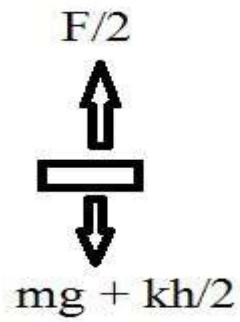
Let the electricity generating magnet is moving in a distance h.

Let, the force between two magnets is F.

For easier calculation we are taking the value F when the electricity generating magnet will be at ground and 0 when it will be totally shielded and we are taking the average value $(F+0)/2 = F/2$.

Let the mass of the electricity generating magnet is m.

Now, when the electricity generating magnet is at ground then from free-body diagram we get,



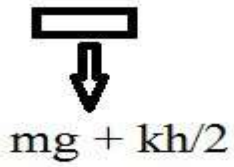
Let upper acceleration be a.

Then from Newton's laws of motion we get,

$F/2 - mg - kh/2 = ma$

⇨ $a = (F/2 - mg - kh/2)/m$

Now when the electricity generating magnet is at upper level then from the free-body diagram we get,



Let downward acceleration be a_1.

Then, from Newton's laws of motion we get,

$mg + kh/2 = ma_1$

⇨ $a_1 = (mg + kh/2)/m$

Now, we have known the upward and downward accelerations which will be required in the calculation of how much emf will be generated from the above system.

This calculation is omitted in this book because we are sure that the system is efficient because input energy = 0 and output energy > 0

For proper calculation of magnetic force we can use the following equations,

$F = [B_0^2A^2(L^2 + R^2)/\pi\epsilon_0L^2][(1/x^2) + \{1/(x+2L)^2\} - \{2/(x+L)^2\}]$

Where, B_0 is the magnetic flux density very close to each pole, in T,

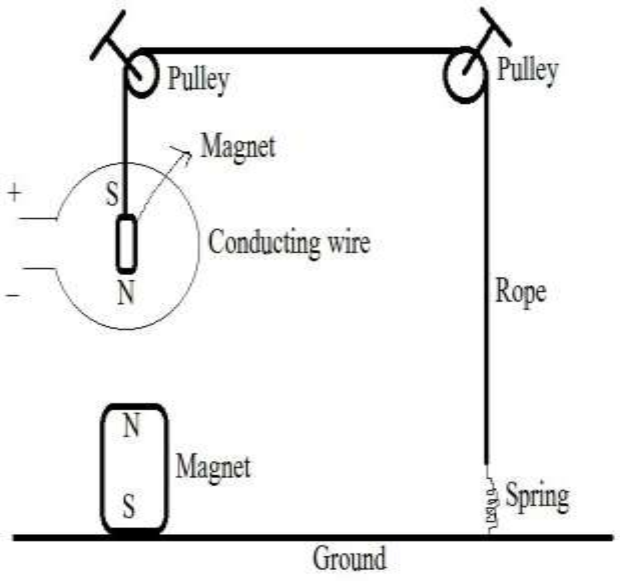
A is the area of each pole, in m^2,

And $F_x = (1/h)[\int_0^h(F*dx)]$ where x is instantaneous distance from lower level.

Conclusion :
When it will be implemented then the position of big magnet, electricity generating magnet and shield should be properly chosen as well as spring. Eddy current loss needs to be considered also. This is just theoretical idea.

Method 6 :

System description :
For system description please see the images below,



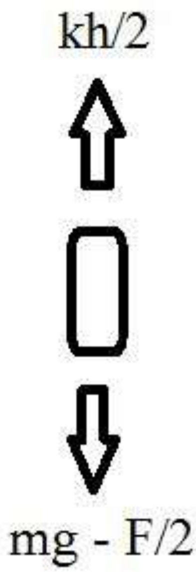
The magnets are of same polarity.

Method :
The magnets are put in such a way that they are opposite polarity so that they can exert a repulsion force. Now, let the electricity generating magnet is running in h distance in the air. Now, when the magnet is at upper level then due to gravitation it will fall downward so that it's mass is heavy enough to fall by negotiation of spring force. Now, when the magnet will come at a distance towards the magnet set in the earth then magnetic repulsion force will act and it will be so high that adding this force with spring force it will get an upward acceleration negotiating gravitation. And this process will continue and according Faraday's law of induction it will generate electricity in the circuit. The energy conversion is based on the principle of dynamically (or motionally) induced e.m.f. Whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produced in it according to Faraday's laws of electromagnetic induction. This e.m.f. causes a current to flow if the conductor circuit is closed.

Advantages :
1. It's maintenance cost is low or negligible.
2. It's a self acting method to generate electricity without any input power.
3. It is pollution free.

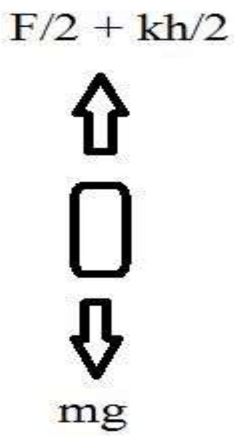
Disadvantages :
1. Initial installing cost may be high.
2. If magnets are losing their magnetic property then they needs to be replaced. So there may be a little bit cost.

Calculation :
Let, spring constant is k.
For easier calculation we take spring force is constant throughout the distance the electricity generating magnet is moving. Let it is h.
Then spring force = (kh+0)/2 = kh/2
Now, we will consider repulsion force of magnet is same throughout the distance h for easier calculation.
So, magnetic repulsion force is (F+0)/2 = F/2
Let the mass of the electricity generating magnet is m.
Now, when the electricity generating magnet is at top most position then from the free-body diagram below we get,



From Newton's laws of motion we get,
mg – F/2 – kh/2 = ma where a is downward acceleration.
⇨ a = (mg – F/2 – kh/2)/m

Now, when the electricity generating magnet is at lowest position then, from the free-body diagram we get,



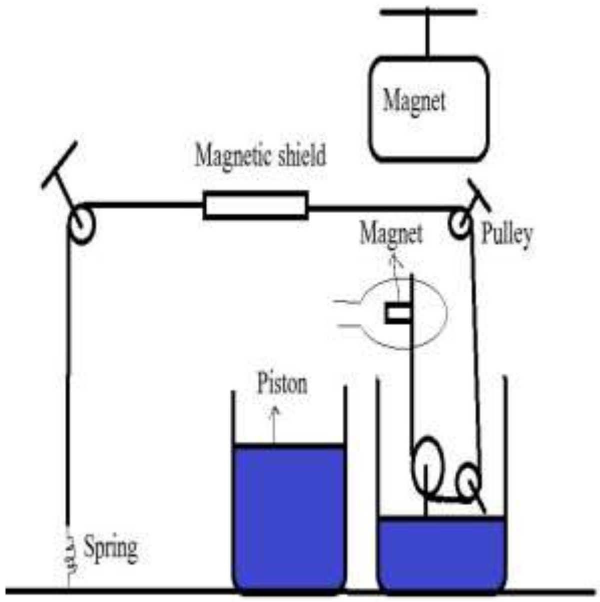
From Newton's laws of motion we get,
(F + kh)/2 – mg = ma_1 where a_1 is the acceleration of the electricity generating magnet upwards.
⇨ a_1 = {(F + kh)/2 – mg}/m

Now, we know the upward and downward acceleration of the electricity generating magnet which will be useful in the calculation of the emf generated in the circuit which is omitted in this book.

Conclusion :
When it will be implemented then we need to properly calculate the magnetic repulsion force and spring force. We also need to consider eddy current losses. The system is obviously efficient because input energy is 0 and output energy > 0.

Method 7 :

System description :
For system description please see the image below,



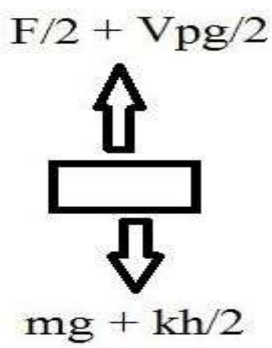
All things are indicated in the picture itself.

Method :
When the electricity generating magnet will go upward for magnetic action between them and also for the law of equal distance of water. Now, when it will go up then magnetic shield will come in between hanging magnet and electricity generating magnet. Now, magnetic force will stop to act and for gravitation and the law of equal level of water it will go down and the water level of the second cylinder will go up. Then again for equal water level law and magnetic pull the electricity generating magnet will go up as when it goes down the magnetic shield will be shifted left by the stretched spring. So, this process will continue and So, here we are converting gravitation, magnet and spring force into electricity. The energy conversion is based on the principle of dynamically (or motionally) induced e.m.f. Whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produced in it according to Faraday's laws of electromagnetic induction. This e.m.f. causes a current to flow if the conductor circuit is closed.

Advantages :
1. It's maintenance cost is low or negligible.
2. We don't need to give any input and it will go on working on its own.
3. Pollution free.

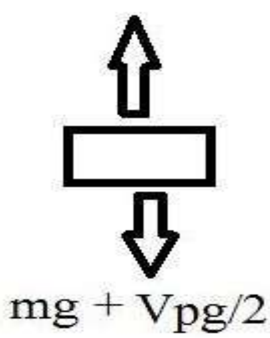
Disadvantages :
1. If the magnet is losing it's strength then we need to add another magnet or replace it by another magnet then there will be a bit of cost.
2. Installation cost is not so high but considerable.

Calculation :
Let F be the maximum force between the magnets. We will consider here the average value of F for easier calculation.
So, magnetic force is $(F+0)/2 = F/2$
Let spring constant be k and we will consider that the spring force is same for all the time and it is equal to $(kh+0)/2 = kh/2$ where h is the height the electricity generating magnet is moving up and down.
Let volume of the tanks be V.
Let the density of water is p.
Now, when the electricity generating magnet is at lower level then according to Archimedes principle the Buoyancy force on the magnet is $(V/2)pg = Vpg/2$ where g is the acceleration due to gravity.
Let mass of the electricity generating magnet is m.
When the piston of the right side cylinder will be down then according to free-body diagram of the electricity generating magnet we get,



Now, from Newton's laws of motion, we get,
$(F/2 + Vpg/2) – (mg + kh/2) = ma$
⇨ $a = [(F/2 + Vpg/2) – (mg + kh/2)]/m$

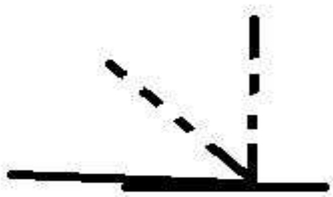
Now, when the electricity generating magnet is at top most point then from the free body diagram we get,



Now, from Newton's laws of motion we get,
$(mg + Vpg/2) = ma_1$ where a_1 is the downward acceleration.
⇨ $a_1 = (mg + Vpg/2)/m$

Now, we have known upward and downward acceleration which will be required during evaluation of emf generated. In this book I will omit that.

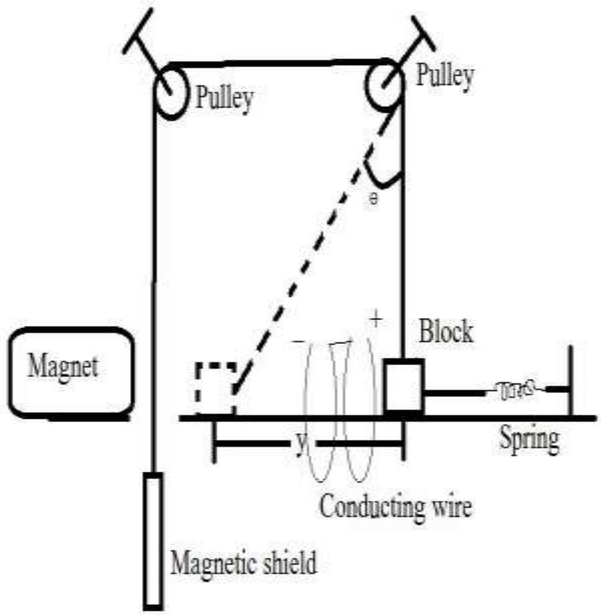
Conclusion :
When it will be implemented then magnetic force and spring force needs to be calculated preciously and also we can remove the piston from left side cylinder. We also need to consider eddy current losses. This is just an theoretical idea where input = 0 and output > 0. So the system is efficient for sure.
Instead of spring we can also hinge joint like this in the below picture.



The hinge will be grounded normally and rotate through as shown in figure when force is applied. If force is removed then it comes to its normal state i.e. in the ground.

Method 8 :

System description :
For system description please see the below image,



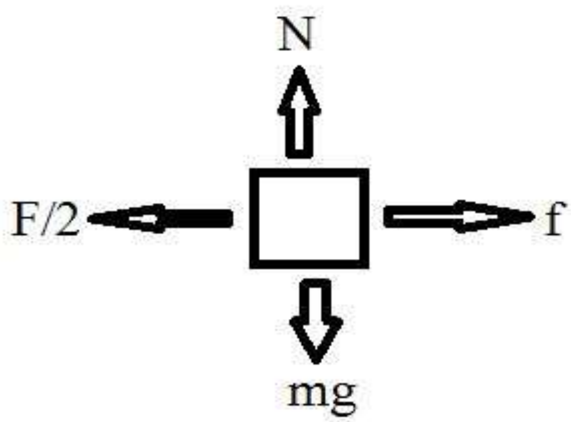
Here, the block is a magnet and the conducting wires are cut in the upper level to give the space for moving the magnet. Rest other are as indicated in the figure.

Method :
The fixed magnet in left side is fixed and it will pull the electricity generating magnet to move towards it against spring force. When the electricity generating magnet will be moving leftward then magnetic shield will go up and spring will be stretched. Now, when the electricity generating magnet will move y distance horizontally then magnetic shield will cut the force between the two magnets. Then due to spring force the electricity generating magnet will move right towards and the magnetic shield will go down and take place where it was before. When the electricity generating magnet will move y distance towards right then again magnetic force will be activated and the electricity generating magnet will again go left towards and this process will continue. So, here we are converting gravitation, magnet and spring force into electricity. The energy conversion is based on the principle of dynamically (or motionally) induced e.m.f. Whenever a conductor cuts magnetic flux, dynamically induced e.m.f. is produced in it according to Faraday's laws of electromagnetic induction. This e.m.f. causes a current to flow if the conductor circuit is closed.

Advantages :
1. Its maintenance cost is zero or negligible or very small.
2. No input is required and it will continue generating electricity with magnet, gravitation and spring force automatically.
3. It is pollution free.

Disadvantages :
1. If magnet lose it's magnetic property then it needs to be replaced then some cost needed.
2. Installation cost is not so high but considerable.

Calculation :
Let the spring constant is k.
We will consider that the spring force is constant over the journey of the electricity generating magnet to travel the distance y and it is average of highest and lowest force for easier calculation.
So, spring force = $(ky + 0)/2 = ky/2$
Let, the maximum magnetic force between the two magnets is F. We here also will be considering magnetic force is constant during the journey of y distance of the electricity generating magnet and it is the average value of maximum and minimum force.
So, magnetic force = $(F+0)/2 = F/2$
Now, let the mass of electricity generating magnet is m.
Let the coefficient of friction between the electricity generating magnet and floor is ɳ.
So, frictional force is ɳN where N is the normal force on the electricity generating magnet by the floor.
Now, from the free-body diagram of the electricity generating magnet when it is at right most side is,

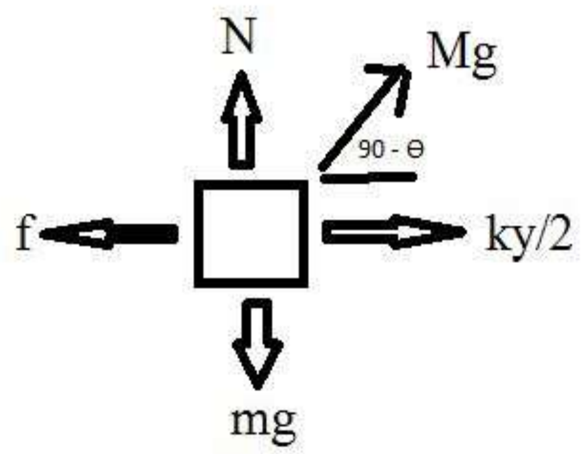


Now, from Newton's laws of motion we get,

$F/2 - f = ma$ where f is the frictional force = $\eta N = \eta mg$ and a is the acceleration towards right side.

⇨ $a = (F/2 - \eta mg)/m$

Now, when the electricity generating magnet is at the left most side then from the free-body diagram of the electricity generating magnet we get,



Here M is mass of the shield. According to figure of system description it will act at an angle Θ with the horizontal.
So, we need to break the force in vertical and horizontal axis.
Vertically upward force component = $Mg*\cos\Theta$
Horizontally rightward force is $Mg*\sin\Theta$
Now, equating the vertical force we get, $N + Mg*\cos\Theta = mg$

⇨ $N = mg - Mg*\cos\Theta$

⇨ f = frictional force = $\eta N = \eta(mg - Mg*\cos\Theta)$

Now, according to Newton's laws of motion we get,
$ky/2 + Mg*\sin\Theta - f = ma_1$ where a_1 is the acceleration of the electricity generating magnet towards right.

⇨ $a_1 = [(ky/2 + Mg*\sin\Theta - \eta(mg - Mg*\cos\Theta)]/m$

Now, we know the acceleration of the electricity generating magnet towards left and right which will be useful in calculation of generating emf in the output.

Conclusion :

When it will be implemented then actual force between magnet at any instant to be considered and also instant spring force to be considered which is omitted in this book. But we are sure about that the system is efficient because input power = 0 and output power > 0. Also eddy current loss needs to be considered. Pulleys are considered massless as well as ropes.

REFERENCE :

[1] Concepts of Physics by H. C. Verma.

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