THEORETICAL AND EXPERIMENTAL RESOURCES ELEMENTS IN ELECTROSTATIC PROPULSION OF THE OUTPUT IN CASE OF ELECTROSTATIC MOTOR

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Abstract: In the construction of the electrostatic motor, that we developed, the rolling spherical bodies caused the rotation at the level of the rotor. For this reason is so important to determine a theoretical output for this model, based on experimental values. Calculate this output for different propulsion situations it can be evaluate the existing optimal number for the rolling spherical bodies. For this reason the electrostatic motor has a four arms collector in which the propulsion it be made with one, two until four rolling spherical bodies.

1. Theoretical and experimental elements

When were presents the electrostatic propulsions for a single rolling body made by iron [1, 3], an experimental conclusion were so interesting: if the high voltage source turned off the electrical energy cumulated in to an electrical condenser mounted in the source caused the rotation of the rolling body.
This motion is constantly for a metal ball for a long time. In time we measure by case to case twenty to twenty-five minutes, [4]. It s amazing to move a metal ball in the inner circle ring (upper size of a spatial condenser), where the mass of the rolling body is at 1,07grames and the metal ring radius is 5, 36 centimeters.
Base on the experimental dates it s determine that a period of one rotation it is 0,53 seconds, that mean for the rolling body a *total distance at more then 950 meters*. In time we must remember that the rolling body makes a complex movement at along this distance, the rolling movement of the body involves the precession of the instantaneous axis of the body's rotation – implying a continuous variation of the sphere rolling circle, a variation of both this circle's plane on the rolling area, and of the length of this circle.
These consequences generate at their turn a "sinusoidal", winding movement of the mass center trajectory to the inner perimeter of the superior fitting's ring of the spatial condenser,[5]. Experimentally, the rolling movement of the body involves the precession of the instantaneous axis of the body's rotation – implying a continuous variation of the sphere's rolling circle, a variation of both this circle's plane on the rolling area, and of the length of this circle.
This fact determine us to tray a mathematical approach for estimation of the output at the electrostatic motor, where the collector of it makes by for arms, altering in plane at nineteen degrees, (symmetrical), [5]. In fig.1 it's representing the construction of the electrostatic motor where just one rolling body causes the rotation of the motor.
The experimental stand contains: the spatial condenser, formed of: the square stand and the inferior dielectric on which the inferior fitting of the condenser is laid, superior dielectric 4, which represents the rolling area of the spherical body 5, in the end of the same time of the stator at the electrostatic engine.

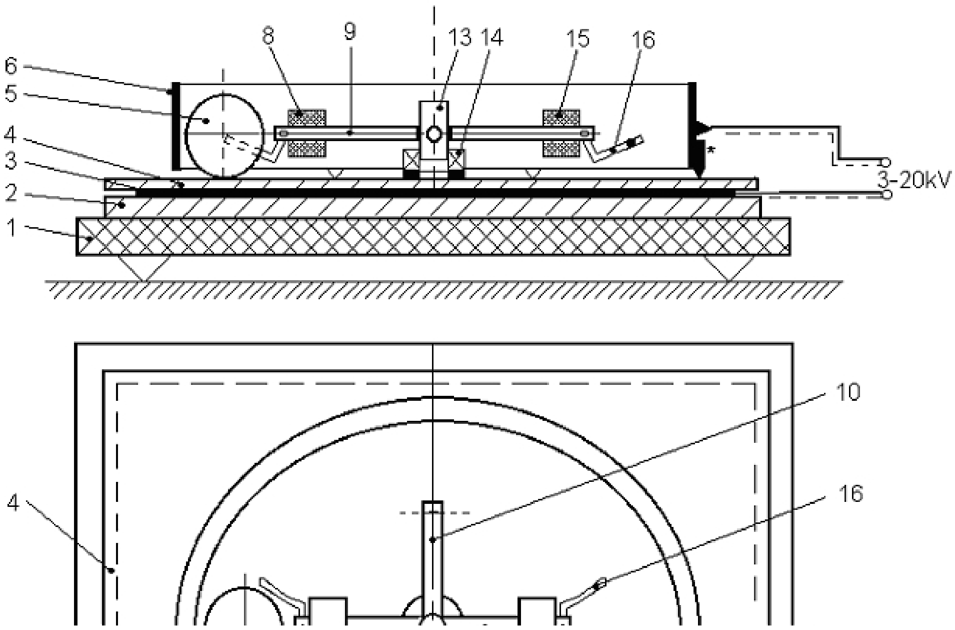

Fig.1 The collector design with the for arms and one rolling body

Placed on the superior dielectric inside the metallic ring 6, it can found the rolling body that, when this condenser is fed from a source of constant high tension, starts the rolling movement, inside the superior fitting.
This movement is taking place in the electric field that is generating by the spatial condenser in the space of the superior dielectric.
In this type of construction the collectors 16, are makes from steel the constructions elements, 1 to 4 and 6 form the spatial condenser in witch is replaces the whole rotor 13, with horizontally two arms 9 and another vertically two arms 10, like as see in top figure. To center dynamically the rotor it's use the masses 8, and 15, for each arm in construction. In this way it's increase kinetically moment of the whole rotor.

2. Mathematical model and experimental data

As fallow we tray to determine the influence of the number of rolling bodies, about the value of output for this type of electrostatic engine. Evidently in the same way we establish the influence of the position in the rotor at two rolling bodies.
Relation for the total output of the experimental construction is including: the electrical output of the hay tension source, the electrostatic field propulsion at the spherical bodies and their frictions with the collectors, the friction between the rolling body and the air, at last, the out put of bearing 14. In this paper actually the out put of the hay tension source it s considering so hay for that in the mathematical simulation is not be considering.
So that the energetically relation between the electrical energy and the mechanical movement energy, it s mean the first tree terms in the right part of the equation 1, in which the last two terms represents the mechanical frictions of the rolling body or bodies with the ring 6, glass 4 and collector 16; and the aerodynamics resistance of the rolling body.

$$iUT_R = \frac{nm_1\omega_{Mn}^2R^2}{2} + \frac{m_2\omega_{Mn}^2R^2}{2} + \frac{nm_1r^2\omega_{br}^2}{5} + \mu_r nm_1 g2\pi R + cnS\rho v^2\pi R \qquad (1)$$

In the relation 1 the electrical energy it s measure for one fool rotation of the rotor in the electric field that is proportional with the energy that is accumulating in the mechanical system, in our case the rotor and the rolling bodies. In the relation 1, we have: i – polarization current, U – high voltage to supply the condenser, spatial condenser form at positions 6-the ring, 4- glass plate, 3- second part of spatial condenser, 2- final insulator of the condenser. T_R represent the rotation period of the rotor, in the right part of relation 1 we have in order: n- number of rotation bodies in the rotor, m_1- mass of the spherical steel body, ω_{Mn} - angular speed for the rotor of the motor, R- radius at the metal ring 6 in figure

1, m_2 – mass of the rotor including elements 8 and 15 (figure 1), for equilibration, ω_{br} - angular speed for the rolling movement, μ_r- friction coefficient between the rolling body and the glass 4, in the figure 1, g- the gravitational acceleration, at last the fifth term represents the aerodynamically friction with the ear, in this case it s very small quantity for one rotation body. Also we consider that for more spherical bodies this become important like as a value.
In the relation 1 the last tree terms in the right term estimate the lost energy by the rotor in different solutions of construction, for this reason can write the relation for the out put of the rotation at the rotor level without the out put of the bearing 14, in figure 1.

$$\eta = 1 - \frac{\frac{nm_1 r^2 \omega_{br}^2}{5} + \mu_r nm_1 2\pi R + cnS\rho v^2 \pi R}{iUT_R} \quad (2)$$

The studies of the rolling body movements in the inner of the ring 6, show that it s exist a correlation relation between the rotation on the inner perimeter of the spatial condenser and the rotation at the one instantaneous axis of the body / bodies rotation.

$$\omega_{br} r = \omega_{Mn} R \quad (3)$$

It is necessary to reduce the number of experimental dates. Like this it can be write the fallow relation for the relation 2.

$$\eta = 1 - \frac{\frac{nm_1 R^2 \omega_{Mn}^2}{5} + \mu_r nm_1 2\pi R + cnSv^2 \rho\pi R}{iUT_R} \quad (4)$$

The total out put in case of the electrostatic motor include the existence of the bearing 14, that means the relation 4 become like as below;

$$\eta_M = \eta \bullet \eta_B \quad (5)$$

Tab.1

Mass of rolling body m_1; [kg]	Radius of the spatial condenser, R; [m]	Electrical high voltage U; [V]	Rotation period T_R; [s]	Mechanical friction at rotation μ_r	Electrical conduction current i ; [μA]	Out put of the bearing μ_B
$1{,}07\ 10^{-3}$	$5{,}35\ 10^{-2}$	1600	0,850	0,05	3,021	0,97

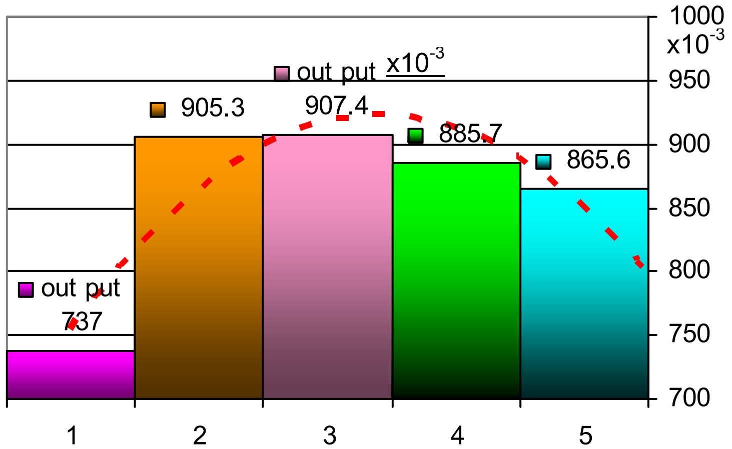

Fig. 2 Out put values for five rotors propulsion types

In figure 2 its show the out put for five different propulsions for the rotor at electrostatic motor. They are calculating with relations 4 and 5 for all situations in which the electrical out put of the supply is not include.
These values are fixing for the high electrical voltage to tray to compare the five solutions. Mathematical data are base on the experimental and geometrical dates at we show in table 1. For each column in figure 2, it's calculating the mean value for three independent experimental determinations in the same construction for the electrostatic motor.

3. Final conclusions

After the studies about the rotation period [6, 7] we make an important observation at the level of propulsion, also just one rolling body push instantly the rotor. Maybe this is a second reason because the rotation period grows with the numbers of rolling bodies. In present determinations we tray to determine if it possible, the optimal relative position for two spherical bodies and more, they works simultaneous.

Construction of the rotor maybe has a relative position between two rolling bodies where the propulsion is better. As we show in figure 2, the solution 'two' and 'tree' involve an increase of the out put. It s maybe possible that the relative angular position is better at 90 degrease like at 180 degrease, (in each case 'two' and 'tree' we have two rolling bodies but the angular position between the rotor arms is 180 degrease for model 2 and 90 degrease for model 3).

Conclusion at these facts is: the increase of out put with the decrease of the angular position at the rotor arms.

When in the rotor is a single rolling body the out put is so small, it is cause by the friction or a wrong montage. It s considering that this data represent an accidental value.

In the last two situations the number of rolling bodies is increasing, at tree for model 4 and four at model 5, it show that the frictions are great and the angular position isn't optimal and so that the propulsion of the rotor is not good.

At last the experimental values its show that the rotor construction must be change first at the angular position of the arms. If we found the optimal angular position between the rolling bodies maybe we can increase the number of arms for the rotor, so that, possible to increase the power.

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