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Electromechanical Converter and Ampere Force. Problem solution – COP > 1

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Let's get started. A little about the "eternal"!

What the Law of Conservation of Energy tells us is that it is a fundamental law of nature, ***established empirically*** and consisting in the fact that for an isolated physical system a scalar physical quantity can be introduced , which is a function of the parameters of the system and is called energy , which is conserved over time. Since the law of conservation of energy does not refer to specific quantities and phenomena, but reflects a general pattern that is applicable everywhere and always, it can be called not a law, but the principle of conservation of energy

The energy conservation law is formulated as follows: the total mechanical energy of a closed system of bodies interacting with the forces of gravity and elasticity remains unchanged. By the total mechanical energy we mean the sum of the kinetic and potential energies of bodies . Kinetic energy characterizes moving bodies, potential energy - interacting bodies. Both energies change only as a result of the interaction of bodies, in which the forces acting on the bodies do work other than zero. If several bodies in a closed system (when no external forces act on them) interact with each other only by gravitational forces and elastic forces, then for any interactions of bodies, the work of elastic forces (gravitational forces) is equal to the change in potential energy, taken with the opposite sign: $A = -(Ep_2 - Ep_1)$. And according to the kinetic energy theorem, the work of the same forces is equal to the change in kinetic energy: $A = Ek_2 - Ek_1$. Comparing both equalities, we get: $Ek_2 - Ek_1 = -(Ep_2 - Ep_1)$, i.e. change in kinetic energy and change in potential energy of bodies in a closed system are equal to each other in absolute value, but have opposite signs. If the kinetic energy of bodies increases, then their potential energy decreases by the same amount, and vice versa. In other words, there is a kind of transformation of one type of energy into another: $Ek_2 + Ep_2 = Ek_1 + Ep_1$... The transformation of potential energy into kinetic energy and vice versa is the main distinguishing property of energy.

This is a prelude. We are interested in an electromechanical converter, which, according to the traditional opinion in physics, is not possible with a conversion factor greater than one (**COP> 1**) or over one (CE). Well, let's make a short course on what this statement is based on.

A bit of electrical engineering theory about electrical machine devices (*you can skip it*)

An electromechanical converter, in traditional solutions, is a device that consists of two components mechanical (kinetic energy) and electromagnetic * (* *in physics there is no concept of electrical energy, there is the concept of electromagnetic field energy*). To shorten the term, traditionally the energy of the electromagnetic field is called electrical energy, we will also apply this in our narration, we will call it electromagnetic energy with the designation [*uh*] and kinetic energy is mechanical energy with the designation [*k*]. Any energy is measured in Joules [*J*]. There is a clear definition of what an electromechanical transducer is. This is a device that converts one type of energy into another, an electric motor (electric motor) - electrical into mechanical, and an electric generator (alternator) - mechanical into electrical. This device is an electromechanical machine, based on the rotation of a moving part (rotor, armature), relatively stationary, static (stator). We will not use the concept of energy as such. We will use the concept of cardinality . Power [***P***] Is a scalar physical quantity that characterizes the instantaneous rate of energy transfer from one physical system to another in the process of its use and, in the general case, is determined through the ratio of the transferred energy to the transfer time. Measured in watts [*W*]. Watt to joule refers to the ratio of $1J = 1W * s$ *or* $1W = 1J / s$.

Power is the resulting concept, let's analyze it for our components.

Rotational power , expressed by the condition $\boldsymbol{Pk = M * \omega}$, where ***M*** is the moment of force, in *Newtons per meter* [*N * m*]; **ω** - angular velocity of rotation, *in radians per second* [*rad / s]* . The angular velocity can still be expressed by the expression $\boldsymbol{\omega = 2\pi * n / 60}$, where ***n*** is the number of revolutions per minute [*rpm*]. We can write down the expression of mechanical power for rotary motion $\boldsymbol{Pk = M * 2\pi * n / 60}$. Let's remember this expression. Finding out the position with the Moment of Power .

The moment of force [***M***] relative to a fixed axis is called a scalar value equal to the projection on this axis of the vector of the moment of force, relative to any point located on the axis. This moment is equal to the projection of the force vector onto the plane perpendicular to the axis of rotation, [***F***], multiplied by the shoulder of the force [***r***] - the shortest distance from the axis to the line of the force action circle: $\boldsymbol{M = F * r}$, where ***F*** is the force in *Newtons* [*N*], ***r*** is the shoulder of the applied force to the axis of rotation, in *meters* [*m*]. Next, we write down the expression for the mechanical moment of force for rotary motion relative to power: $\boldsymbol{M = Pk * (60 / 2\pi) / n}$, where: $\boldsymbol{60 / 2\pi = 30/2 * 3.14 = 9.55}$, we get the expression $\boldsymbol{M = Pk * 9.55 / n}$. If we transform this formula to determine the power from the moment of force, it will take the form: $\boldsymbol{P = M * n / 9.55}$. Traditionally, this formula is used with a power value in kilowatts with a coefficient: $\boldsymbol{60 / 2\pi * 1000 = 9550}$.

Electrical power is a physical quantity that characterizes the rate of transmission or conversion of electrical energy. The power of the electric current is equal to the product of voltage and current: $\boldsymbol{P_e = U * I}$, where ***U*** is the voltage on the circuit section, *in volts* [*V*]; ***I*** - current strength in this area, *in amperes* [*A*]. The expression of electrical power, according to Ohm's law, can be written using the resistance to current in the conductor ***R*** , *in ohms* [*Ohms*]: $\boldsymbol{P = U^2 * R}$; $\boldsymbol{P = I^2 / R}$. For alternating current circuits, the expression $\boldsymbol{P_e = U * I * \cos \varphi}$ ***is also used*** , where $\boldsymbol{\cos \varphi}$ is the power factor .

How do these completely different systems fit together? To begin with, according to the power of 1 *kW* [***P*** *k*] = 1 *kW* [***P*** *em*] . The second is on the **Moments of Power** . An electric motor and an electromechanical generator have such an indicator as the electromagnetic moment of an electric machine. You can find this expression: The moment of force developed by the electric motor is equal to the electromagnetic power divided by the synchronous rotation speed of the electric drive: $\boldsymbol{M = P_e / \omega}$. We can freely write in this form $\boldsymbol{M = P_e * (60 / 2\pi) / n}$ or $\boldsymbol{M = P_e * 9.55 / n}$. Following the logic, if the powers- mechanical and electrical are equal, then their Moments of force on the shaft are also equal.

For an electromechanical generator, such an expression is conditional, so it will not always be fulfilled. For a synchronous generator, the following condition is met: $\boldsymbol{M = F * (d / 2)}$. For example, for a direct current generator, the expression of the electromagnetic moment is: $\boldsymbol{M = N * F * (d / 2) = (p * N / 2\pi * a) * \Phi * Ii}$ where: ***d*** is the diameter of the armature; ***p*** is the number of pole pairs; ***N*** is the number of armature winding conductors; ***a*** is the number of pairs of parallel branches; ***Ii*** - armature current; ***Φ*** is the magnetic flux of the poles.

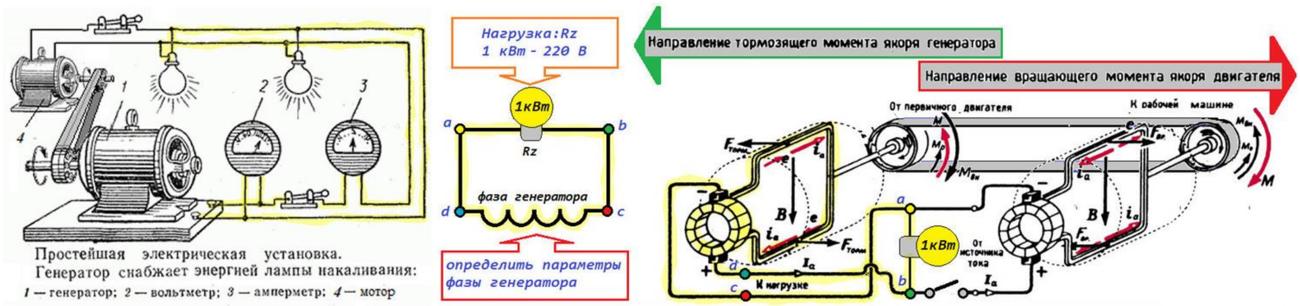
The electromagnetic power of the electromagnetic moment of the generator can be expressed by the condition $\boldsymbol{P = M * \omega}$ or $\boldsymbol{P = M * n / 9.55}$. The only question remains is whether the equality between the electrical power expressed by the formula $\boldsymbol{P_e = U * I}$ and the power of the electromagnetic moment expressed by the formula will be fulfilled : $\boldsymbol{P_e = M * \omega}$. A logical question arises about the relationship between the electromagnetic moment and the electric power of the electric motor. We will understand how an electromagnetic moment arises in a generatorand an electric motor. Let's consider all this on the example of a frame in a magnetic field. Here is a picture you can see in the tutorials.

Electromagnetic force ***Fa*** [*H*] has its own definition formula. For a straight wire in a magnetic field $\boldsymbol{Fa = B * I * l}$, where ***B*** is the magnetic induction from the wire from the wire to the point of contact with the plane of the magnet pole, *in Tesla* [*T*]; ***I*** is the current in the wire, *in Amperes* [*A*]; ***l*** - active wire length, *in meters* [*m*].

The magnetic induction is determined by the formula: $\boldsymbol{B = \mu_0 I / 2\pi r}$, where $\boldsymbol{\mu_0}$ is the magnetic constant; ***I*** is the current in the wire; ***r*** is the distance from the wire to the pole, *in meters* . The current in the wire is determined by the current formula for the complete circuit $\boldsymbol{I = E / (R + r)}$, where: ***E*** *is* the electromotive force, *in volts* [*in*], ***R*** *is* the load resistance and ***r*** *is* the source resistance, *in ohms* [*Ohm*]. The electromotive force in the conductor that crosses the magnetic field is determined by the formula: $\boldsymbol{E = B * l * v * \sin(a)}$, where **B** is the magnetic induction from the magnetic pole, ***l*** *is the* length of the wire, which is affected by the magnetic induction (active wire) , *in meters* , and ***v*** is the rate of change of the magnetic induction in the zone of the wire, *in meters per second* [*m / s*], ***sin (a)*** *is the* sine of the angle of the magnetic induction vector to the axis of the conductor *(in our case, it will be = 1, which corresponds to the right angle at 90* ^{0} *).*

Condition and solution of the problem.

It remains to check whether the condition that the electromagnetic moment of the generator (mechanical power of the resistance) is identical is its electrical power. Let's take a drawing of the simplest electrical circuit with a generator. Generator in the same circuit with incandescent lamps. Suppose incandescent lamps are included in the circuit, with a total power of P_e = **1000** ***watts*** (**1** ***kW***), at **220** ***volts of*** voltage, in the network circuit. It is necessary to calculate the parameters of the generator, and find out the possibility of connecting a motor to the circuit to rotate the generator of the same circuit.



Простейшая электрическая установка.
Генератор снабжает энергией лампы накаливания:
1 — генератор; 2 — вольтметр; 3 — амперметр; 4 — мотор

First, we need the generator parameters. We will calculate the generator according to the classical scheme of a frame rotating in a magnetic field between two poles.

Solution -1: defining the raw data of the generator:

For the calculation, we already have the initial load data: $\mathbf{P_e = 1\ kW}$ (**1000** ***W***); Mains voltage **-** $\boldsymbol{U}$ **= 220** ***V*** ; We determine the load resistance of the formula $\boldsymbol{Rz = U^2 / P}$ **= 220** ^{2} **/1000 = 48.4*ohms*** . Determine the effect of the load current $\boldsymbol{Iz = P_e / U}$ **= 1000/220 4.55 =** ***A*** .

We choose a wire by cross-section, taking into account the current throughput: [***d***] the diameter of the copper wire in the varnish = **1** ***mm*** , $\boldsymbol{S}$ = **0.79** $\boldsymbol{mm^2}$, with $\boldsymbol{Ai}$ = **8** ***A*** per *square meter. mm* , the capacity of the current will be: $\boldsymbol{J = Ai / S\ (mm^2)}$ **= 8 / 0.79 = 6.28** ***A*** .

Let's define the following parameters for the generator: angular speed of rotation of the shaft: ***n*** **= 650** ***rpm*** ; the diameter of the armature ***d*** **= 0.35** ***m*** (*in our case, the distance between the active conductors of the frame relative to the center of rotation*); Magnetic induction ***B*** **= 0.4** ***T*** , maximum index ***sin (a)*** **= 1** , at 90^0 .

We need to calculate the EMF [*E*] and the length of the active wire [*l*]:

EMF [***E***] is calculated from the current formula for the complete circuit: $\boldsymbol{Ii = (E - U) / (R + Rz)}$, (*where* ***R*** *is the resistance of the active wire of the generator frame).* To calculate the EMF, the formula will take the form: $\boldsymbol{E = (U + I) * (R + Rz)}$ **= 220 + 4.55 * 48.4 +**

[?] , - we do not know the resistance of the active wire, the frame. There is another option, to calculate the EMF [***E***] according to the formula: ***E = U * k*** , where - ***k*** is the coefficient expressed by the ratio of the mains voltage to the EMF of the phase. Coefficient [***k***] cannot be less than **2** . When ***k* = 2** , the ideal state is when the phase resistance is **0** . Let's check: ***E = U + (I * (R + Rz))*** **= 220 + (4.55) * (48.4 + 0)) = 440 *V*** ; ***The U * = E the k*** **= 220 * 2 = 440 *In*** . Now we need to determine the length of the wire and its resistance. We find it emf of formula [***E***] for a linear wire: ***E = B * l * v*** , of it to derive the active wires: ***l = E / v / B*** . For the calculation, we need the parameter of the rate of change of the magnetic flux - ***v*** , we find it by the formula: ***v = πnD / 60*** **= 3.14 * 650 * 0.35 / 60 = 11.9 *m / s*** . We find the length of the wire: ***l = E / v / B*** **= 440 / 11.9 / 0.4 = 92.44*meters*** . Determine the resistance of the active phase wire: ***R = Ri * l*** [where *Ri* = *ρ* * (1 / *mm²*) = 0.017 * (1 / 0.79) = 0.0276 *Ohm*] **= 92.44 *m* * 0.0276 *Ohm* = 2 , 55 *Ohm*** . Next, we can calculate the current in the loop. Mains current ***Ii*** (at ***E* = 440 *V***): ***Ii = (E - U) / (Rz + R)*** **= 440 - 220 / 48.4 + 2.55 = 4.32*A*** . We received between the load current to the power circuit current: **4 55 - 4.32 = 0.23 *A*** . We can correct our coefficient: ***k* = 2 + (1 - *Ii / Iz)* = 2 + (1 - 4.32 / 4.55) = 2.05054945055** . We adjust our frame generator emf: ***E = the U * the k*** **= 220 * 451 = 2.05054945055 *in*** . We correct the length of the active wire of the generator frame: ***l = E / v / B*** **= 451 / 11.9 / 0.4 = 94.75 *meters*** . We check on the initial value of the electromotive force formula: ***E = B * l * v*** **= 0.4 * 94.75 * 451 = 11.9 *in*** . We check the value of the current in the circuit: ***I = (E- U) / (R + Rz*** **) = 451 - 220 / 48.4 + 2.55 = 4.55 *A*** .

As a result, the load power: ***P e*** = **1000 *W*** , with a resistance of **48.4 *Ohm*** , which is provided by the generator phase, the length of the wire of which is: **94.75 *meters*** with a current of **4.55 *A*** ,and the resistance of the active wire of **2.55 *Ohm*** .

Solution - 2: determining the possibility of connecting the motor to a circuit with a generator and load:

We can, according to the classical formula, calculate the electromagnetic moment of the generator (*provided that* , ***P e = P k***) : ***M = P e*** *** 9.55 / *n* = 1000 * 9.55 / 650 = 14.69 *N * m*** . It remains to clarify the coefficient of the idle moment of the generator (*what resistance to rotation is provided by the mechanical part of the generator, when rotating at a given speed without including the frame in the circuit with a load*), traditionally they take 20% of 100% of the electromagnetic moment under load. As a result, 100% + 20% = 120% of the electromagnetic moment of the generator generated by the induction of the current: ***k* = 1.2**... The electromagnetic moment of the drive motor will be = **1.2 * *M* = *17.63 N * m*** . Define the electrical power of the drive motor: ***P e motor*** **= 17.63 * 650/9550 = 1.20 *kW*** .

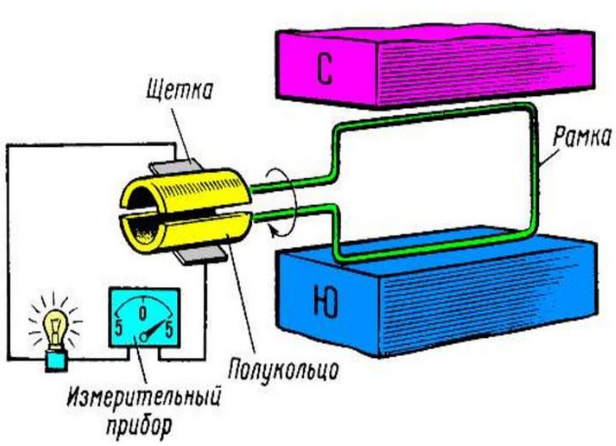
We define transform coefficient **COP =** P $_f$ generator / R $_e$ Motor = 1 / 1.2 = **0.83** .

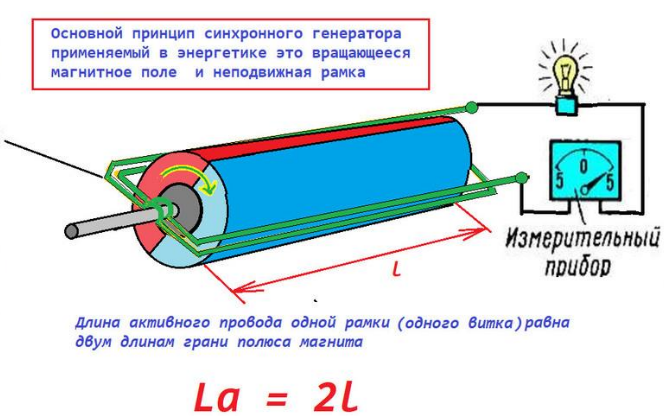
As you can see, everything coincides with the traditional statements. Conversion factor: **COP = 0.83 <1** . We cannot include an additional drive motor for the generator to the load, proceeding from the condition of equilibrium of the kinetic and electric powers.

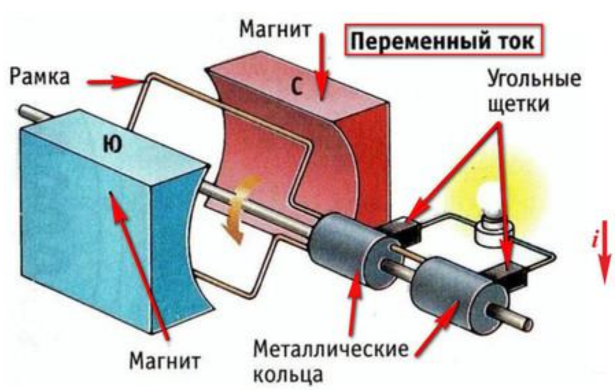
But that's not all, let's go ahead and calculate the electromagnetic moment of the generator through the ampere force and the radius vector.

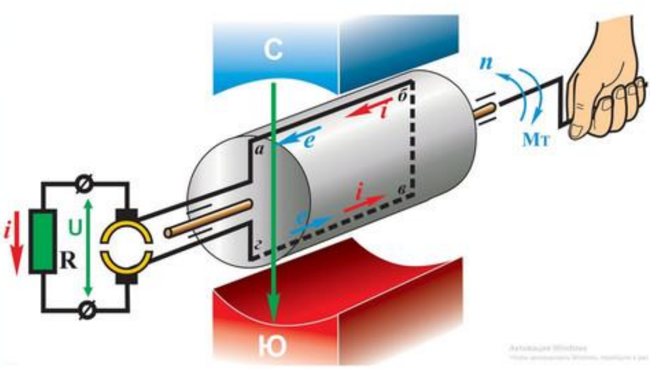
We examined the basic mechanism and technology for calculating a circuit for a load of appropriate power. The element of this circuit is precisely the electric circuit of the generator, in which the EMF is induced ($E = Blv$). The current in the circuit is the resultant balancing of the potential difference of the induced EMF [E] ($I = EU / R * r$), where; U is the voltage of the circuit, or the level to which the EMF voltage drops; R - load resistance; *r is the* resistance of the active active conductor of the generator phase, on which the EMF is induced.

This matrix is the basis for starting the design of a generator or OU electromechanical converter for the planned corresponding load. The whole problem of such machines lies in the factor of the electromagnetic moment of the generator and motor









Solution - 3: determination of the electromagnetic moment of the generator through the electromagnetic force and the radius vector:

To calculate the electromagnetic moment, through the Ampere force, we use the basic formula: $M = Fa * (d / 2)$: where Fa *is the* Ampere force, *in Newtons* . The Ampere force is calculated by the Formula: $Fa = B * In * La$, where: magnetic induction: $B = \mu_0 * (In / 2\pi * r)$, *in T* , current in ampere turns: $In = n * I$, *in Amperes* ; and La *is the* sum of the lengths of the two active sides of the frame, divided by the number of turns: $La = 2 * l / n$, *in meters* .

Imagine that our frame is elongated to the full length *1/2 of the* length of the generator phase = 94.75 meters / 2 = 47.36 meters, we get the length of one face of the frame, which is actually not the real length of the generator armature, for an electromechanical device. We will assume that we have it with a minimum or very high idle torque.

Let's calculate the electromagnetic moment of one frame of an *unreal* generator, with magnetic induction on the surface of the wire (no gap) r = 0.1 *mm* (0.0001 *m*):

$$M = ((\mu_0 * I * n / 2\pi * r) * (I * n) * (La * n) * (d / 2) = (0.00000126 * (4.55 * 1/2 * 3.14 * 0.0001)) * (4.55 * 1) * (2 * 47.36 * 1) * (0.5 * 0.35) = 0.681 \ Nm$$

We got a completely unrealistic small dimensionality of the electromagnetic moment **EMM =** **0.681** ***N * m*** , against **EMM = 14.69** ***N * m*** , subject to the equilibrium of powers!

That's the result! According to traditional canons properly substitute the induction of the external magnetic field: *Bm = 0.4 Tesla* .

$$M = Bm * (I * n) * (La * n) * (d / 2) = 0.4 * (4.55 * 1) * (2 * 47.36 * 1) * (0.5 * 0 , 35) = 29.8 \ Nm,$$

which is much more for the equilibrium condition to be fulfilled.

I double-checked it again for an error, but there are more likely two different indicators. One is with what force a magnetic field acts on a conductor with a current in a magnetic field, and the second indicator is what force a conductor with a current develops in response to the force of an external magnetic field.

I also made a calculation: I put the length of the wire in turns and reduced the length of the frame (armature / rotor) until the equilibrium condition of the Power was met. Results in the table:

Проверка возможностей преобразователя по расчету электромагнитного момента генератора

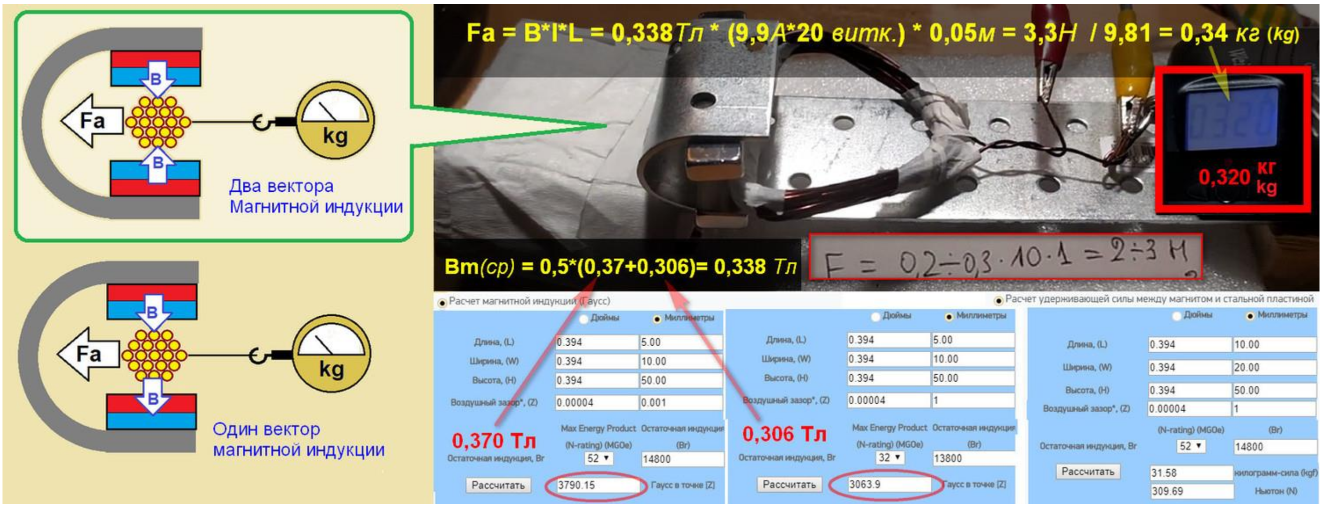
№	*Наименование*	*об.*	*Изм.*	A	B	C	
1	Количество витков	*N*	*i*	***1***	***1***	22	
2	Длина активного провода рамки с током	*La*	*м*	***94,9***	***94,9***	***4,31***	***La = l / N***
3	Магнитная индукция провода с током	*B*	*Тл*	0,4000	0,0091	0,2002	$B=\mu_o*(I*N/2\pi r)$, $r = 0,0001$
4	Сила Ампера длины активного провода или жгута	*F*	*N*	172,64	3,93	86,40	$F(a)=B*(I*N)*La$
5	Предпологаемый Электромагнитный момент	*M*	*Nm*	**30,21**	**0,69**	**15,12**	$M[g]=Fr$
6	Предпологаемая мощность на валу	*Pg*	*kW*	**2,056**	**0,047**	**1,029**	$Pg=M*n/9550$
7	Коэффициент холостого хода электромашины	*Km*		*1,200*	*1,200*	*1,200*	
8	Предпологаемая мощность приводного двигателя	*Pm*	*kW*	**2,468**	**0,056**	**1,235**	$Pm=Km*M*n/9550$
9	Мощность генратора	*Pg*	*kW*	1,00	1,00	1,00	
10	КПД преобразования			0,41	17,81	0,81	

The first two columns are actually what we counted. The first column (A) is the result of the classic application of the Ampere Force, the mechanical power on the shaft was 2 kW. against 1 kW of electric power of the generator, with an idle torque and a drive motor, conversion efficiency COP-0.41. The second column (B) is the result based on the magnetic induction of the wire. That is, if we start from exactly these data, and in the presence of one frame, the simplest generator, the power on the shaft will be 47 W. The efficiency of the converter in ideal conditions will be COP - 17.8 (this is incredible) !!! To reach the parity with conventional formula frame laid in turns (*with the proviso that* , $P_E = P_k$) achieved at 22 turns. With the condition of idling and the drive motor, the conversion efficiency will be COP - 0.81. Obviously, an anchor with two support points, of this length, cannot be made.

We have two more calculations. The wire was laid in turns (*we will take an inactive wire for zero resistance, and we will not take it into account*). To achieve parity with the condition when $P_{EM} = P_k$, we got 22 turns. The frame edge length has been reduced from 47 *meters* to 2.15 *meters* . It turns out that the current and magnetic induction increased 22 times, and the length of the active wire decreased 22 times. If someone thinks that some kind of insanity, nothing like that, this is not compliance with the law of conservation of energy, when the kinetic power is equal to the power of an electric electromechanical machine.

I have not succeeded, at the moment, either to refute or confirm the condition of equality of mechanical and electrical power in the simplest generator.

To convince me of the work of the canonical power of Ampere, the seeker under the nickname DED conducted an experiment LINK on YouTube



The author has two magnets attached to a magnetic clamp with identical poles oriented to a bundle of 20 wires. I counted on the basis of the given average magnetic field strength of the magnets at the pole and a distance of 1 mm. Got 3.3 N versus 3.13 N in the experiment. Now let's recalculate how much force the wire itself will develop, or rather a bundle of 20 wires with a current in the core of 9.9 A (9.9 * 20 = 198 A). To do this, you need to calculate the resulting magnetic induction on the surface of the wire and the ampere force: Fa = (μ_0 * I * N / 2πr) * (I * N) * La

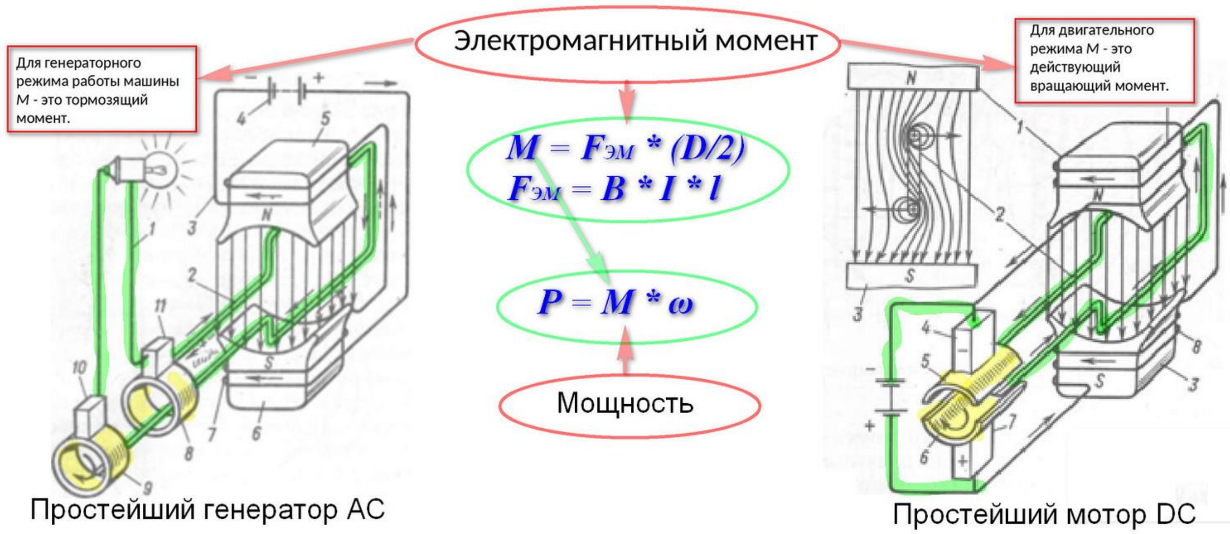
***Fa* = 0.00000126 * (9.9 * 20) / (2 * 3.14 * 0.0001) = 0.396 T * (9.9 A * 20) * 0.05 m = 3.92 Newtons**

The result is a very striking small difference in values: The fact of the experiment was 3.3 *Newtons* , and the force on the surface of the wire was 3.92 *Newtons* . Even if we compare with the data obtained, the resulting force does not exceed the result based on the magnetic induction of the external field for a conductor with current. Let me draw your attention to the fact that the magnetic inductions in the conductor zone both from the external field and the conductor itself are approximately equal.

In our calculation, when using the traditional method, by substituting the magnetic induction, it is the external field, the result of the calculated force, exceeds the value twice, both from the calculation of the power ***M = P * 9550 / n*** , and the value obtained in the experiment. It's just a paradox.

Pk *= Bm * (N * I) * La = 0.4 * (4.55 * 22) * 4.31 = 172.5 H * (0.5 * 0.35) = 30.21 Nm * 9550/650 =* ***2.05 kW > Pe - 1.0 kw***

Pk *= B * (N * I) * La = 0.2 * (4.55 * 22) * 4.31 = 86.4 H * (0.5 * 0.35) = 15.12 Nm * 9550/650 =* ***1.03 kW = Pe - 1.0 kW***

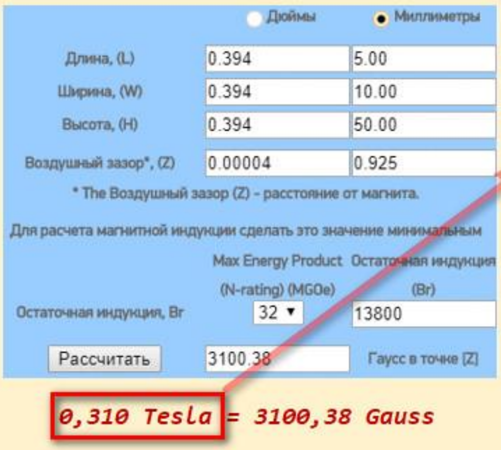


It turns out that if we make a motor with such characteristics, then at the input, we supply electrical power ***Pe = 1 kW*** , and on the shaft we get mechanical power exceeding the electrical ***Pk = 2 kW*** ? And if the calculation is correct, then how can a generator, in a pair with a motor, form an electromechanical converter with an efficiency of 0.6-0.7?

And if we apply other indicators, a larger field and a smaller current (we are specifically interested in this option), a smaller field and a larger current (for analysis), how will the Ampere force on the displacement of the conductor in a magnetic field depend. Moreover, our external field is static, and the conductor is dynamic. For example, in a permanent magnet DC motor, the current factor in the wire changes. no magnetic induction or length does not change?

There are too many questions, if there are constants, they must be fulfilled primarily in basic devices, which for the generator are the simplest ones in the form of a frame with a current in a magnetic field.

The searcher under the nickname DED conducted two more experiments. **REFERENCE 1** ; **REFERENCE 2** ***,*** were very interesting results are obtained, ***F = 0.32 kg (3.1 N)*** , the tractive force in the wire at a current ***of 100 A*** , the wire length ***of 0.2 m*** and the magnetic flux density ***0.340 - 0.100 Tesla*** . :



Расчет от Магнитной индукции внешнего поля

Calculation of the magnetic induction of the external field

		Bm (T)	*I(A)*	*La*	*F (N)*	*F (kg)*
1.	0,340 + 0,100/2 = 0,220	0,220	100	0,2	4,40	0,45
2.	0,310 / 2 = 0,155	0,155	100	0,2	3,10	0,32
3.	Bm =F/(I*La)	0,155	100	0,2	3,10	0,32
4.		0,310	100	0,2	6,20	0,63

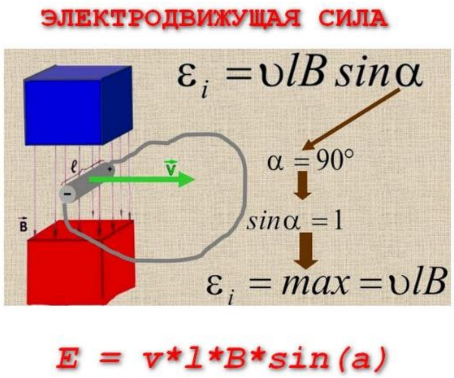
Расчет от магнитной индукции проводника с током

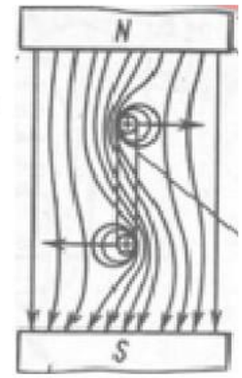
Calculation of the magnetic induction of a conductor with a current

	r (m)		*B (T)*	*I(A)*	*La*	*F (N)*	*F (kg)*
5.	0,000129	*0,129 мм*	0,155	100	0,2	3,10	0,32
6.	0,0001	*0,1 мм*	0,200	100	0,2	4,00	0,41
7.	0,001	*1 мм*	0,020	100	0,2	0,40	0,04
8.	0,004	*4 мм*	0,005	100	0,2	0,10	0,01
9.	0,0000648	*0,0648 мм*	0,310	100	0,2	6,19	0,63

If you perform calculation of the resultant magnetic flux density ***Bm*** of Formula modulus ***Bm = Fa / (I La *)*** ; we get ***Bm = 0.155 T*** / *first table 3 row* /, i.e. this *is the* actual value of the flux density for a given Ampere force modulus. There are two options to explain this.

The first option , the wire adjoins only one side of the magnet (not being in a continuous magnetic flux), then it is logical to assume that the magnetic induction parameter from the pole should be divided into two / *second line of the upper table /* . To do this, we need to find the actual value of the Induction of the magnet. According to the calculation, we found this value for a magnet, it corresponds to the magnetic induction at a distance of ***0.925 mm***... We can write off this distance. for wire insulation in the experiment. But there is one thing, this test setup. is a kind of direct current magnet and the wire will act in the pole of the magnet according to its magnetic field spin or be attracted or repelled. We cannot explain this effect by dividing by two, the parameters of the magnetic induction. If you place a conductor in a uniform field, its field will also have a higher density on one side than on the other. When you turn on the current in the conductor, the wire just sticks to the pole of the magnet. For such a magnet flux density on the surface of the pole estimated **0.375 *T*** , measured **0.340 *Tesla*** . (the *difference is very big*). It is not important to the resultant magnetic induction upon: ***Bm = 0.155 T,*** in less than half of the magnet ***Bm = 0,310 T*** . You do not find a parallel with our question! The same difference in half. In fact, tractive effort does not fulfill the condition of Ampere's Law in its purest form. In the sources there is such a term **-** *the* average value of the force. It is associated with the angle ***sin (a)*** :





I want to clarify that we are calculating the peak value, which means that this value will correspond to the peak current in the circuit, respectively, the peak value of the Ampere force and, as a consequence, the peak value of the electromagnetic moment. This value should correspond to the maximum value of the mechanical power. According to the canonical rule of calculation, the steelyard was supposed to fix the value: ***F = 0.310 T * 100 A * 0.2 m = 6.2 N * 9.81 = 0.63 kg*** , and in fact it is half less.

If we consider a school drawing, how a magnetic field pushes out a conductor, we will see that the pressure occurs only from the back side of the pushing out, this is not a condition of the experiment, but a pattern. Here is just one problem, I have never met such a situation that the calculated ampere force is divided in half, to calculate the electromagnetic moment of a motor or generator, but it is asking.

Option two , if we take into account what force the current conductor itself develops. Many will object, they have long established that any conductor with current creates a magnetic field in the surrounding space. In this case, the electric current is the ordered movement of electric charges. This means that we can assume that any charge moving in a vacuum or medium generates a magnetic field around itself. As a result of generalization of numerous experimental data, a law was established that determines the field ***B of a*** point charge ***Q*** moving at a constant nonrelativistic speed. This law is expressed by the formula:

$$\mathbf{B} = \frac{\mu_0 \mu}{4\pi} \frac{Q\,[\mathbf{vr}]}{r^3}, \qquad (113.1)$$

where r - radius vector drawn from the charge ***Q*** to the observation point *M* . According to expression (113.1), the vector B is directed perpendicular to the plane in which the vectors v and r are located, namely: its direction coincides with the direction of translational motion of the right screw as it rotates from v to r. The modulus of magnetic induction (113.1) is calculated by the formula

$$B = \frac{\mu_0 \mu}{4\pi} \frac{Qv}{r^2} \sin\alpha, \qquad (113.2)$$

where a is the angle between the vectors v and r. Comparing expressions (110.1) and (113.1), we see that a moving charge in its magnetic properties is equivalent to a current element:

$$\boldsymbol{I}\, d\, \boldsymbol{l} = \boldsymbol{Qv} .$$

In the Ampere Force formula, this ratio of current to the length of the conductor in the equivalent of charge to speed is applied: $\boldsymbol{F} = \boldsymbol{Bm} * \boldsymbol{I}\, d\, \boldsymbol{l}$. Everything is correct here. But the wire is not a ball, and probably having its own magnetic field, it resists pushing out. In this case, the actual direction of the Ampere force is perpendicular to the direction of magnetic induction at its maximum value, that is, the sine of the right angle $\sin(90^0) = \mathbf{1}$.

We have established what force the external magnetic field will exert, and what force the conductor itself will develop. We can calculate from the magnetic induction of the conductor itself using the formula $\boldsymbol{B = \mu_0 * I / 2\pi r}$, where $\boldsymbol{r} = 0.0001\ m$, this is the distance from the surface of the conductor to meeting the external magnetic field (*0.0001 m = 0.1 mm*). Someone will object that no one does this, but let's try:

$$\boldsymbol{B = \mu_0 * I / 2\pi r = 0.00000126 * 100 / (2 * 3.14 * 0.0001) = 0.200\ T.}$$

Now let's try to calculate the distance $\boldsymbol{r}$ - the *boundary of the conductor field from the surface of the conductor* (*5th row of the second table*). We found this value $r = 0.000129\ m$. At this distance, the electromagnetic force of the conductor will be equal to the ampere force acting on it.

Let us return to the first experiment, in which the condition for the modulus of force was satisfied. First, two vectors of external magnetic force are directed to the conductor, oriented towards the center of the conductor. When a conductor has its own vortex magnetic field, it will interact at two points. We can multiply the resulting index of magnetic induction to calculate the ampere force by two, or find out the resulting magnetic induction of one vector. Let's calculate the resulting magnetic induction from the force modulus:

$$\boldsymbol{Bm = F / (I * N) * La = (0.32 * 9.81) /(9.9 * 20) * 0.05 = 0{,}317\ T} .$$

For a single vector of the magnetic induction of the external field ***0.317 / 2 = 0.1585 tesla*** . As we can see, here and here everything came together. Let us now calculate the distance r - the boundary of the equilibrium magnetic induction of a conductor with a current:

$$\boldsymbol{B = \mu_0 * N * I / 2\pi r = (0{,}00000126 * 9{,}9 * 20) / (2 * 3.14 * 0.0001255)\ T = 0.317} .$$

And so for a conductor with a current of 100 A, but if in a conductor we reduce the current value to 50 A.

Fa = Bm * I * La = (0.5 * 0.310) * 50 * 0.2 = 1.55 N , The magnetic induction of the wire will be $\boldsymbol{B = \mu_0 * I * N / 2\pi r = (0.00000126 * 50) / (2 * 3, 14 * 0.0000645) = 0.155\ T.}$

As you can see, the dependence is direct. All ambiguities have been removed. The statement that the mechanical and electrical power is equal have logical confirmation in calculations and experiments. At the same time, we figured out how to apply the formula for calculating the Ampere force

#	Позиция	Об.	Изм.	Показатель		Формула
1	Магнитная индукция внешнего поля / Magnetic induction magnet	Br	Тл	0,4000		
	Результирующая магн. индукция /The resulting magn. Induction	Bm	Тл		0,200	Bm = Br / 2
2	Результирующая сила Ампера / Resulting Ampere Force	F	N	172,6	86,32	F(a)=Bm*(I*w)*La
3	Электромагнитный момент машины / Electromagnetic moment	M	Nm	30,21	15,11	M=F*(1/2d)=F*r
4	Мощность на валу генератора / Generator shaft power	P(m)	kW	**2,06**	**1,03**	P=M*n / 9550
5	Мощность приводного мотора / Drive motor power	P(m)	kW	**2,47**	**1,23**	Pm = 1,2*M*n /9550
			COP	**0,80**	**0,80**	

As there Lenz - " **The magnetic field created by the induction current prevents the change of the magnetic flux that caused this induction current** ." Lenz formulated this rule in 1833. If you think about the physical meaning of Lenz's rule, then this is a special case of the Law of Conservation of Energy. For our generator In fact, the action of the field is opposed by the field of the conductor and their resultant is important. It turns out that to calculate the electromagnetic force, it is quite natural to use the calculation of the reaction force in the same way.

Thus, it is impossible to make a generator in the forehead that would have an efficiency of more than 1. To do this, you need to have an engineering solution, which we will consider further, but already for the readers of my guide.

I want to draw your attention, my dear reader, that research (experiment and analysis) revealed an interesting point in the use of the Ampere Force. In the case when two poles of the same name are directed to the conductor from two sides, the resulting Ampere force takes into account both of these vectors. With this effect, a motor is possible, with the conversion of electrical power into mechanical power with an indicator greater than one.

Later, the author apologized for making a reservation, in the first video about the orientation of the poles of the magnets in the clamp. Its installation option is as in the first picture. It is confirmed, a constant of physics, that the higher the density of the magnetic flux (magnetic induction), the more effective the Ampere force. It remains only unclear why science claims that the mechanical and electrical powers are equal, on the example of the simplest electrical machine at the maximum point of the EMF and current in the circuit, the mechanical power is twice the electrical power. Under the condition of an ideal flow that permeates a conductor with a current of $\boldsymbol{2P_{to}} > \boldsymbol{P_e}$. If the conductor or field moves with one side towards each other, the condition $\boldsymbol{1/2\ Fa}$ is fulfilled and the condition $\boldsymbol{P}$ is fulfilled $_k = \boldsymbol{P_e}$.

Unfortunately, I have not found an explanation for how the balance is deduced in reality, there is only **Mitkevich's rule**

A series of works [by V.F.Mitkevich] devoted to a deep [study of the physical nature of electromagnetic phenomena], to which he devoted the last thirty years (1921-1951) of his life. The deep ideas expressed by him are only now acquiring exceptional significance in modern physics and its latest applications, in connection with which the scientific foresight of V.F.Mitkevich becomes clear, which should be especially mentioned, marking the centenary of the birth of this outstanding Soviet scientist. We are talking about a large number of articles and speeches by Academician V.F. These views and ideas of V.F.Mitkevich were honed in passionate discussions and scientific disputes, in which he held fundamental materialist positions. The main points from these works are summarized in VF Mitkevich's large monograph " Magnetic flux and its transformations " (Publishing house of the Academy of Sciences of the USSR, 1946).

I would agree with this, but the electrical power of the generator and the network with the load must match.

The generator does not develop any power without a connected load, except for the idle power spent on rotation. no-load EMF voltage will be at the generator terminals: $\mathbf{E = Blv}$

§ 6.4. РЕАКЦИЯ ЯКОРЯ

В режиме холостого хода генератора постоянного тока в его обмотке индуцируется только ЭДС, а тока в обмотке нет, так как ЭДС параллельных ветвей взаимно компенсируются. При этом машина имеет только один магнитный поток — поток полюсов. Но стоит включить нагрузку, как в обмотке якоря появится ток и, как известно, этот ток создаст свой магнитный поток, который начнет накладываться на ток полюсов, т. е. имеет место явление, называемое *реакцией якоря*.

Mitkevich equation: $Pe = EI = Blv * I = BlI * v = Fv = Pk$,

where E [*idling EMF*] $E = Blv$, and F [*Ampere force*] $F = BlI$, is also fulfilled in the solution of the following condition: $Pk = M * n / 9.55$,

where: M [*Electromagnetic Torque*]: $M = F * (D / 2) = BlI * (D / 2)$, it is this formula that is unchanged in calculating the actual mechanical power.

Go ahead, we connect the load Pz , to the output terminals of the generator, and the voltage at the output will already change, it can be expressed by the condition: $U = E - (I * Rz * r_0)$,

where Rz is the load resistance, r_0 is the source resistance, i.e. wires of the entire phase of the generator. The result: ***the*** $U = 1/2\ E$.

Moving on electric power load $F z$ is expressed by $F z = U * I$. Electrical power in the chain, you can also express $Pe = I$ ***of the*** $U *$.

$$(Pz = U * I) = (Pe = U * I) < (Pe = EI)$$

In order for the equation to hold, for the equality of the output electrical power of the generator, the electrical power of the network and the electrical power of the load to the mechanical power of the generator, the equation must be written in the following form:

$$Pe = {\color{blue}1 / 2E} * I = {\color{blue}1 / 2B} * l * v * I = {\color{blue}1 / 2B} * l * I * v = Fv = Pk$$

for the Ampere Force, the values of the conductor length [l] and the current in it [I] , do not change, can be changed, only the resulting magnetic induction [V] . It is for this reason that I drew attention to the resulting magnetic induction in the formula for the Ampere Force:

Performed experiment REFERENCE Magnetic induction in the gap of *0.4 T* (table)

			Измерения / Trials				
			#1	#2	#3	#4	
Магнитная индукция в зазоре (средняя)/ Magnetic induction in the gap (average)	Bm	T	0,4	0,4	0,4	0,4	0,4 - 0,35
Ожидаемая сила в Ньютонах / Expected force in Newtons	F	N	**1,00**	**1,50**	**2,00**	**2,62**	F = BIl
Расчетное расстояние магнитной индукции / The calculated distance of magnetic induction.	r	m	0,0000250	0,0000375	0,0000500	0,0000655	$r=\mu_0*(I/2\pi*Bm)$
Сила измерительного прибора / Measuring device power	F	kg	0,065	0,105	0,135	0,18	
Сила в Ньютонах /Force in Newtons	F	N	**0,64**	**1,03**	**1,32**	**1,77**	F(N) =F(kg)*9,81
Коэффициент: факт/ожидание / Coefficient: fact/expectation			*0,64*	*0,69*	*0,66*	*0,67*	
Сила тока в Амперах /Current strength in Amperes	I	A	50	75	100	131	
Длина проводника, м /Conductor length, m	l	m	0,05	0,05	0,05	0,05	
Результирующая магн.индукция /The resulting magn.induction	B	T	0,255	0,275	0,265	0,270	B = F/(I*l)
Магнитная индукция провода /Magnetic induction of the wire	B(l)	T	0,255	0,275	0,266	0,270	$B=\mu_0*I/2\pi r$
Растояние от провода r = (метры) / distance from the wire r = (meters)	r	m	0,0000392	0,0000546	0,0000755	0,0000972	$r=\mu_0*(I/2\pi*B)$
Исходное напряжение / Initial voltage	U1	V	12,0	18,0	24,0	31,4	U1
Сопротивление проводника / Conductor resistance	R		0,2	0,2	0,2	0,2	
Напряжение с уч. падения / Voltage from the drop	U2	V	7,7	12,4	15,9	21,2	U2=U1-(I*R)
Величина падения напряжения/ The magnitude of the voltage drop		V	-4,3	-5,6	-8,1	-10,3	U2-U1
Коэффициент U2/U1/ Coefficient U2/U1			0,64	0,69	0,66	0,67	U2/Ui
Коэффициент коррекции точки поля проводника / Correction factor of the conductor field point			1,6	1,5	1,5	1,5	k"=U1/U2
Обратный коэффициент / Inverse coefficient			0,64	0,69	0,66	0,67	1/k"
Растояние магнитной индукции проводника/ Calculation of the magnetic induction distance of the conductor	r	m	0,0000392	0,0000546	0,0000755	0,0000972	$r=\mu_0*((I*k")/(2\pi*Bm)$

The experiment was carried out more or less correctly. The wire adhered to the pole of the magnet, the approximate insulation thickness is *1 mm* (*0.001 m*). Under the condition of compression by the wire at the moment of electromagnetic force, the probability of a smaller gap. The force of a dynamometer (electronic hand-held weighing scale) is the resultant electromagnetic force in kg. It is not difficult to calculate the magnetic induction knowing the strength, the current in the wire and its distance according to the formula $B = F / (I * l)$. It is also not difficult to calculate the distance of the magnetic induction of the wire, equal to the resulting one in fact, from the formula for the magnetic induction of the wire $B = \mu_0 * I / 2 \pi r$, we get $r = \mu_0 * (I / (B * 2\pi))$.

With a current of 50A in the wire, the expected ampere force will be: ***F = B * l * I = 0.4 * 0.05 * 50 = 1 Newton*** , and in fact ***0.64 Newton*** (less by ***1.6 times***). The question remains unclear what the resulting force and magnetic induction will be if the wire is rigidly fixed between the poles and can only move along the line in the middle of the gap. This remains to be seen.

In any wire, when creating a field, there is a voltage drop, in principle we calculate it $U = E - (I * R + r)$ drop coefficient $k_U = 1 + ((E-U) / E)$ and take it into account in the formula: calculating the distance ***r*** : $r = \mu_0 * k_U * I * / (2\pi * Bm)$ Then the equality of 1 kW of mechanical power to 1 kW of electrical power, we come out finely, you just need to check the fulfillment of this dependence Theoretically, based on the DED experiment

measuring the Ampere force in the gap between the magnets with a clamp, I established a direct relationship between the Ampere force and the level of voltage drop in the conductor. As much as the voltage drops, the point of the resultant magnetic induction of the conductor rises.

It can be concluded that the basic condition of the formula for the modulus of the magnetic

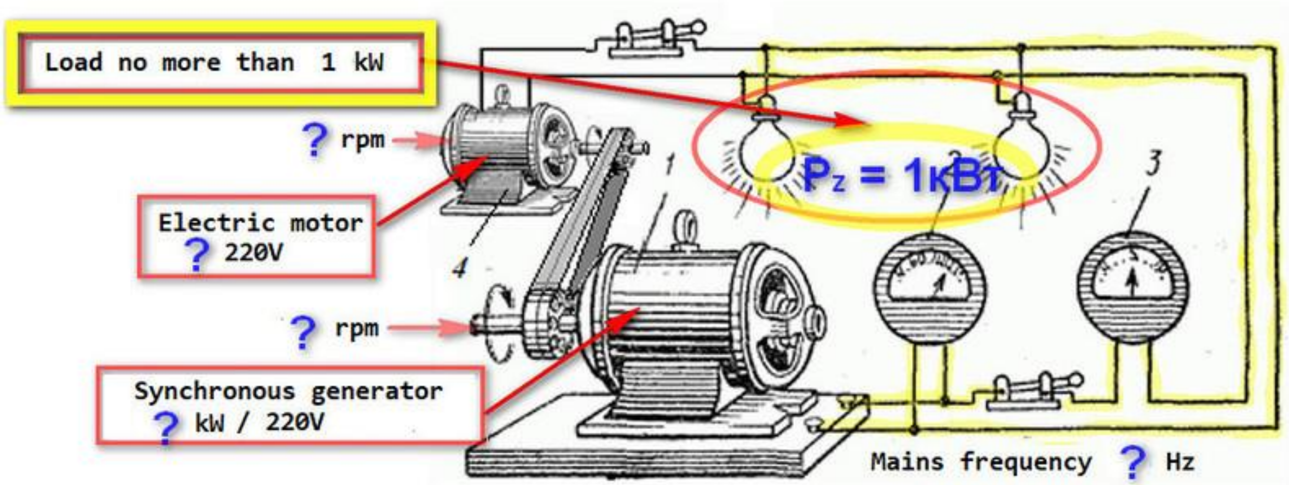
induction of the electromagnetic force: ***B* = *F / L* * *I is*** based without taking into account the field of the conductor based on the electric voltage. And as a matter of fact, it just probably has a meaning. The direct dependence of the Mitkevich equation is too obvious , since it takes into account the EMF of the conductor and the magnetic induction of the magnetic field, and the voltage at the terminals of the generator under load and the resulting magnetic induction, taking into account the voltage drop in the conductor, follows.
Constant: ***B* = *F* /*L* * *I*** derived for full power or absolute voltage drop. It turns out that way, in any case, this is the only explanation for the results. With this information in mind, the mechanical power and the electrical power of an ideal generator are equal. The problem has been solved. Moving on to designing the generator itself

It is simple, solving a problem in physics, while observing the fundamental foundations of the physics of electrical engineering. Doubt? That's right, you need to check everything yourself.

Final part.

Actually, the calculation of the simplest generator with a motor (electromechanical converter)

The goal is to calculate the fundamental possibility of creating a closed device for an electromechanical converter with the delivery of a given power to the consumer inside the circuit.

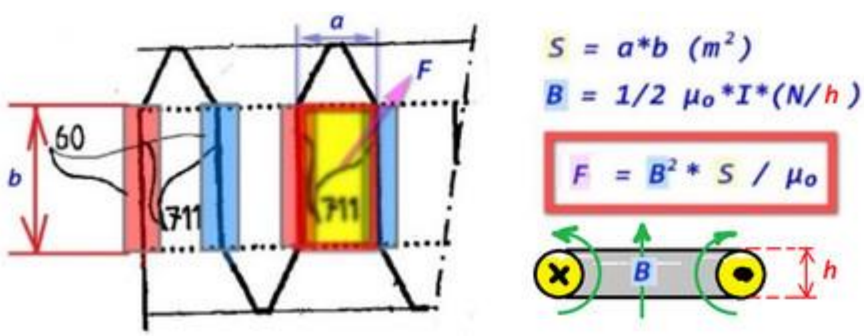


We found out that, in the simplest generator, mechanical power is equal to electrical power. Thus, for the calculation of an electromechanical converter, with an output power of ***Pz - 1 kW*** . we need to recalculate the output power. Suppose 1.5 kW to use 0.5 kW of generator output to maintain torque of the electromechanical converter. 1 kW to load. Calculated

Received the following data, along the way calculated the addition of the wire in 16 turns and laying in a wave of 72 shares, 36 pairs of poles. At a rotation speed of 650 rpm, the generation frequency is expected ***f = p * n / 60 = 36 * 650/60 = 360 Hz*** :

№	Параметр	Обз.	Изм	A	B
	Расчет электромагнитного момента генератора				
1	Количество витков	N	i	1	16
2	Длина активного провода рамки с током	La	м	94,9	5,93
3	Сила тока в проводе	I	А	6,92	110,71
4	Результирующая магнитная индукция для ЭМ	B	Тл	0,195	0,195
5	Результирующая Сила Ампера активного провода	F	N	128	128
6	Предпологаемый ЭММ Силы Ампера	M	Nm	22,38	22,38
7	Предпологаемая мощность на валу	Pg	kW	1,523	1,523
	Расчет простейшего генератора с волновой обмоткой				
2	Ширина магнитного полюса	p(m)	мм / м	10	0,010
3	Зазор между полюсами	z(m)	мм / м	5,26	0,00526
4	Ширина доли	a(p)	мм / м	15,3	0,0153
5	Количество долей	i(p)	шт	72	72
6	Количество пар полюсов	p	шт	36	36
7	Общая длина активн. жгута фазы /Ширина барабана	h®	м	5,93	0,0824
8	Частота генератора	f	Гц	390	390

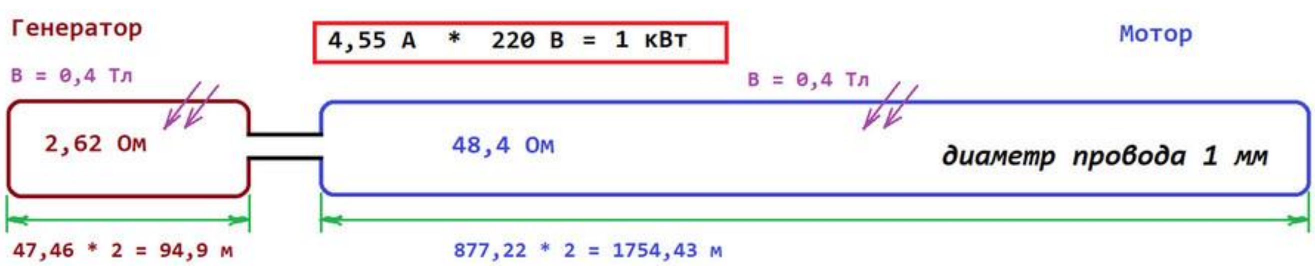
With wave laying, we have conditional turns from straight sections of wires with multidirectional spin of magnetic induction, which also form their electromagnetic focused force.



This flux will also form its share of the electromagnetic moment of the generator, without a core, for this we need to calculate it. To begin with, we determine the cross-section of one "turn", the magnetic induction, and the electromagnetic force of one turn and multiply by the number of sections

№	Параметр	Обз.	Изм	Знач.
1	Количество зикзагов волноьой укладки	c		72
2	Днина грани витка	мм	м	0,082
3	Ширина зазора между проводами	мм	м	0,0153
4	Высота катушки / толщина жгута	мм	м	0,002
5	Сечение витка	S	м	0,001257
6	Магнитная индукция витка	Bc	Тл	0,035
7	Электромагнитная сила тяги	F	N	87,139

This vector of electromagnetic force will interact simultaneously with the approaching pole (abutting) and decreasing (holding it with electromagnetic attraction), if the resulting Ampere force from the wires is ***127.86 Newtons*** at the peak (***Pk = 1.5 kW***), then the traction electromagnetic force will be a peak of 87.14 N, which in terms of mechanical power will already be ***1 kW*** , for our generator. In total, this is already an impressive electromagnetic moment on the generator shaft comparable to a power of ***2.5 kW*** , versus ***1.5 kW of*** output electrical power. For the simplest generator, this is a parasitic module of the generator's electromagnetic torque, how to curb it in the manual.For a single-phase motor, it will not work at the same time to use these forces, since for a variable electric motor, the obtained electromagnetic moment must be divided by two. Let's deal with the electromagnetic moment of the simplest motor.



Let's start with the analogy of the ideal frame of our generator (*see the picture above*), as if our load were the motor. The load is 1 kW at 220V, this is a resistance of 48.4 Ohm. The length of the wire is 1 mm in diameter and will be ***1754.43 meters*** . Let's calculate the voltage drop in the frame ***U"= U - (I * R) = 220V - (4.55A * 48.4 Ohm) = 0 V*** , in fact, complete utilization of power. Calculate the coefficient ***k '= 1 + (U - U" / U) = 1+ (220 - 0/220) = 1*** . the coefficient indicates precisely this fact.

Let's calculate the resulting magnetic induction for the Ampere force, for a start, the distance ***r*** : ***r = (k'* μ_0 * I) / (2π * Bm) = 0.000000364 m*** .

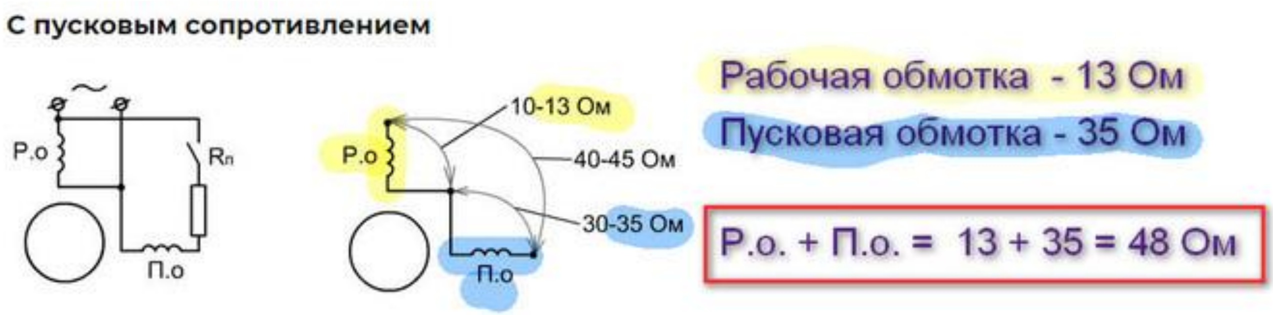
Next, the resultant magnetic induction: ***B = μ_0 * I / 2πr T = 0.4*** .

And actually the maximum Ampere force ***F = B * I * l*** and the maximum ***M = F * (D / 2)*** :

M = (0.4 * 4.55 * 1754 = 3195 Newtons) * (0.35 / 2) = 558.65 Nm

Oh wow! Let's calculate the power from half of the result: ***Pk** = **(0.5 * 558.65) * 650/9550*** = ***19 kW of*** mechanical power on the shaft .

Of course, this is simply impossible, since in its pure form, like a generator with a rotor of this length, and even more so a motor, it is simply impossible, even if we put it in turns, we have a reactance, and to obtain a working resistance, the length decreases. For example, single-phase AC motors have a working and starting windings (winding *resistance of a single-phase motor 1 kW*). In series connection, they just have a load resistance of 1 kW at 220V.



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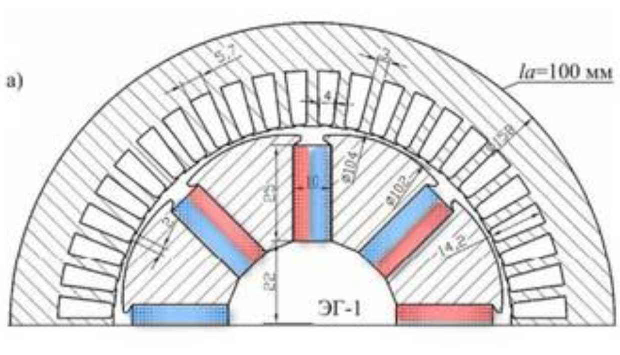
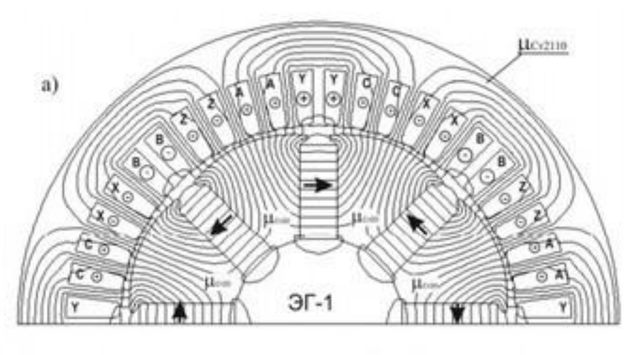
Naturally, the cross-section of the wire will be different for starting and working, but in any case, no less than the current carrying capacity of 4.55A for 1 kW load. Perhaps I counted something. No, I was not mistaken. it's just that my calculation takes into account only the electromagnetic force of a permanent magnet. But this shows that the potential is high there. Suppose the AC motor does not have a short-circuit rotor, but with permanent magnets. The magnets must be correctly placed in the rotor, for example, one of the correct engineering solutions





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One conclusion suggests itself. that design engineers adjust the optimal winding options for electrical power consumption and output mechanical power on the shaft to industry standards. There is one more point, this is the parallel connection of a ***1 kW*** load ***(48.4***

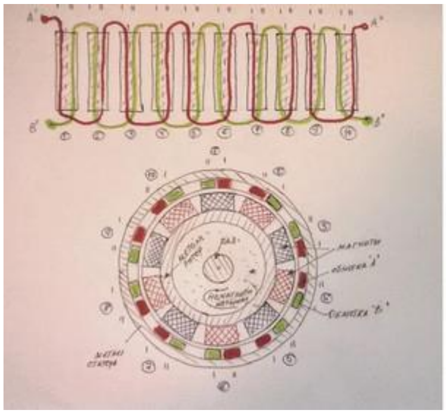
Ohm) and a motor, the total parallel connection should not exceed the load resistance of ***32.27 Ohm*** , for ***1.5 kW*** for the generator, which we calculated above. It remains for us to find the resistance of the electric motor based on the rule of parallel connections of resistances (*calculator*):

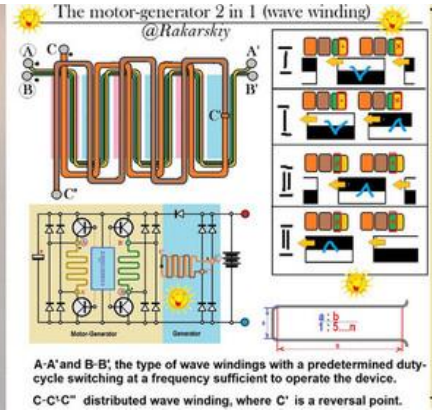
It turns out that in order to fulfill the condition: ***1 / 32.27 = 1 / 48.4 + 1 / 96.91*** - the motor resistance must be ***96.91 Ohm*** .

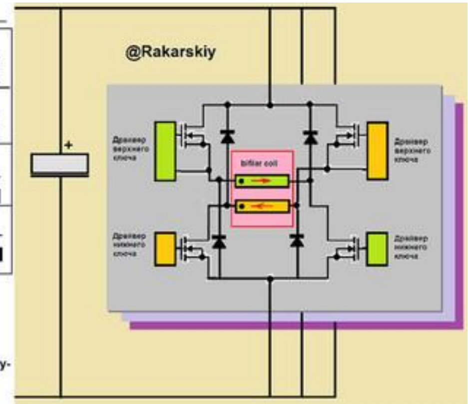
Another condition is the current strength: ***6.82A*** (***1.5 kW*** generator) - ***4.55A*** (1 kW load) = ***2.27 A*** (remains for ***0.5 kW of the*** electric motor). It is in itself incredible that less electrical power would translate into a larger mechanical bulk. But we still take and try to calculate the design of an electric motor by analogy with our generator. The winding is wave-like, we actually calculate the maximum EMM or electromagnetic force

№	Параметр	Обз.	Изм	A	B
1	Мощность мотора / сопротивление для мотора	Рм / R	Вт/ Ом	499	96,91
2	Сила тока	I/R	А /Ом	2,27	96,91
3	Действующий ток	I	А	1,8	
4	Диаметр провода жилы	d	мм	0,6	
5	Сопротивление провода жилы	Rm	Ом/м	0,213	96,91
6	Плотность тока / Сечение провода	Ai	мм²	8	0,2826
7	Пропускная способность жилы по току	J	А*мм²	2,2608	
8	Количество витков	N	i	1	40
9	Длина активного провода рамки с током	La	м	455	11,38
10	Сила тока в проводе	I	А	1,8	72
11	Магнитная индукция Постояннiх магнитов	Bm	Тл	0,6	0,6
12	Падение напряжения	U'	вольт	45,6	45,6
13	Коэффициент k', расстояние r	1,2071	м	0,0000007	0,0000290
14	Результирующая магнитная индукция для ЭМ	B	Тл	0,497	0,497
15	Результирующая Сила Ампера активного провода	F	N	407,33	407,33
16	Предпологаемый ЭММ Силы Ампера	M	Nm	71,28	71,28
17	Результирующий ЭММ	0,5	Nm	35,64	35,64
18	Предпологаемая мощность на валу	Pk	kW	2,43	2,43

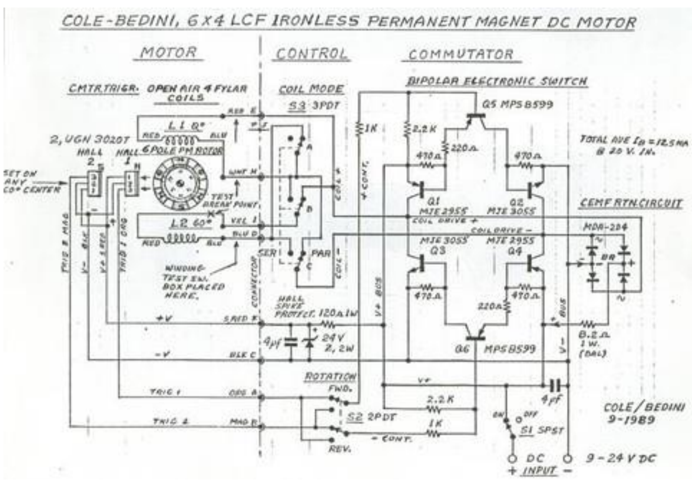
In the table, the data for magnets and magnetic induction [Vm] in the winding area of 0.6 Tesla. If you execute 0.4 Tesla (as for a generator), then the mechanical power on the shaft at its peak will be 1.617 kW. Many will argue that the reactance of the winding will prevent such a motor from performing. I would argue that if you are not greedy for material consumption and use two parallel windings, the reactance can be reduced to a minimum. I once approached this system, in various guises

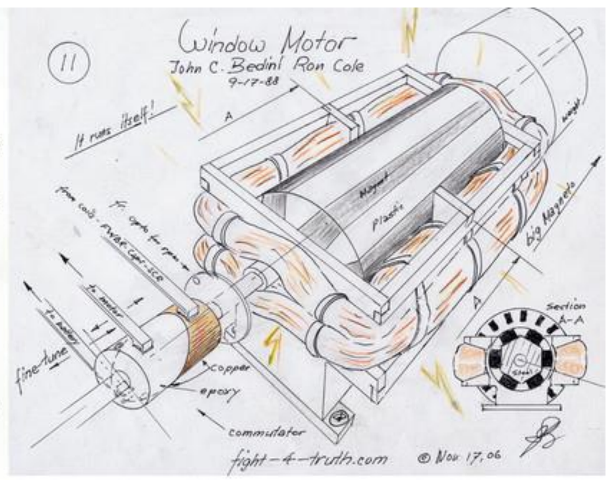






The first was John Bedini, the Bedini-Cole motor-generator. This model has repeatedly demonstrated self-propelled operation.





For normal operation, it is definitely necessary to make a buffer storage of electric charge, and an inertial storage that would work with a dynamic torque. The main thing is that all this is not beyond the bounds of fantasy, but in the field of canons of physics, engineering solutions.

Still, ask "why does the motor have a CE result". Let's see the peak values of the ampere force in the generator winding and the active motor winding:

Generator: peak Ampere force ***128.86 Newtons*** (*excluding electromagnetic focal thrust*) with a rotor thickness / length along the axis of ***74 mm*** (***1.5 kW*** electrical power)

Motor: Peak Ampere Force ***271.55 Newtons*** at rotor thickness / length along the axis of ***158 mm*** (***0.396 kW*** electrical power). How did it happen?

Understand, everything is in the material, I believe there is enough material to just wonder if we know everything about electromechanical converters. *

****

We need to look for a solution for the design of the generator, which would have an efficiency factor of more than 1. This is what we will do on the pages of my manual. Today there is a variant of such a machine with pronounced poles, which excludes the complete closure of the magnetic flux in the rotor-stator magnetic circuit, painted and implemented in the theory of Robert Adams, with a vivid illustration in the Karl Latmmer patent 1983-86 (Australia) .Let us also consider a system with an inertial storage flywheel. The flywheel has an interesting feature in the overclocked state, when the work of the system is organized in the overclocking mode. Acceleration is carried out from the point when the application of force for acceleration is minimal, and removal is carried out by decelerating the inertia of the flywheel, through the control of the power taken, to the point where the acceleration begins. It is on this principle that the installation of an autonomous generator "Earth Engine" Company IE, USA is built . And yet, at the request of the readers, we will consider in more detail, and we will find the optimal version of the machine described in my book "A-Generator" The second question is the accelerating module, in fact the motor, we will also consider the optimal options on the pages of the manual. The third question is inertia, how to use it correctly.

This is a Guide, a living material that is edited and supplemented, in the course of the analysis work being carried out and the development of the appropriate technology for technical solutions.Everyone who purchases the material. in the future, all other materials are received free of charge.

Best regards, Serge Rakarsky

Calculator manual - purchase.