# TWO-STAGE AND THREE-STAGE OSCILLATOR AS A COMPRESSOR

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**ABSTRACT**: The purpose of this paper is to explain the functioning of two-stage and three-stage mechanical oscillator, i.e. to demonstrate the possibility of generation of excess energy in two-stage mechanical oscillator invented by academician Veljko Milkovic. Compression of air would be proposed for potential application of two-stage and three-stage oscillators. The paper would discuss the dynamics of the body when gravitational forces acts upon it and the methods of obtaining the over unity.

**Key words**: velocity, kinetic energy, moment, over unity, pendulum.

## 1. INTRODUCTION

This work has the goal to clarify the attitude of Mr. Veljko Milkovic who came to the conclusion that from his two-stage mechanical oscillator can be extracted more energy than it was invested in[1]. This adding of small energy to a movable body has looked to most people as nothing important for energetic balance of the machine. However, Mr. Milkovic has continued his investigation and was searching for the answers for effects which two-stage mechanical oscillator had on the opposite end of a lever where a pendulum was fixed. Obvious energy surplus on the end of the lever is not understandable by using "theoretical truths" that energy can not be lost or produced from nothing. In this work, the existing laws of the movement of a body will be critically investigated and the way of energy generation by the action of gravitation will be explained.

In the second part of the work, functioning of two-stage and three-stage mechanical oscillator will be described as well as possibility of its usage for air compression. The air under pressure is stored in a reservoir and then it can be transformed into another kind of energy as needed (mechanical work, electrical energy etc.)

## 2. KINETIC ENERGY INCREASE

The known principles of mechanics and the laws say that a force committing the work is passing its energy to a body or transforms it into another form. Here will be analyzed a case of passing energy from an external force to a body. It will be assumed that the force is fast enough so that velocity of the body can be disregarded. Practically, the force must be an impulse which passes the same path regardless if the body was in the rest or it was in the motion. It can be a set of electromagnets which acts on the body from the same distance with the same intensity. Velocity of the force is equal to velocity of the light and thus the condition that the force is fast enough is satisfied. In nature there are two forces fast enough, and it is gravitational force and electromagnetic force.

Force *F*, *figure 1*, has acted against the ball for time *t*. The ball has received acceleration *a* and for time *t* got velocity *v* equal to *a* x *t*. Then the force stopped pushing the ball forward. In the next period t, the ball has doubled its velocity, but its kinetic energy has increased four times. The force has acted with the same intensity in the same time period and thus spent the same quantity of energy. Is it true that invested energy is equal to work F*s in this case? If yes then there exists energy which increased intensity of force F. **What is that energy**? If the work is equal to product of the power and time then it appears that action of natural forces has variable power, but that is not true.

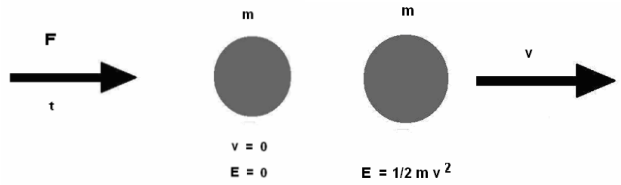


*Figure 1*

If we examine a free falling body then we can see that the body, under influence of the same force for the same period of time, significantly increases its

kinetic energy. Body with mass M is falling from some height. At the end of the first second its velocity is 9,81m/s and kinetic energy $E = 1/2 \cdot M \cdot 96.24$. In the next second of gravitational influence, the body got velocity of 19.62 m/s and its energy is $E = 1/2 \cdot M \cdot 384.94$ or around four times greater. After the third second, energy is nine times greater than after the first second.

**The conclusion is that by acceleration of mass of a body, by action of natural forces, its kinetic energy "accelerates" too.**

In previous paragraph has been shown that passing energy by sufficiently fast force was the key for energy increase. Here will be explained general case. Regardless of how many times there was passing the energy, for the ball and the force, only two states existed: old state where the ball had constant velocity *Vs* and pushing state where force *F* caused velocity increase *Vn*. If both time intervals were short and equal then *Vs=Vn.* This means that after the pushing state the ball got total velocity: *V = Vs + Vn*

In old state the ball had kinetic energy, i.e. its acceleration consumed $Es = 1/2 \cdot m \cdot Vs^2$ and for velocity increase in the second period, of equal length, would be logical to expect consummation of the same quantity of energy because F=m•a and because force F and mass are constant then acceleration will be the same for the same periods of time. By using logic of currently accepted theory it would appear that magnitude of gravitational force is variable (we talk about small altitude changes). Thus, $En = 1/2 \cdot m \cdot Vn^2$. Summary of energies of both forces is $Es + En = \frac{1}{2} \cdot m \cdot (Vs^2 + Vn^2)$

If we calculate total kinetic energy of the ball we have:.

$$E = \frac{1}{2} m(Vs + Vn)^2 = \frac{1}{2} m(Vs^2 + 2Vs \cdot Vn + Vn^2)$$

Energy increase or Over-unity energy ***Eo*** can be found as the difference of kinetic energies after pushing state and kinetic energies of both states:
*Eo = E - (Es + En)*
It is obvious that energy increase is given as

$$Eo = m * Vs * Vn$$

## 3. PENDULUM AND OVER UNITY

The same logic can be applied on mathematical pendulum and be show that there is energy increase if in upper points, when the pendulum has velocity$v_k = 0$, is acting an impulsive force. Then the pendulum will be accelerated to velocity $v_0$, and kinetic energy is increasing by rate of square of velocity. That energy should be "stolen" during half period of oscillation. Increased velocity will increase centrifugal force and hence tension in pivot point of the pendulum. Let's investigate ideal case when there is no friction and air resistance. When the pendulum is raised in its initial position and released it will always oscillate on the same way, performing energy transformation, figure 2.

Potential energy of the pendulum raised till height *h* is *m g h*. Potential energy will start transformation into kinetic energy when the pendulum is released to fall freely. Conversion is finished when the pendulum comes in low position 3, and velocity of the pendulum is also greatest in that position. When the pendulum starts rising up kinetic energy will start transforming into potential energy again.

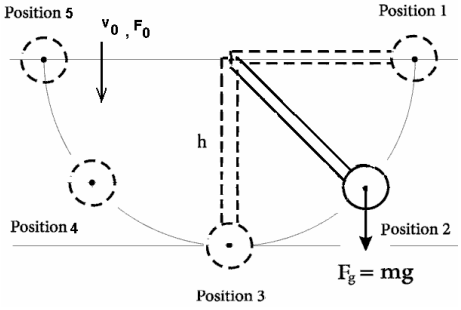


*Figure 2*

Besides pendulum weight which acts in the pivot point, in the same point is acting centrifugal force which is stronger if the velocity is greater. By increasing initial position of the pendulum, its velocity will be increased, but also centrifugal force which acts in the pivot point. The sum of centrifugal force and the weight is giving total force which is a vector with magnitude of sinusoid character.

Two-stage oscillator of Veljko Milkovic has specific attributes and complex motion of a mathematical pendulum, the lever and mass **M** on the other end of the lever**.**

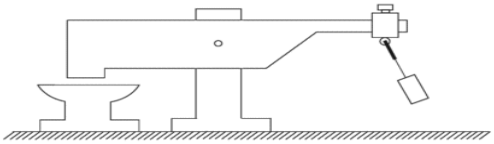

Figure 3

Pivot point of the pendulum is not fixed, but moves up-down depending of forces acting on ends of the lever. In such a situation the pendulum bob doesn't have circular movement, but a trajectory which is conditioned by lever parameters, mass of the pendulum on another end of the lever and also by the swing of the pendulum. In fact, because of acting of the force, the lever will start moving and raising the mass on other side. In figure 4 is displayed a trajectory of the pendulum when pivot point O is moving up down. In the case of a mathematical pendulum, vector of the velocity is perpendicular on the pendulum handle, has changeable magnitude and sinusoidal shape. However, when the pivot point is moving along the vertical line (horizontal movement will be disregarded) then velocity vector is not perpendicular on the pendulum handle and magnitude is increasing for vertical movement of the pendulum bob.

Let's suppose that pivot point O started moving downwards when the pendulum was in position 2 and returned back in the same position when the pendulum is in position 9, i.e. it came in position O2 when the bob reached position 6. If we now separate kinetic energy of the pendulum bob according to velocity components, we will see that horizontal component is smaller in position 5 then in position 4, if pivot point O didn't move.

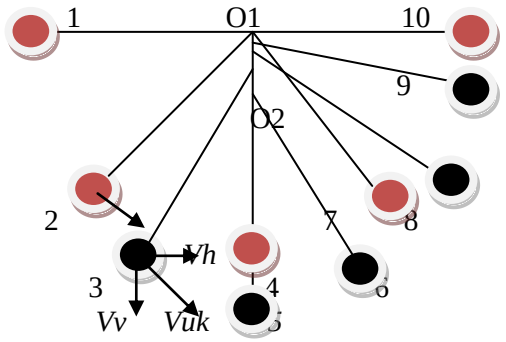


*Figure 4. Trajectory of pendulum bob*

Vertical component of energy is spending on movement of the lever and raising of mass M (potential energy increased for MgΔh), but by lowering down of mass M in starting position a part of energy is returning back to the pendulum because moment of inertia is decreasing and tangential velocity increasing. Thus, the energy balance of the two-stage oscillator is stable if mass M has soft touch when it returns in low position. As it is not always possible, mass M strikes against the surface and transformation of vertical component of kinetic energy into mechanical energy is coming about. In ideal case, when displacement of pivot point O from position O1 to O2 would happen instantaneously, when the pendulum is in position 5, i.e. returning of pivot point O into upper position when the pendulum is in positions 1 and 10, then the work of total tension force in position 5 would be:

$$E_5 = mg\Delta r + \frac{m v^2{}_5 \Delta r}{r}$$, where:

m –mass of the pendulum;
g- gravitational acceleration;
Δr-distance between points O1-O2 ;
r-length of the pendulum handle and
$v_5$ -pendulum velocity in position 5.

From the other side, energy necessary for instantaneous returning of pivot point O into position O1 is equal to 0, because in points 1 and 10 there is no tension in pivot point, i.e. we can deem that m=0. However, because horizontal component of energy is lost the pendulum bob has lost potential energy mgΔr which must be compensated in order that the pendulum can come to position 10. Total balance of work or energy is:

$$E = mg\Delta r + \frac{m v^2{}_5 \Delta r}{r} - mg\Delta r = \frac{m v_5^2}{r}\Delta r$$

**Thus only centrifugal force can produce energy surplus trough work, by movement of the pivot point.**

As movement of pivot point is not instant, but depends on several parameters then energy balance is changing according to position of the pendulum during the displacement of the pivot point. Because the tension force is a vector variable then only vertical component of the force commits the work and energy gain is much smaller then in ideal case.

In order that the system were able to function, i.e. "to steal" vertical component of kinetic energy it is necessary to add impulse of a force in positions 1 and 10 which will add initial velocity to the pendulum bob and compensate loss of horizontal component of pendulum velocity, in order that the bob could reach height of position 10. It should be noted that it is necessary to invest much less energy to acquire initial velocity of the pendulum in position 1 and 10, then acquired energy gain of vertical component of kinetic energy. As only centrifugal force is making energy surplus, and it increases with the square of the velocity, then it is obvious that it is necessary to achieve greater velocity of the pendulum in positions 3, 5, 6.

It is also necessary to note that, when the pendulum is in position 5, a horizontal displacement of pivot point O is possible with small amount of energy which would have the goal for minimization of

moment of inertia and increase of angular velocity of the pendulum.

It is very hard to describe dynamics of the pendulum bob when initial velocity is kept adding in positions 1 and 10, because then the pendulum bob is moving faster and gravitational force acts in shorter period of time. If initial velocity were greater the pivot point would move earlier and horizontal component of velocity of the bob is smaller, but vertical component is greater because of longer influence of the gravitation and also the movement of pivot point O is greater. Therefore we have one complex movement of mass of the bob which for the consequence has transformation of part of kinetic energy surplus in mechanical work.

**Because of the above reasons it is hard to calculate Over unity which certainly exists in two-stage oscillator invented by Veljko Milkovic, because energy is produced under gravitational influence, or "gravitational energy" is transforming into kinetic energy.**

## 4. THREE-STAGE MECHANICAL OSCILLATOR

If we accept the thesis that energy surplus is produced by centrifugal force than we should investigate ways of its increase. One of the solutions can be three-stage oscillator as follows:

If we allow one more degree of the freedom to the pendulum bob and separate the pendulum handle on two parts, where the second part of the handle has dependent motion with ratio 1:2, then we have an interesting effect. The design would be as displayed in figure 5 below.

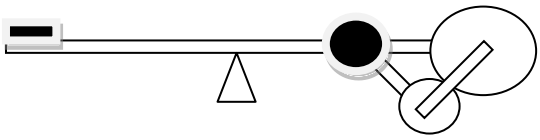

Figure 5. *Three-stage mechanical oscillator*.

Greater gear, which center is in pendulum pivot point, is still because it if fixed for main lever. Smaller gear is connected with greater gear and has a rod connected to pendulum bob on its lower end. When the rod with the bob is oscillating then, because of connected forces, tangential velocity of the bob is increasing as well as its total velocity, thus centrifugal force in the pivot point is increasing manifold. It is necessary to note that the mass of smaller gear is also important because it contributes to the rotation of the bob and total tension force due to its oscillation. Such design is making mathematical model of the oscillator more complex.

In figure 6, are displayed positions of the system for each quarter of the period of oscillation.

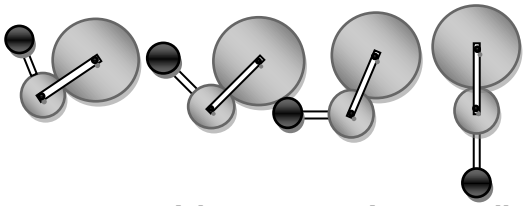

Figure 6. *Pendulum positions during oscillation*

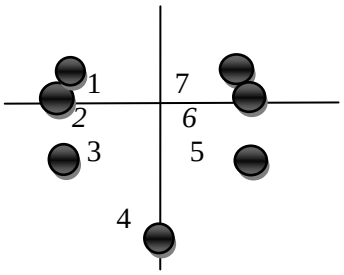


Figure 7. *Trajectory of the pendulum bob during oscillation*

If the pivot point didn't move then three-stage oscillator would oscillate as mathematical pendulum, continuously transforming potential energy into kinetic and vice verse.

We can see that trajectory of the bob has the shape of an ellipsis, figure 7. The bob is moving almost vertically in positions 1, 2 and 3, thus its acceleration is almost vertical, is similar to free fall. In those points centrifugal force practically doesn't exists as velocity of small gear is pretty small. However, from position 3 till position 5, centrifugal force is significantly increased as well as total tension force in the pivot point. Angular velocity of the bob is double greater then angular velocity of small gear around the pivot point. The mass of the lever will be disregarded and thus in position 4 we have the greatest magnitude of the tension force which is equal to:

$$F = m_z g + m_z r_1 \omega^2 + m_m g + 4m_m (r_1 + r_2) \omega^2$$

where:

$m_z$ -mass of small gear

$m_m$ -mass of pendulum bob

$\omega$ -angular velocity of small gear

$g$ - gravitational constant

$r_1$ -distance from the pivot point till center of the small gear

$r_2$ -distance from the center of small gear till center of the bob.

If we transform the equation we have that

$$F = (m_z + m_m) g + (m_z r_1 + 4m_m (r_1 + r_2)) \omega^2$$

Hence, the tension force depends on total mass of the moving system, lengths of the rods and angular velocity which depends of pendulum swing. The first member in above equation is the force which is product of the gravitation and only depends on mass of the system. The second member represents centrifugal force. Centrifugal force can be increased if angular velocity were increased by adding initial velocity in positions as displayed in figure 8, i.e. when the bob reaches upper position.

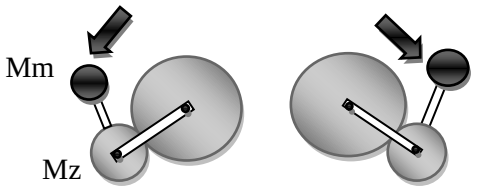


Figure 8. *Acting moment of external force*

If we keep adding initial velocity to the pendulum bob, i.e. to the oscillating system, then it is logical that angular velocity of the system in position 4 will be increased for $\omega_i$, thus tension force in position 4 is equal to

$$F_i = (m_z + m_m)g + (m_z r_1 + 4m_m(r_1 + r_2))(\omega + \omega_i)^2$$

hence,

$$F_i = (m_z + m_m)g + (m_z r_1 + 4m_m(r_1 + r_2))(\omega^2 + 2\omega\omega_i + \omega_i^2)$$

Now, tension force increase can be found as

$$F_u = (m_z r_1 + 4m_m(r_1 + r_2))(2\omega\omega_i + \omega_i^2)$$

If it is allowed that above force commit the work on path *s* (length of the displacement of the pivot point) then we have:

$$R = F_i s$$

In the same time, the work necessary to invest in order that the pendulum compensate lost energy is

$$R_d = (m_z + m_m)gs$$

The difference between preformed work and added work is over unity and is equal to:

$$R_{bi} = (m_z r_1 + 4m_m(r_1 + r_2))(\omega^2 + 2\omega\omega_i + \omega_i^2)s$$

For the sake of easier analysis the masses of the levers will be disregarded and it will be assumed that mass **Mz** (the mass of the gears) is equal to **Mm** (the mass of the bob). In position as in figure 8, it can be seen that the angle of **Mz** is 45°. Gravitation force is acting equally on both masses, but they are receiving different accelerations, i.e. manifestation of gravitational force is different. Namely, mass **Mm** is receiving maximal influence of gravitational force in the same time when mass **Mz** is receiving component ***gsin45*=0,705*g***. Therefore, in mentioned position mass **Mm** is pushing mass **Mz** and accelerates its motion. From the other side, in one moment, horizontal movement of **Mz** starts pulling mass **Mm** and decelerates **Mz**. As mass **Mz** is losing acceleration, by the angle decrease, it will be pushed by **Mm** more and more because it has mild elliptic trajectory and its velocity component is similar to free fall until angle of mass **Mz** become 30°. Then mass **Mm** suddenly gets circular movement and lose acceleration.

During "free fall", conditionally said, mass **Mm** is retarded by mass **Mz,** but has got enough velocity that in low position has 8 times greater centrifugal force then centrifugal force of **Mz** (according to formula if **Mm** and **Mz** were equal and lengths of the levers were equal).

It also should be noted that the mass of smaller gear is also important because it contributes to the rotation of the bob and to total tension force because it also oscillates.

There exists one better effect of three-stage oscillator in comparison of two-stage one and it is concentrated action of tension force in shorter period of time. In fact, when mass **Mm** starts intensive circular motion and when acquires enough velocity, centrifugal force is significantly increasing. The same way it decreases fast when **Mm** starts rising.

It will be very interesting to measure performances of three-stage oscillator on a real model and with variable parameters (mass of the bob, mass of small gear, length of the rods and of the swing) as well time distribution of the tension force. Supposition is that three-stage oscillator gives significantly greater magnitude of the tension force, but in a shorter period of time.

## 5. TWO-STAGE and THREE-STAGE OSCILLATOR as a COMPRESSOR

Two-stage oscillator of Veljko Milkovic can be used for production of compressed air, in such a manner that on the other end of the lever a cylinder with piston would be build and had the role of a compressor. Vertical movement of the lever would periodically suck air in the cylinder and compressed it in a reservoir. Energy stored in such a way could be used for various purposes as the starting of pneumatic motors, refrigerating of premises, electric energy production etc. Thus, energy surplus of the pendulum is used for rising of mass **M** and air compression. When the tension force diminishes, then the piston sucks air by motion of mass **M** downwards. When the tension force acquire enough intensity to raise mass **M,** there will be compression of air in reservoir and "stealing" of part of kinetic energy of the pendulum. In figure 9, is displayed a simplified scheme of a mechanism which works as a compressor.

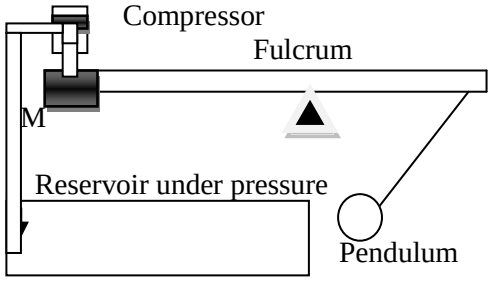


Figure 9. *Two-stage oscillator as a compressor*

Stored compressed air can be wormed up by solar energy and that way increase total potential energy. The advantage of this approach is that energy can be produced any time and be used when necessary. It is known fact that more energy is in demand during the day than the night, and it is possible to make solar reservoirs under pressure in such a manner that they are worming in day time, i.e. solar energy is directly transforming into potential energy of air under the pressure.

The same is valid if we used three-stage oscillator instead of two-stage oscillator with assumption that better performance were obtained.

## 6. CONCLUSION

Here is presented a new theory, the theory which says that an impulse force which acts on a body in the state of motion does accelerate not only its mass, but existing kinetic energy too. The product of initial velocity, additional velocity and the mass is a measure of energy surplus or over-unity energy, but only in the cases of actions of natural forces which have great velocity of the same magnitude. As already said, this theory is founded on the fact that laws of mechanics can be applied equally on bodies at rest as well as on bodies which moves with constant velocity, without changing the direction of the movement. This fact is known in mechanics under the name of Relativity of classic mechanics, and referential systems with uniform motion which are moving with constant velocity are named Inertial Systems. Connections between two inertial systems are named Galileo's transformations.

Basic dogma of classic mechanics is that there is no any mechanical experiment inside an inertial system which can confirm if that system is moving in straight direction and was with constant velocity or it is in the sate of the rest [5]. Here presented theory says that such experiment does exist. If it were confirmed that a mechanical system gives more energy than invested in it, i.e. it has over-unity energy, such system had initial velocity.

The second question which could be asked is: Does a body which is in the state of absolute rest, in cosmic dimensions, can have gravitation or electromagnetic field? As Earth, Sun, and whole cosmos are moving we have inertial systems which we are not able to understand completely. Therefore, the manifestation of natural forces, which always acts with great speed and the same intensity (gravitation and electromagnetic force), we still are not capable to understand completely. The example is manifestation of gravitational force through manifold mechanical oscillators, displayed in this paper. It opens many questions and the need to reinvestigate existing laws of mechanics when in question was dynamics of a body under influence of natural force. If the existing laws proved to be valid, weather manifold mechanical oscillator transforms kinetic energy of Earth, which is huge, in mechanical work by the usage of gravitational force? I do not have answer on that questions, but it is certain that two-stage mechanical oscillator of Veljko Milkovic does exists and it proves that we didn't discovered all natural laws in mechanics. If I were able to tickle the expert publicity to continue to investigate three-stage mechanical oscillator or to deny the results presented in this paper, than I achieved the goal.

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In Novi Sad, Serbia June 30, 2011